

[54] SAFETY SYSTEM IN ELECTROSTATIC COPIER

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[51] Int. Cl. G03g 15/00

[58] Field of Search 355/3, 14, 67; 320/1

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[57] ABSTRACT

A copier is provided with a corona discharge device for charging copy paper and a discharge tube for exposing copy paper. In order to eliminate hazards attributable to high voltage attending repair and inspection of the machine, the copier further includes a system for stopping charging of a high voltage capacitor after the charge thereon has been released for exposing the last sheet of copy and a safety switch circuit for quickly releasing the charge on the high voltage capacitor simultaneously when a door or hinged part of the machine is opened.

11 Claims, 10 Drawing Figures

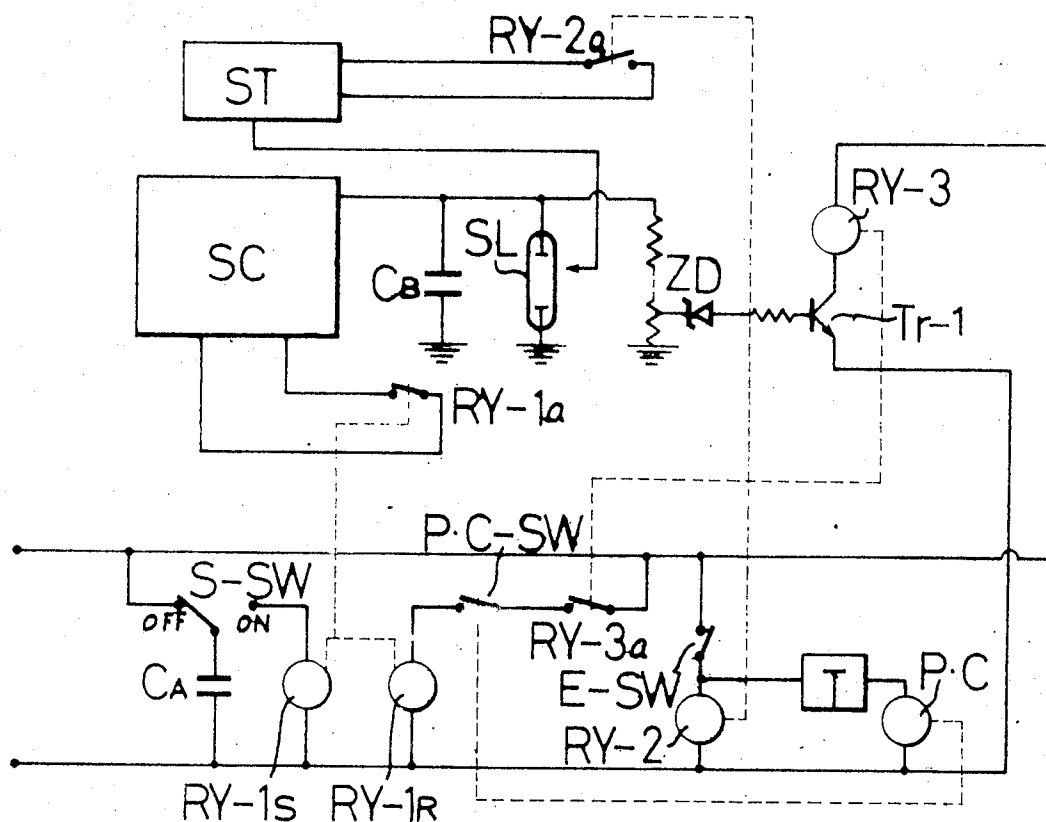
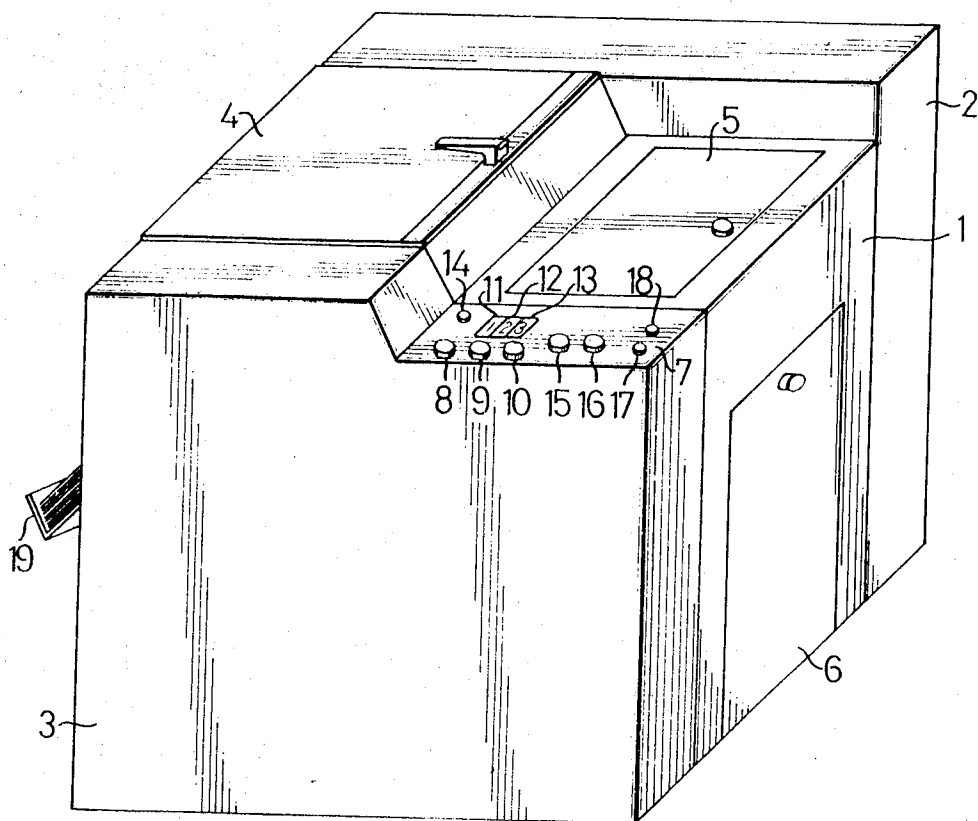
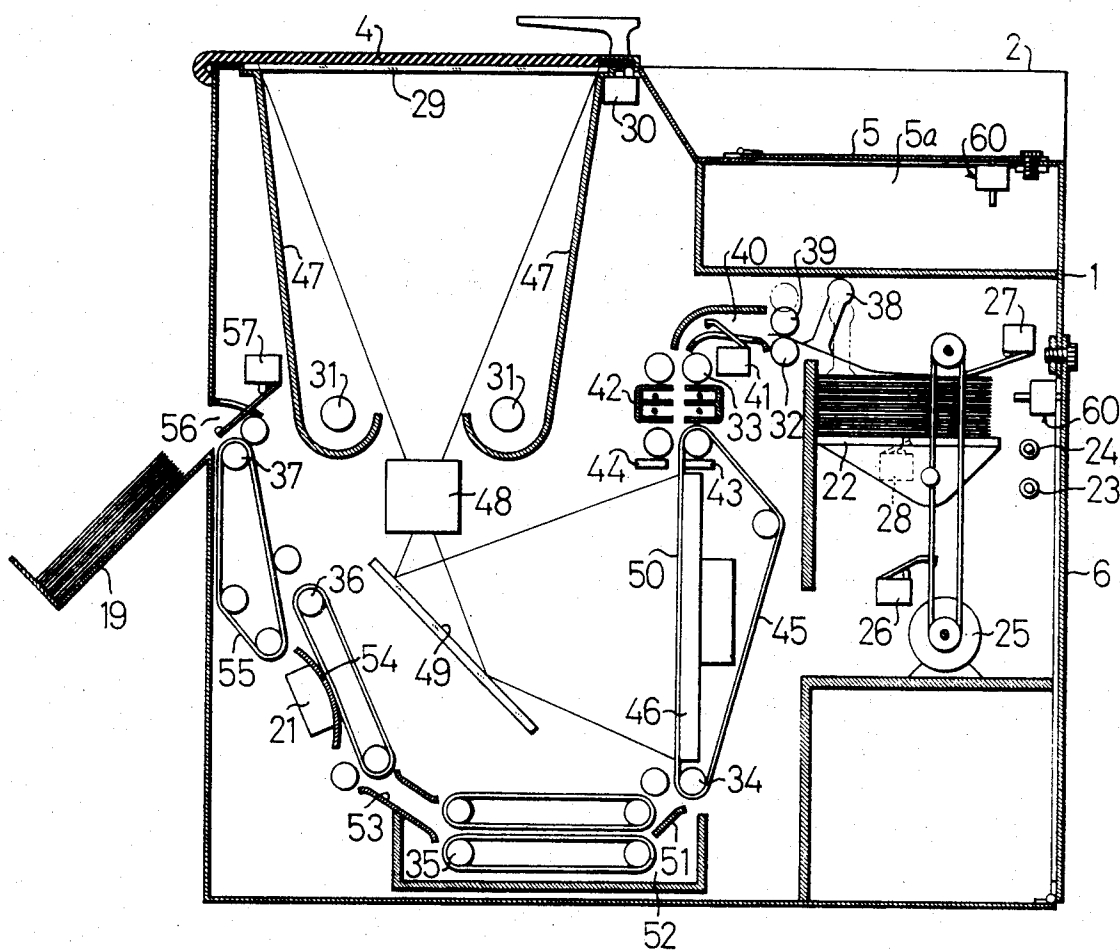


Fig. 1



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Fig. 2



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Fig. 5

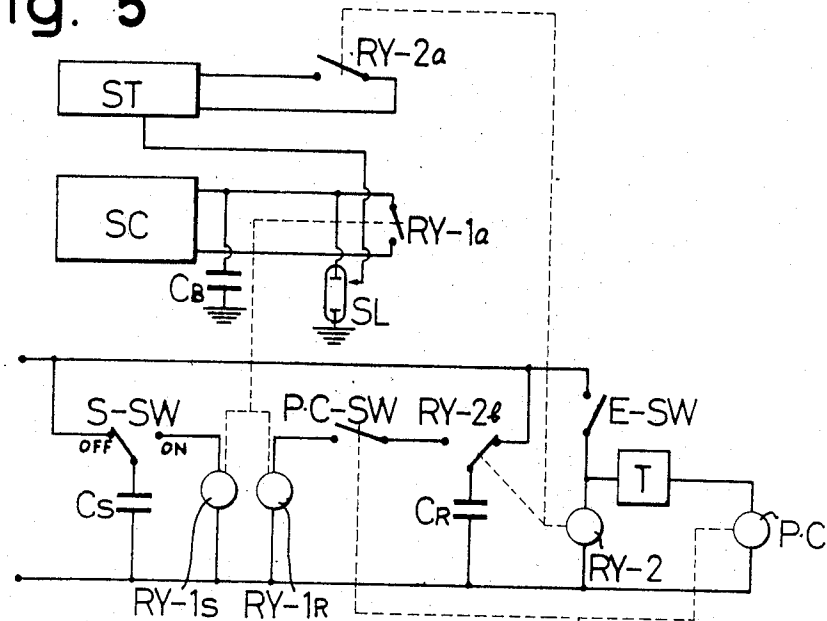
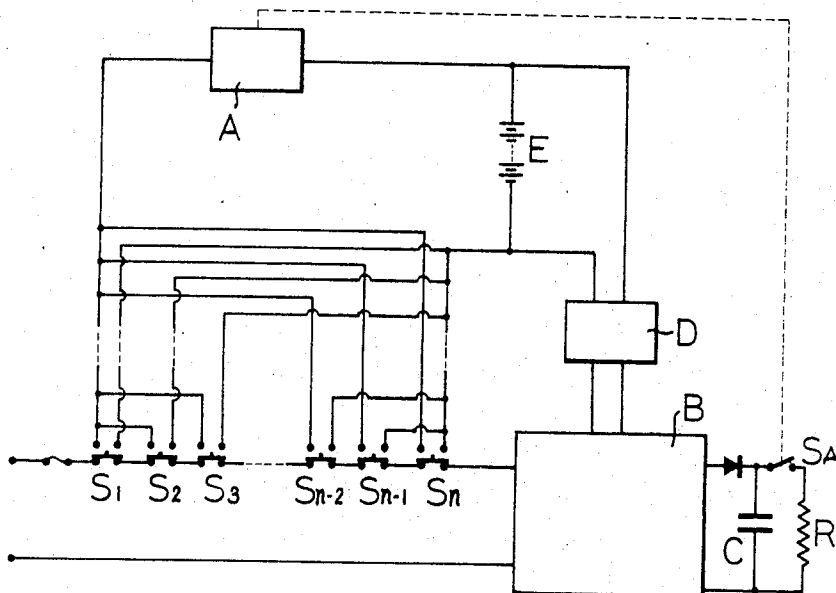


Fig. 6



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Fig. 7

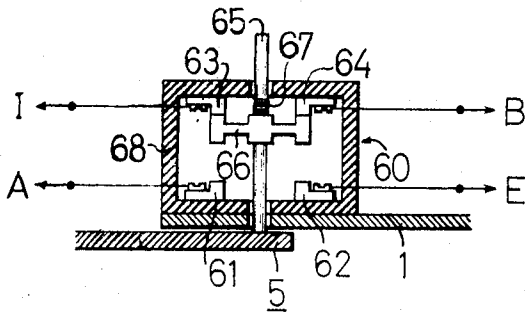


Fig. 8

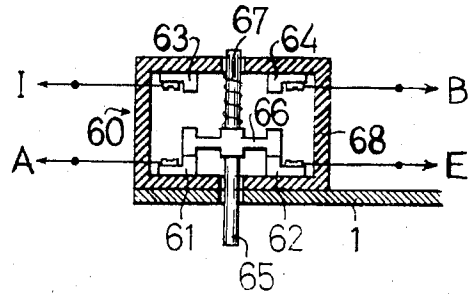


Fig. 9

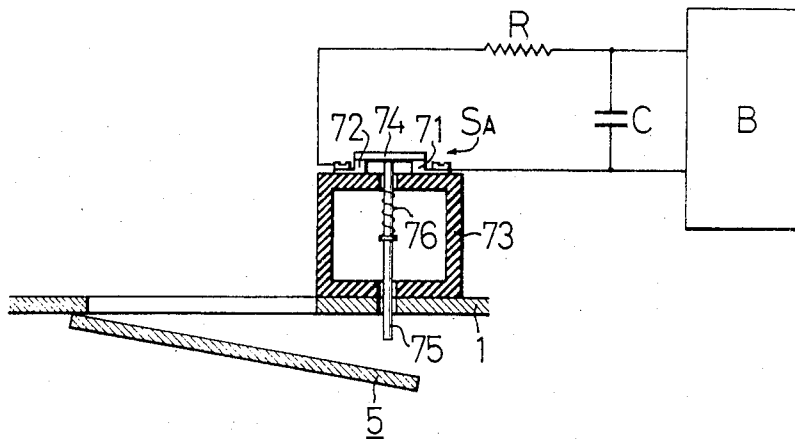
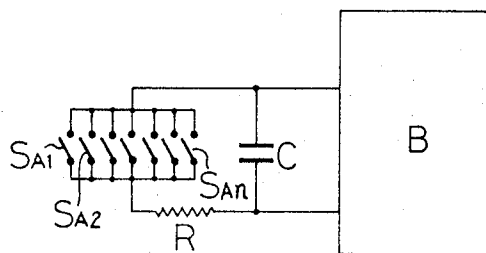


Fig. 10



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SAFETY SYSTEM IN ELECTROSTATIC COPIER

BACKGROUND OF THE INVENTION

The present invention relates to an electrostatic copier incorporating a high voltage capacitor, and more particularly to a safety system for an electrostatic copier provided with means employing a high voltage capacitor such as a charging device for effecting corona discharge by employing a high voltage unit and an exposure system for exposing copy paper with light produced by a discharge tube.

In an electrostatic copier, the copy paper coated with photoconductive material is charged, prior to exposure, by corona discharge means to which a high voltage is applied by a high voltage unit. The copy paper thus charged is then subjected to exposure by exposure means to produce a latent image which is in conformity with the original. As means for effecting exposure instantaneously, some electrostatic copiers employ a discharge tube as a source of illumination. However, since corona discharge or production of light by a discharge tube requires a high energy, the capacitor to be employed therefor is of high voltage type and is very hazardous to handle. Particularly it is noted that a high voltage capacitor stores high voltage even after the power source switch is turned off and repair or inspection of the machine therefore entails no small danger. Conventionally, copying machines of such type were not provided with any positive means for preventing hazards such as above and safety is insured only with extreme care of the operator.

SUMMARY OF THE INVENTION

An object of the present invention is to eliminate possible hazards due to high voltage in an electrostatic copier by providing a system which is so adapted that after a desired number of copies have been made the electric charge on a high voltage capacitor for causing a discharge tube to produce light is released.

Another object of the present invention is to provide an electrostatic copier which is so adapted that when there arises a need to handle the interior parts thereof for repair, inspection or the like, the remaining charge on the high voltage capacitor will be quickly discharged simultaneously upon opening the door, cover or the like of the machine so as to insure safety in carrying out above procedure.

Still another object of the present invention is to provide an electrostatic copier in which discharging described above can be effected automatically by a very simple system.

In order to fulfil the foregoing objects, a circuit for controlling charging of a high voltage capacitor is adapted to be prevented, during an operation to make a desired number of copies, from charging operation just before, or simultaneously when, the last sheet of copy paper is exposed, the circuit being such that after the high voltage capacitor has been discharged for the exposure of the last copy paper charging of the capacitor is prevented until the machine is set for making a new copy. The charging control circuit is provided with a switch for initiating or interrupting the operation to charge the capacitor. The switch is closed by a start button for feeding copy paper or by an electrical contact which is actuated in operative relation therewith, while the switch is opened by a relay which functions

when the number of the remainder of copies indicated on a presetting counter is reduced to 1, the operation of the relay being effected just before, or simultaneously when, the discharge tube produces light. In this way, the circuit for controlling charging of the high voltage capacitor stops its charging operation and even after the capacitor is discharged for exposing the last copy, the capacitor will no longer be charged.

It is noted that even after the capacitor is discharged for the discharge tube to produce light for exposing the last copy, some electric charge still remains in the capacitor, while the corona discharge system also includes a high voltage capacitor which is still loaded with electric charge.

In accordance with the present invention, it is possible to quickly release the charge from the high voltage capacitor by way of a desired resistor simultaneously when a cover or door of the machine is opened as for inspection. That is to say, the copying machine of this invention incorporates safety switches which function in operative relation with doors or covers through which access to the interior is provided. The safety switch is so designed that when a door or cover is opened the switch closes, directly or indirectly, a circuit which comprises a high voltage capacitor and a resistor disposed for releasing the charge from the capacitor, the switch further being adapted to open the circuit upon closing the door or the cover. Thus, opening the door or cover allows the capacitor to quickly discharge through the resistor, hazards entailed in repair or inspection of the machine thereby being completely eliminated.

Other objects and features of the present invention will become apparent from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing an embodiment of the electrostatic copier in accordance with the present invention;

FIG. 2 is a front view in vertical section showing an arrangement of internal structure of the embodiment in FIG. 1;

FIG. 3 is view showing an embodiment of the electric circuit for controlling a charging control circuit in operative relationship with copying operation, the charging control circuit being provided for a high voltage capacitor for causing a discharge tube to produce light;

FIG. 4 is a graph showing the sequence of operations of the electric circuit in FIG. 3;

FIG. 5 is a view showing another embodiment of the electric circuit for controlling a charging control circuit in operative relation with copying operation, the charging control circuit being provided for a high voltage capacitor for causing a discharge tube to produce light;

FIG. 6 is an electric circuit diagram showing an embodiment for opening or closing a discharging circuit for the high voltage capacitor in operative relation with the opening or closing of a door or cover;

FIG. 7 and 8 are views showing an embodiment of the switch structure used in the circuit in FIG. 6; and

FIG. 9 and 10 are views showing another embodiment of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, designated at 1 is a main body of an electrostatic copier provided with a rear door 2 and a front door 3 which are hingedly attached to the front and rear of the main body 1, the interior of the machine being adapted to be exposed by opening the front and rear doors when there arises a need to repair or inspect the machine. An original sheet holder 4 placed on the main body 1 is made of a rubber sheet or the like and serves to press the original into snug-fit contact with a glass plate under the original sheet holder 4. The holder 4 also serves to prevent leakage of the light for illuminating the original. A power source box cover 5 is adapted to be removed from the main body 1. Housed in a power source box 5a (see FIG. 2) are unillustrated high voltage capacitor, high voltage transformer, high voltage rectifier, charging control circuit, trigger circuit, discharging means, etc. A paper supply cover 6 is opened when copy paper is placed into the main body 1.

Attached to the upper face of the front door 3 is an operation panel 7 on which operation members are disposed. Copy number setting dials 8, 9 and 10 are arranged from the left to the right for setting respective numbers in the third place, second place and first place of the copy number so as to indicate the number on the number indication tubes 11, 12 and 13. At the same time a presetting counter is set to obtain a desired number of copies. Designated at 14 is a resetting switch to be used when it is desired to change the set number of the copies or to interrupt copying operation for some reason.

Designated at 15 is a volume dial for controlling the amount of exposure to be given to the copy paper whereby brightness of the copy can be determined as desired. By means of a switch 16 for changing the magnification of lens, the magnification of the copy to be obtained is changed. A warming-up switch 17, used for warming-up at the time of initiating operation, is adapted to be turned on when depressed and to be turned off when the pressure is relieved. A start switch 18, like the warming-up switch, is adapted to be brought into "on" position when depressed, whereupon copying operation is initiated. Paper tray 19 receives finished copies.

With reference to FIG. 2 illustrating the interior mechanism of the electrostatic copier shown in FIG. 1, the operation will be described. When the plug is connected to the power source and the warming-up switch 17 is depressed with the front and rear doors 2, 3 and power source box cover 5 closed, the electric circuit of the machine is actuated in operative relation therewith to supply current to a heater within a heat generator 21, a heat sensitive element disposed close to the heater simultaneously controlling the temperature of the heater. At the same time a drive motor and a paper feeding motor (both not shown) are initiated into operation. However, drive mechanism and paper feeding mechanism which are adapted to be driven respectively by the drive motor and the paper feeding motor by way of electromagnetic clutches have not yet been brought into operation at this stage.

When the paper supply cover 6 is released and a switch 23, one of the switches 23, 24 for actuating a

paper table 22 into upward and downward movements, is pushed, a motor 25 is driven in reverse direction to lower the paper table 22. The paper table 22 in turn actuates a limit switch 26 to stop the motor 25. The downward movement of the table 22 is therefore halted. When the switch 24 is pushed after desired copy paper is placed on the paper table 22, the motor 25 is driven in the normal direction to elevate the table 22 until the upper surface of the copy paper piled thereon actuates a limit switch 27 to halt the motor 25, whereupon the upward travel of the paper table 22 is stopped. A limit switch 28 serves to detect absence of the copy paper on the paper table 22. When the lowermost sheet of copy paper is sent out toward the exposure section, the switch 28 functions to detect absence of copy paper.

The original sheet holder 4 is opened to set the original on the original support plate 29 made of glass and the holder 4 is then returned to the covering position so as to bring the original into snug-fit contact with the support plate 29, whereupon a limit switch 30 is closed.

After the presetting counter is set to the desired number of copies by operating copy number setting dials 8, 9 and 10, the start switch 18 is pushed, which closes a circuit for controlling charging of a high voltage capacitor for causing a discharge tube 31 to produce light and charging of the high voltage capacitor is initiated. At the same time, the clutches connecting the drive motor and paper feeding motor with the operation mechanisms thereof are brought into engaged position, whereupon drive rollers 32, 33, 34, 35, 36, 37 for transporting copy paper are driven, while a swing arm 38 and a paper holding roller 39 are initiated into movement from the position indicated in solid line to the position shown in imaginary line in the figure. The swing arm 38 supplied with negative pressure by the paper feeding motor sucks the uppermost sheet of copy paper and feeds the same between the drive roller 32 and paper holding roller 39.

The copy paper sent into a path 40 by means of the drive roller 32 actuates a microswitch 41 by its leader end to close the high voltage power source circuit for corona discharge means 42 and initiate corona discharge. When moved into the corona discharge means 42 from the path 40, the copy paper is charged and further actuates by its leader end a photoelectric switch comprising a projector 43 and a receiver 44, so that even when the microswitch 41 is turned off by the tail end of the copy paper the corona discharge means 42 is allowed to keep discharging.

A belt 45 to be driven by the drive roller 34 is formed with a plurality of small holes and due to the negative pressure given to a suction box 46 disposed along the back face of the belt 45 the copy paper on the front face of the belt is attracted. Thus the copy paper is moved together with the belt 45 while being sucked thereto. The tail end of the paper passes through the corona discharge means 42 and the photoelectric switch. At this time, charging of the high voltage capacitor for discharging the discharge tube 31 has already been completed and terminal voltage of the high voltage capacitor is applied to the discharge tube 31.

Upon the tail end of the copy paper passing through the photoelectric switch, the high voltage power source

circuit for the corona discharge means is opened and the trigger circuit of the discharge means is opened and the trigger circuit of the discharge tube 31 is actuated. Due to this, very high voltage pulse is generated at the output terminal of the trigger circuit to instantaneously discharge the high voltage capacitor and cause the discharge tube 31 to produce light. A reflector 47 enables the discharge tube 31 to illuminate the original support plate 29 uniformly. The image of the original positioned on the support plate 29 is projected, by means of a lens 48 and a mirror 49, on the light sensitive surface 50 of the copy paper which is moved forward on the belt 45 to produce a latent image. Since the duration of illumination of the discharge tube 31 is as short as several hundreds of microseconds, the copy paper need not be stopped for exposure. The high voltage capacitor discharged is detected by a detector of the terminal voltage, and the charging control circuit resumes charging operation. On the other hand, the number indicated on the presetting counter is reduced by 1.

The exposed copy paper is sent into a developing section 52 along a guide plate 51 for development, and further carried forward along a guide plate 53, the paper is rapidly dried by a dryer 54. The copy paper is then sent out of an outlet 56 by a belt 55 onto the paper tray 19. A microswitch 57 disposed at the outlet 56 serves to detect jamming of the developing section 52, dryer 54 or the like.

The movements of the swing arm 38 and the paper holding roller 39 are repeated at a definite interval to send out copy paper one sheet after another and exposure operation above is also repeated for each sheet. The amount of copy paper on the paper table 22, when reduced, is detected by the limit switch 27, which sets the motor 25 driving to elevate the table 22 a distance corresponding to the reduced amount. When copy paper is no longer left on the table 22, the limit switch 28 detects the absence.

The operations described above are repeated until the number set on the presetting counter is reduced to zero. If the set number of the copies is to be changed during the operation and there arises a need to step the machine, the resetting switch 14 may be pushed to reset the presetting counter. Further in order to prevent the machine and discharge tube from overheating, a fan (not shown) may be incorporated in the machine for cooling during copying operation.

FIG. 3 shows an electric circuit by which the circuit for controlling charging of the high voltage capacitor in accordance with the present invention is adapted for intended object, the electric circuit being applicable to the electrostatic copier already described above.

Referring to the figure, designated at S-SW is a switch for starting copying operation or a power source switch (which includes an engageable contact to be functioned in operative relationship with the start switch or power source switch), the switch normally being closed at OFF contact which is connected to a relay operating capacitor C_A so as to charge the capacitor C_A , with ON contact left open which is connected to a relay $RY-1_S$. Upon initiation of operation, the OFF contact is opened and ON contact is closed, the charge stored in the capacitor C_A being thereby discharged through the relay $RY-1_S$ to operate the relay $RY-1_S$.

Designated at $RY-1a$ is a switch which is actuated by means of relays $RY-1_S$ and $RY-1_R$. When the relay $RY-1_S$ is actuated, the switch $RY-1a$ is turned on and held in "on" position even after the relay $RY-1_S$ is returned, but when the relay $RY-1_R$ is actuated, the switch is brought to "off" position and held in this position even after the relay $RY-1_R$ is returned. While the switch $RY-1a$ is on, charging control circuit SC functions to charge a high voltage on capacitor C_B for causing the discharge tube SL to produce light.

A circuit T serves to delay the operation of a presetting counter P-C when the presetting counter P-C is to be actuated by a switch E-SW being turned on. The switch E-SW, normally disengaged contact, is adapted to be turned on when the copy paper comes to the predetermined exposure position and to be then returned, the switch being adapted to be actuated by a photoelectric switch in FIG. 2. The switch E-SW, when brought to "on" position, sends out an operation instructing signal to the above-mentioned T circuit and initiates the same into operation while actuating the relay $RY-2$ at the same time.

A switch $RY-2a$ is actuated by the relay $RY-2$. Simultaneously with actuation of the relay $RY-2$, the switch is brought to "on" position, while it is returned to "off" position upon return of the relay $RY-2$. When the switch $RY-2a$ is turned on, the trigger circuit ST causes the discharge tube SL to produce light.

A switch P-C-SW is adapted for operation in operative relationship with the presetting counter P-C. If the presetting counter P-C indicates that at least two sheets are left to be copied, the switch is in "off" position, but when only one sheet is the remainder indicated, it is brought to "on" position and retained in the same position.

A relay $RY-3$ is so adapted as to be actuated when the terminal voltage of the high voltage capacitor C_B for the discharge tube exceeds a given value. The relay $RY-3$, when actuated, closes a switch $RY-3a$ which is a normally disengaged contact.

The circuit SC for controlling the charging of the high voltage capacitor C_B is so adapted as to stop charging when the terminal voltage of the capacitor C_B reaches a predetermined value and to effect charging when it drops to a level lower than the voltage at which charging is stopped. The operation voltage of the relay $RY-3$ is determined at a value which is the same as, or slightly lower than, the above-mentioned predetermined voltage of the control circuit SC. Indicated at Tr-1 and ZD are a transistor and a Zener diode for operating the relay $RY-3$ in accordance with the terminal voltage of the high voltage capacitor C_B .

With reference to FIGS. 3 and 4, the operation of the electric circuit described above will be explained. After placing copy paper in the electrostatic copier and setting the original in position, the presetting counter P-C is set to the desired number of the copies and the start switch S-SW is turned on, whereupon the charge on the capacitor C_A is discharged to actuate the relay $RY-1_S$ and to turn on the switch $RY-aa$. Accordingly, the charging control circuit SC starts charging the high voltage capacitor C_B with the result that the terminal voltage of the capacitor C_B gradually increases. On the other hand, the swing arm 38, drive rollers 32, 33, belt 45, etc. shown in FIG. 2 begin to send a sheet of copy

paper toward the exposure position. When the terminal voltage of the capacitor C_B reaches a predetermined value, the control circuit SC stops charging and at the same time the relay RY-3 is brought into operation to close the switch RY-3a. At this stage, the number, indicated on the presetting counter P-C, of the remainder of the copies to be made is at least two and therefore the switch P-C-SW is still in open position with the relay RY-1_R out of operation. The switch RY-1a is kept in closed position. The charging control circuit SC is in such condition that when the terminal voltage of the capacitor C_B drops, it can resume charging. When the paper transport mechanism carries the copy paper to the exposure position, the switch E-SW is turned on to emit an operation signal to the T circuit and to actuate the relay RY-2 at the same time. As a result, the switch RY-2a is turned on, allowing the trigger circuit ST to generate trigger pulse which triggers the discharge tube SL for production of light so as to subject the copy paper to exposure.

The high voltage capacitor C_B discharges its electric charge to cause the discharge tube SL to produce light, so that the terminal voltage abruptly drops to return the relay RY-3 and open the switch RY-3a. Consequently, the charging control circuit SC starts charging the high voltage capacitor C_B again. The paper transport mechanism carries the exposed copy paper into developing section, while a new sheet of copy paper is subsequently sent toward the exposure position. On the other hand, when a period of time lapses after emission of light by discharge tube SL, the T circuit subtracts one from the number of the copies to be made which is indicated on the presetting counter P-C.

The operations described above are repeated every time the discharge tube SL produces light. When the number indicated on the presetting counter P-C is reduced to 1 after repetition of the operations, the switch P-C-SW is turned on. Upon the terminal voltage of the capacitor C_B reaches a predetermined value, the relay RY-3 is operated to bring the switch RY-3a to "on" position, permitting the relay RY-1_R to operate, whereby the switch RY-1a for the charging control circuit SC is turned off. It is no longer possible to charge the capacitor C_B .

At the time when the last sheet of copy paper reaches the exposure position, the switch E-SW is turned on to operate the relay RY-2 and trigger the discharge tube SL, whereupon the charge on capacitor C_B is discharged to allow the discharge tube SL to emit light. Although the high voltage capacitor C_B loses its charge, the charging control circuit SC will no longer be actuated. The exposed copy paper is further guided toward the developing section.

FIG. 5 shows an electric circuit in which the relays RY-1_S and RY-1_R for controlling the operation of the charging control circuit SC are adapted to be actuated by releasing the charges on the respective capacitors C_S and C_R , the relay RY-3, transistor Tr-1 and Zener diode ZD in FIG. 3 thus being dispensed with. In FIG. 5 the same parts as those in FIG. 3 are indicated at the same reference numerals and characters. The capacitor C_S in FIG. 5 performs the same function as the capacitor C_A in FIG. 3, although it is designated at C_S .

The circuit in FIG. 5 is different from the circuit of FIG. 3 in that the circuit for operating the relay RY-3 is

removed while a change-over switch RY-2b is provided in the circuit for operating the relay RY-1_R, the switch RY-2b being adapted to be switched by the relay RY-2, the movable contact thereof for switching being connected with the capacitor C_R so as to charge the capacitor C_R while the relay RY-2 is not in operation, the arrangement being such that when the relay RY-2 is actuated to switch the contact, the charge on the capacitor C_R is released to bring the relay RY-1_R into operation of the switch P-C-SW is closed.

In accordance with the electric circuit in FIG. 5, the capacitors C_S and C_R are charged when the circuit is connected to the power source. Further when the switch S-SW is turned from "OFF" contact to "ON" contact to initiate the travel of copy paper, the capacitor C_S is discharged through the relay RY-1_S, the operation of the relay RY-1_S further making the switch RY-1a closed. As a result, the circuit SC for controlling charging of the high voltage capacitor C_B is energized so as to charge the capacitor C_B . Before the copy paper comes to the predetermined exposure position, the terminal voltage of the capacitor C_B reaches a predetermined value. The copy paper, when reaching the exposure position, causes the switch E-SW to close, thereby bringing the T circuit into operation, while at the same time permitting the relay RY-2 to operate. The switch RY-2a is therefore closed, whereby the trigger circuit triggers the discharge tube SL with the result that discharging of the capacitor C_B allows the discharge tube to produce light. The relay RY-2 further turns the change-over switch RY-2b simultaneously when it closes the switch RY-2a. Since the switch P-C-SW is kept open if the number of copies indicated on the presetting counter is at least 2, completion of exposure of copy paper returns the relay RY-2 and opens the switch RY-2a without operating the relay RY-1_R, and simultaneously with this, the change-over switch RY-2b is also returned. As a result, the switch RY-1a which is kept closed resumes charging of the capacitor C_B which has been relieved of its charge due to emission of light by the discharge tube. On the other hand when the number indicated on the counter P-C is 1, the switching of the change-over switch RY-2b due to the operation of the relay RY-2 results in discharging of the charge on the capacitor C_R since the switch P-C-SW is closed, with the result that the relay RY-1_R is operated by way of the P-C-SW to open the switch RY-1a. Accordingly, the control circuit SC can not be operated and the capacitor C_B which has lost its charge for the discharge tube will not be charged. That is, at the time when copying operation is finished, the terminal voltage of the high voltage capacitor C_B is reduced to the low level, the same state brought about upon completion of discharging.

A system shown in FIG. 6, if incorporated in an electrostatic copier, makes it possible to remove the remaining charge of high voltage capacitor and therefore to eliminate possible hazard to be caused by the remaining charge, very high safety thus being insured in repairing and inspecting the machine.

Referring to FIG. 6, a resistor R for quickly releasing the charge on the high voltage capacitor C is disposed parallel thereto, the discharging circuit further including a switch S_A to be operated by a contact switch A. Safety switches $S_1, S_2, \dots S_n$ each provided for doors or

other devices which have to be opened or closed for repair or inspection of the interior of the machine. The operation circuit of the contact switch A is so designed as to be closed to further close the switch S_A when any one of the safety switches $S_1, S_2, \dots S_n$ functions, this permitting the high voltage capacitor C to discharge quickly through the resistor R. The contact switch A is operated by a battery E. The safety switches $S_1, S_2, \dots S_n$ are each disposed in series with an input circuit of an electric circuit B of the electrical operation mechanism in the interior of the machine, the arrangement being such that when the doors or disengageable parts are in closed position the input circuit is closed. The battery E is charged by a charger D while the electric circuit is closed. Thus, when any one of the doors or hinged parts is opened, one of the safety switches $S_1, S_2, \dots S_n$ opens the input circuit of the electric circuit B and the operation circuit of the contact switch A is closed. Consequently, the switch S_A is closed to quickly release the charge on the high voltage capacitor C. The switch S_A is such that the distance between the contacts in open position is so great as to eliminate spark even when the terminal voltage of the capacitor is maximum.

FIGS. 7 and 8 show an embodiment of safety switches $S_1, S_2, \dots S_n$ described. A safety switch 60 comprises a box 68 made of a suitable, electrically insulating material and contacts 61, 62, 63, 64 disposed therein, the contacts 61, 62 being respectively connected to A terminal and E terminal in the operation circuit of the contact switch A in FIG. 6, the contacts 63, 64 being connected to I terminal and B terminal in the input circuit of the electric circuit B shown in FIG. 6. A stem 65 extending through the center of the box 68 and electrically insulated from the respective contacts 61, 62, 63, 64 and electric circuits is supported on the box 68 so as to be movable in the longitudinal direction thereof. Further fixed to the stem 65 is a contact member 66 which is adapted to short-circuit either the contacts 61 and 62, or the contacts 63 and 64. By means of a spring 67, the stem 65 is urged in such direction that the contact member 66 may be brought into contact with the contacts 61, 62. The box 68 is fixed to the main body 1 provided with a door 5 or other disengageable parts, the arrangement being such that when the door 5 is opened, the stem 65 projects outward under the action of the spring 67, causing the contact member 66 to short-circuit the contacts 61 and 62. FIG. 2 shows safety switches 60 fixed to the main body 1 at the hinged portion of the cover 5 of the power source box 5a and at the hinged portion of the paper supply cover. It is desired that the safety switches be disposed at all portions which are opened for repair or inspection of the machine such as power source box cover 5, paper supply cover 6, rear door, back door, etc. However, it is not necessary to mount them in places where there is no hazard of high voltage.

In the state where the door 5 is closed, the safety switches $S_1, S_2, \dots S_n$, as shown in FIG. 7, keep the input circuit I-B of the electric circuit B closed while leaving the operation circuit A-E of the contact switch A open for operation of the machine, whereas if the door 5 is opened, the spring 67 permits the contact member 66 to disengage from the contacts 63 and 64 and to close the contacts 61 and 62, thus opening the input circuit I-B of the electric circuit B and closing the

operation circuit A-E of the contact switch A. As a result, the contact switch A is operated and the switch S_A is closed to effect quick discharge of the capacitor C.

The discharging system above may of course be used as a safety switch for capacitors such as high voltage capacitor for producing light by a discharge tube, a high voltage capacitor for a corona discharge device serving as means for charging light sensitive paper or various capacitors to be employed in other sections where necessary.

FIGS. 9 illustrates an embodiment in which the switch S_A is adapted to be opened directly by opening of the door 5. In accordance with this system, the contact switch A, battery E for operating the switch and the charger D therefor in FIG. 6 can be dispensed with. However care should be directed to the high voltage to be applied to the terminal of the switch S_A which is connected to the high voltage capacitor.

The circuit shown in FIG. 9 includes a high voltage capacitor C and a resistor R connected in parallel therewith and adapted for quickly discharging the capacitor C. The discharging circuit includes contacts 71 and 72 of the switch S_A which are fixed to the box 73. A contact member 74 for the contacts 71 and 72 is fixed to the end of a stem 75 extending through a box 73 and adapted for movement in the longitudinal direction thereof. By means of a spring 76, the stem 75 is urged in such a direction that the contact member 74 may be brought into contact with the contacts 71 and 72. The box 73 is fixed to the inner side of the main body provided with a hinged portion such as door 5 and the stem 75 is projected externally of the main body 1. Thus, closing of the door 5 pushes the stem 75 against the action of the spring 76 to open the switch S_A , while when the door 5 is opened, the spring 76 urges the switch S_A into closed position, whereupon the charge of the capacitor C is quickly released through the resistor R. The contacts of the switch S_A are spaced apart by such a distance that even the maximum terminal voltage of the capacitor C will not produce a spark.

In the case where the switches S_A in FIG. 9 are provided for all of the doors and other parts of the copying machine which are opened for repair, inspection and maintenance, switches $S_{A1}, S_{A2}, \dots S_{An}$ may be arranged in parallel into the discharging circuit of the capacitor C as shown in FIG. 10.

I claim:

1. An electrostatic copier including an exposure illuminating discharge tube, a cabinet including an access door, a capacitor for energizing said tube housed in said cabinet, means for effecting a preselected number of exposures and characterized in the provision of a safety system comprising means for charging said capacitor, means responsive to the last exposure of said predetermined number for deactuating said charging means, and means responsive to the opening of said door for discharging said capacitor.

2. The electrostatic copier of claim 1 wherein said capacitor discharging means comprises a switch, means including a resistor connecting said switch across said capacitor, and means responsive to the opening of said door for closing said switch.

3. An electrostatic copier comprising an exposure illuminating discharge tube, a capacitor for energizing

said tube, a selectively preset exposure counter including a first switch closed in response to the 1 condition of said counter, a copy operation starting second switch and characterized in the provision of means for charging said capacitor, a third switch transferable between closed and open conditions for actuating and deactuating said charging means, a fourth switch closed in response to the voltage across said capacitor exceeding a predetermined value and means responsive to the actuation of said second switch for closing said third switch and responsive to the closing of said first switch and the closing of said fourth switch for opening said third switch.

4. The electrostatic copier of claim 3 including a fifth switch, a sixth switch and means responsive to the actuation of said fifth switch for triggering the flashing of said tube, said fifth switch being actuated in response to the closing of said sixth switch and said counter being actuated in response to the closing of said sixth switch.

5. An electrostatic copier comprising an exposure illuminating discharge tube, a capacitor for energizing said tube, a selectively preset exposure counter including a first switch closed in response to the 1 condition of said counter, a copy operation starting second switch and characterized in the provision of means for charging said capacitor, a third switch transferable between closed and open conditions for actuating and deactuating said charging means, a fifth switch actuated to a closed position in response to the flashing of said discharge tube and means responsive to the actuation of said second switch for closing said third switch and responsive to the closing of said first switch and the closing of fifth switch for opening said third switch.

6. An electrostatic copier including a cabinet having an access door movable between an open and closed position, a high voltage capacitor housed in said

cabinet, a first switch transferable between a first and second state in response to closing and opening respectively of said door, a second switch transferable to a closed and open condition in response to said first and second states of said first switch respectively, and means connecting said second switch across said capacitor.

7. The electrostatic copier of claim 6 wherein said means connecting said second switch across said capacitor includes a shunting resistor.

8. The electrostatic copier of claim 6 including a plurality of access doors and a plurality of said first switches each of said first switches being closed and opened in response to the opening and closing respectively of a corresponding door, said second switch being closed in response to the closing of any of said first switches.

9. The electrostatic copier of claim 8 including a plurality of third switches, connected in series, each of said third switches being open and closed with the closing and opening respectively of a corresponding door, and means for connecting said copier to an energizing current source through said series connected third switches.

10. The electrostatic copier of claim 9 comprising means for actuating said second switch to its closed position, an electrical power source for energizing said switch actuating means, and means connecting said first switches in parallel and connecting said actuating means through said first switches to said power source.

11. The electrostatic copier of claim 9 wherein each pair of said first and third switches comprises first and second pairs of contacts and a switch arm actuated by a respective door alternatively bridging said first or second contact pairs.

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