

[54] **APPARATUS FOR PREVENTING
SUCCESSIVE JAMMING OF COPY
SHEETS IN COPYING APPARATUS**

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[58] Field of Search **271/57, 47; 355/8,**
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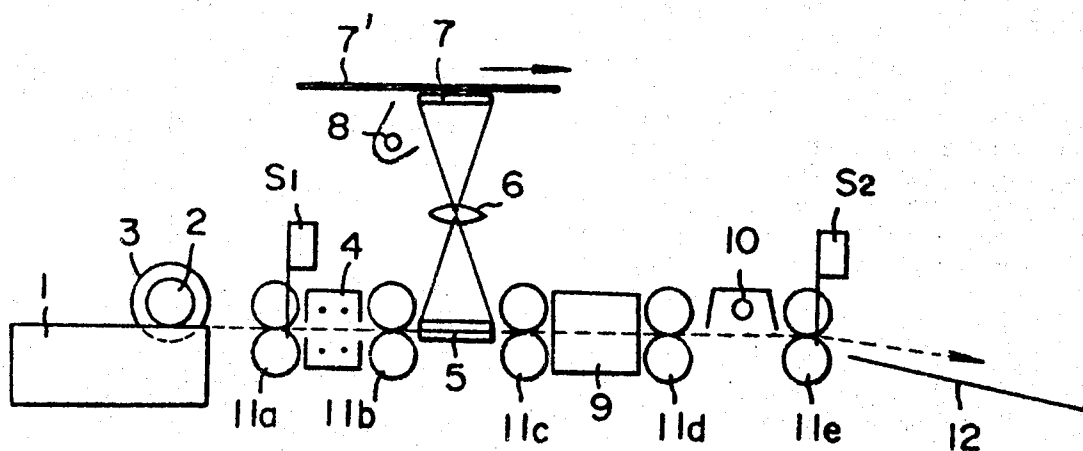
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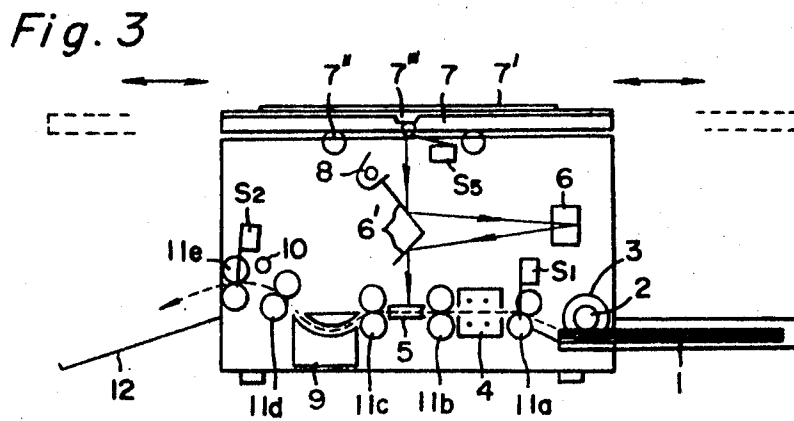
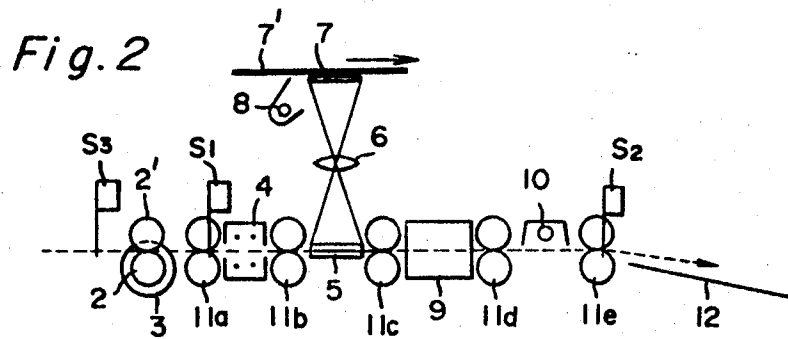
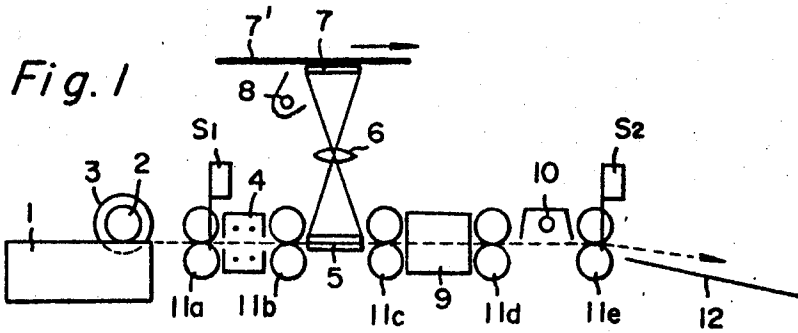
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[57] **ABSTRACT**

Apparatus for preventing successive jamming of copy sheets in copying apparatus including a detecting machine generating a first signal in response to delivery of a copy sheet at the initial nip of a forwarding mechanism of the copying apparatus by a copy sheet feeding mechanism, another detecting mechanism generating a second signal in response to the arrival of a copy sheet at a discharge nip of the forwarding mechanism, and a control switch mechanism responsive to the first and second signals to inhibit operation of the copy sheet feeding mechanism when in a first state responsive to the first signal and to enable operation of the copy sheet feeding mechanism in response to the second signal such that the copy sheet feeding mechanism is inhibited when a copy sheet is in a forwarding passage of the copying apparatus to prevent successive jamming of the copy sheets. The control switch mechanism is essentially a bistable circuit switching states in response to the first and second signals and various control mechanism are disclosed utilizing relays, semi-conductor devices, gas tubes and combinations thereof.

10 Claims, 7 Drawing Figures





APPARATUS FOR PREVENTING SUCCESSIVE JAMMING OF COPY SHEETS IN COPYING APPARATUS

This invention relates to a copying apparatus in which successive jamming of copying sheets is prevented. More specifically, this invention relates to a copy apparatus in which, in case a copy sheet is jammed in a forwarding passage of the copying apparatus, a mechanism for feeding copy sheet to said passage is not actuated and thus a subsequent copy sheet is not fed, whereby successive jamming of copy sheets is prevented.

Generally, a copying apparatus comprises a treatment zone for forming a visible image on a copy sheet and a forwarding mechanism for forwarding the copy sheet to the treatment zone. For instance, in the case of an electrophotographic copy apparatus a copying sheet having a photoconductive layer is forwarded by a suitable forwarding mechanism to a charging zone and a light-exposing zone where an electrostatic image is formed on the copy sheet, and the copy sheet bearing the so formed electrostatic image is forwarded to a developing mechanism where the image is developed by colored toner particles, following which, if required, the copy sheet is forwarded to a fixing mechanism in which the toner particles are fixed on the photoconductive layer of the copy sheet.

In such electrophotographic copying apparatus, a copy sheet tends to stick in the passage in the apparatus under influence of the electrostatic charge on the copy sheet or under influence of a coating layer formed on the copy sheet or action of a developer, and such sticking results in undesired jamming of copy sheets in the apparatus passage. Occurrence of such jamming of copy sheets is greatly influenced by delicate changes in the humidity or temperature of the ambient atmosphere. Accordingly, it is very difficult to prevent completely the jamming of copy sheets in the apparatus passage.

In the art of electrophotography, proposals have heretofore been made as to a device for detecting jamming of copy sheets in the copying apparatus. For instance, the specification of Japanese Pat. Application Publication No. 23918/67 teaches a Xerographic copying apparatus comprising a member for transmitting one pulse per delivery of a copy sheet; a programming device provided with a counter actuated by the pulse-transmitting member to integrate the number of copy sheets; a register; a pulse-receiving member for actuating the register in response to an input pulse; and a member for operationally connecting the counter and pulse-receiving member in according with a multiplex program.

The above copying apparatus is advantageous in that jamming of copy sheets can be detected while a plurality of copy sheets are forwarded to the treatment zone coincidentally. However, electric circuits are extremely complicated, and such complicated detecting mechanism is unfit for a copying apparatus of a type in which one copy sheet is supplied per one copying treatment.

The primary object of this invention is to provide a copy apparatus of a type in which one copying sheet is supplied per one copying treatment, wherein a mechanism for effecting the feeding of a copy sheet is not actuated while a copy sheet is present in the treatment zone and the discharge of the copy sheet has not been

completed, whereby successive jamming of copy sheets can be effectively prevented.

The present invention is generally characterized in an improvement in copying apparatus including a treatment zone for forming a visible image on a copy sheet, a forwarding mechanism for moving a copy sheet along a forwarding passage through the treatment zone from an initial nip to a discharge nip, and a copy sheet feeding mechanism for delivering single copy sheets to the initial nip of the forwarding mechanism, the improvement including first detecting means generating a first signal in response to delivery of a copy sheet at the initial nip of the forwarding mechanism, second detecting means generating a second signal in response to arrival of a copy sheet at the discharge nip of the forwarding mechanism, and control means for controlling the copy sheet feeding mechanism having a first state inhibiting operation of the copy sheet feeding mechanism and a second state enabling operation of the copy sheet feeding mechanism, the control means being placed in the first state in response to the first signal and being placed in the second state in response to the second signal whereby the control means is in said first state when a copy sheet is in the forwarding passage to inhibit the feeding of another copy sheet to the initial nip of the forwarding mechanism and prevent successive jamming of copy sheets.

The device of this application can be applied to copying machines of various types. For instance, the device of this invention is particularly preferably applied to an electrophotographic machine in which a photosensitive copy sheet having a photoconductive layer is passed successively through a charging zone, a light-exposing zone, a developing zone and a drying or fixing zone. In addition, the device of this invention is adaptable to other copying machines of various types; for example, a copying machine in which a copy sheet is forwarded onto a photoconductive layer or a laminated photosensitive layer comprising an electroconductive layer, a photoconductive layer and an insulating layer to thereby effect (i) the image transferring and the fixation or (ii) the electrostatic transferring, the development and the fixation; a diazo-type copying machine of a dry, wet or hot type where a diazo-type copy sheet is exposed to light to form a latent image and then development is effected; and a Thermofax copying machine.

This invention will now be detailed specifically by referring to accompanying drawings. In the drawings, in order to avoid repetition of explanation, elements having the same function are designated by the same reference numbers.

FIG. 1 is a diagram showing the arrangement of an embodiment of this invention applied to an electrophotographic copying machine of a type in which copy sheets are fed automatically;

FIG. 2 is a diagram showing the arrangement of another embodiment of this invention applied to an electrophotographic copying machine in which photosensitive copy sheets are fed manually;

FIG. 3 is a diagram showing the arrangement of still another embodiment of this invention applied to an electrophotographic copying machine;

FIG. 4 is a circuit diagram of a control switch mechanism utilizing relays for use with this invention;

FIG. 5 is a circuit diagram of a control switch mechanism utilizing transistors for use with this invention;

FIG. 6 is a circuit diagram of a control switch mechanism utilizing electronic tubes for use with this invention; and

FIG. 7 is a circuit diagram of control switch mechanism utilizing light-detecting means for use with this invention.

In FIG. 1, illustrating an embodiment where this invention is applied to an electrophotographic copying machine of a type in which copy sheets are fed automatically, a pack 1, in which are contained copy sheets, is provided on the copy sheet feed side upstream of a forwarding passage through the copying apparatus, and a mechanism for effecting the feeding of a copy sheet comprising a feed roll 2 rotated intermittently by means of a feed clutch 3 is arranged at the top end portion of the pack 1. The feed roll 2 is mounted on a machine frame in a manner such that when the copying is conducted under normal operation, it will be in pressing contact with a copy sheet. The forwarding passage in the copying apparatus includes of a group of rolls 11a, 11b, 11c, 11d and 11e. The feeding mechanism in the copying apparatus of this invention comprises the mechanism for effecting the feeding of a copy sheet composed of feed rolls 2 and 3 and clutch mounted on the feed side of the apparatus, and a forwarding mechanism composed of rolls 11a to 11e, which is driven continuously during the copying operation and positioned downstream of the mechanism for feeding copy sheets. Along the forwarding passage composed of continuously driven rolls 11a to 11e, there are arranged successively zones for treating the copying sheet. More specifically, a charging mechanism, for example, a corona discharge member 4, is disposed between rolls 11a and 11b, and a zone 5 for exposing the copy sheet to light is arranged between rolls 11b and 11c. An original 7' on a transparent plate 7 for exposing the original to light is exposed to light from a light source 8, and an image of the original 7' is transferred to a photoconductive layer of the copy sheet travelling between rolls 11b and 11c by means of an optical system comprising the transparent plate 7, a lens 6 and a transparent plate for exposing a copy sheet to light. Thus, there is formed an electrostatic image on the copy sheet. A developing zone 9 is disposed between rolls 11c and 11d, and in the developing zone 9, the electrostatic image is converted to a visible image by a known developing mechanism, for instance for instance by the application of dry or wet toner particles. A drying or fixing zone 10 is arranged between rolls 11d and 11e to dry the copy sheet or fix the toner image formed on the copy sheet. The drying or fixation is accomplished by means of a known mechanism such as an electric heater, an infrared lamp or a hot air feeding device.

Thus, the copy sheet is passed through the charging zone, the light-exposing zone, the developing zone and the drying or fixing zone successively in the direction indicated by the arrow in the drawings, and then is discharged in a copy receiver 12.

Important characteristics of this invention reside in the feeding mechanism being as described above, made up of the mechanism for effecting the feeding of a copy sheet and the continuously driven forwarding mechanism; a first detecting mechanism for transmitting a first signal in response to the delivery of a copy sheet mounted adjacent rolls 11a at the initial nip point of the continuously driven forwarding mechanism or in a position downstream of the first nip point but upstream of

the developing zone; a second detecting mechanism for transmitting a second signal in response to the transit of the copy sheet mounted adjacent rolls 11c at the discharge nip of the continuously driven forwarding mechanism or in a position adjoining the discharge side of the continuously driven forwarding mechanism; and a control mechanism for controlling the mechanism for effecting the feeding of a copy sheet including a normally closed switch which is connected with a source of electricity and opened by said first signal transmitted by the first detecting mechanism and kept in the open state but which is closed again by the second signal transmitted by the second detecting mechanism and is then kept in the closed state.

By dint of such characteristic features, in the copy apparatus of this invention, when a copying sheet is present in the forwarding passage of the continuously driven forwarding mechanism, the mechanism for effecting the feeding of a copying sheet cannot be actuated to feed another copy sheet to the forwarding passage. Accordingly, when a copy sheet is jammed in the forwarding passage, the mechanism for effecting the feeding of a copy sheet is rendered inoperable to feed a successive copy sheet and, therefore, a subsequent copy sheet can not be fed to the continuously driven forwarding mechanism, with the result that successive jamming of copy sheets is effectively prevented.

These characteristic features will now be detailed by referring to FIG. 1. In the apparatus shown in FIG. 1, a first detecting mechanism S_1 is disposed at the first nip point at the inlet side of the forwarding mechanism, that is at the nip of the first rolls 11a, or in a position a little downstream of the first nip point. At the discharge side of the forwarding mechanism, that is at the discharge nip at the last rolls 11e, or in a position adjoining the rolls 11e there is disposed a second detecting mechanism S_2 . Any member that can transmit a signal in response to the passage of a copy sheet can be used as the detecting mechanisms S_1 and S_2 . For example, there may be employed switch actuated by a contact with the copy sheet or a photoelectric switch including a light source and a light-detecting member. When the first detecting mechanism S_1 is mounted downstream of the first nip point of the forwarding mechanism, it is important that the first detecting mechanism S_1 is so arranged that a subsequent copy sheet will not arrive at the first nip point before the first signal is transmitted from the first detecting mechanism S_1 .

Control of the mechanism for effecting the feeding of a copy sheet so that successive jamming of copy sheets in the copying apparatus is prevented can be accomplished by a combination of detecting mechanisms S_1 and S_2 shown in FIG. 1 with, for example, a control switch mechanism, a circuit diagram of which is shown in FIG. 4.

In the embodiment shown in FIG. 4, the first detecting mechanism S_1 is a normally open switch, and the second detecting mechanism S_2 is a normally closed switch. The switch mechanism responsive to the detecting mechanisms S_1 and S_2 includes the combination of a relay R having a holdin contact Rb and a normally closed contact Ra, the normally open switch S_1 and the normally closed switch S_2 . More specifically, an actuating solenoid C for the clutch 3 of the mechanism for effecting the feeding of a copy sheet is connected with an electric power source 13 in series with the normally

closed contact Ra (*c-b*), an actuating switch S_3 and a power switch S_4 . The relay R is connected with electric power source 13 via the hold-in contact Rb, the normally closed switch S_2 and the power switch S_4 , and the normally open switch S_1 is connected with the relay R in parallel to the hold-in contact Rb and the normally closed switch S_2 . A member for actuating the forwarding mechanism, for example, a motor, is connected via the power switch S_4 with the electric power source 13.

When the power switch S_4 is turned on and electrical power is applied to 14', roll 11a to 11e of the forwarding mechanism, and each of the charging zone, the light-exposing zone, the fixing zone and other zones begin to operate, and only the operation of the mechanism for effecting the feeding of a copy sheet is inhibited due to deenergization of the solenoid C for the clutch 3 by means of switch S_3 .

In conducting the copying, the actuating switch S_3 is turned on; and, thus, solenoid C for the electromagnetic clutch 3 is connected through *c-b* of the normally closed contact Ra with the power source 13. Accordingly, the clutch 3 is actuated and the feed roll 2 is rotated, whereby a copy sheet is fed to a pair of the first rolls 11a and nipped thereby. Thus, the copy sheet is fed into the forwarding passage of the copying apparatus and, at the same time, the copy sheet contacts the switch S_1 . To close, the contact *a-c* of the normally open switch S_1 to actuate the relay R, whereby the hold-in contact Rb of the relay R is closed and the normally closed contact *c-b* of switch R a is opened.

By the opening of contact *c-b* of switch Ra, the clutch 3 is deactuated and the feed roll 2 thus completes the feeding of one copy sheet, while the copy sheet is forwarded to each treating zone by means of rotating rolls 11a to 11e. When the trailing edge of the copy sheet has passed the switch S_1 , the switch is returned to the *a-c* open state, but since the hold-in contact Rb is in the closed state, the relay R maintains its function through the contact *b-c* of the closed switch S_2 . The copy sheet which has been allowed to pass through the charging zone 4, the light-exposing zone 5, the developing zone 9 and the fixing zone 10 contacts switch S_2 disposed on the discharge side of the forwarding mechanism at the last nip and is discharged into the copy receiver 12. Thus, the copying on one copy sheet is completed. Upon the contact of the copy sheet against the switch S_2 , the normally closed contact *b-c* of the switch S_2 , which is connected in series with the hold-in contact Rb of the relay R, is opened, with the result that the relay R is de-energized the normally closed contact *b-c* of switch Ra is closed and the hold-in contact Rb is opened. When the trailing edge of one copy sheet has passed the switch S_2 the contact *b-c* of switch S_2 is opened and the hold-in contact Rb and the contact *a-c* of switch S_1 is opened. Accordingly, the relay R is not actuated. Thus, the original state is restored. In case a plurality of copies are desired, when the actuating switch S_3 is set to repeat its action depending on the desired number of copies, as soon as the preceding copying is completed, the normally closed contact *b-c* of switch Ra is closed and the clutch 3 is actuated, with the result that the copying operation proceeds in the same manner as described above. In case a copy sheet is jammed in any of treating zones 4, 5, 9 and 10, the relay R remains in the energized state and relay contact *b-c* of switch Ra is kept in the open state. Accordingly, even if the switch S_3 is closed, the

clutch 3 is not actuated and, therefore, the subsequent feeding of a copy sheet is not effected.

The apparatus is restored to the operative state by opening the power source switch S_4 , releasing the self-holding of the relay R, withdrawing the copy sheet jammed in the apparatus, and closing switch S_4 again. Thus, the normal condition is restored in the apparatus. When the desired number of copies is completed, if the actuating switch S_3 is opened, the feeding of a copy sheet is stopped, and if the input switch S_4 is opened, the apparatus is stopped.

In case an alarming member indicating jamming of a copy sheet is desired, a lamp or other alarming member L is connected with the normally open contact *c-a* of the relay switch Ra through a switch S_5 which is closed only when a copy sheet is not travelling in the apparatus. The user is informed of the jamming of a copy sheet by energization of the alarming member L.

Various modifications of this invention are possible. For instance, a manual mechanism of feeding a copy sheet may be adopted instead of the automatic feeding mechanism described above. If the manual feeding mechanism is adopted, there may be employed any optional member that can feed a copy sheet at the first nip point of the forwarding mechanism only when the second signal is transmitted from the second detecting mechanism.

FIG. 2 illustrates an embodiment where this invention is applied to an electrophotographic copying apparatus of a type where a copy sheet is fed manually. On the upstream feed side of the forwarding mechanism including rolls 11a to 11e, a pair of feed rolls 2, 2' are provided so that they will be intermittently rotated by an electromagnetic clutch 3, and upstream of the rolls 2, 2' there is disposed an actuating switch S_3 . As the switch mechanism for controlling the mechanism for effecting the feeding of a copy sheet, for instance, rolls 2, 2' and clutch 3, there may be employed those such as illustrated in FIG. 4.

In conducting the copying operation, when a copy sheet is being inserted between feed rolls 2,2', the actuating switch S_3 is closed, and in the same manner as explained by referring to FIG. 4, the solenoid C for electromagnetic clutch 3 is connected with the electric power source and feed rolls 2,2' are rotated, with the result that the copy sheet is nipped by the first rolls 11a of the forwarding mechanism and forwarded to each of the treating zones successively. If the copy sheet is jammed in any of the treating zones between switches S_1 and S_2 and a signal is not transmitted from the switch S_2 of the second detecting mechanism, in the same manner as explained by referring to FIG. 4, the electromagnetic clutch 3 will not be actuated and, hence, the feed rolls 2,2' are not rotated, with the result that the subsequent feeding of a copy sheet is inhibited. Thus, successive jamming of copy sheets can be effectively prevented.

In the copying apparatus illustrated in FIG. 2, feed rolls provided with an electromagnetic clutch are disposed upstream of forwarding rolls 11a positioned upstream of the charging member 4 to define the first nip in the forwarding passage, but it is possible to adopt a modification where a pair of forwarding rolls 11a are replaced by a pair of feed rolls 2,2' and the first detecting mechanism S_1 is disposed at the point of a pair of forwarding rolls 11b or downstream of the rolls 11b. Further, it is possible to adopt a modification where in-

stead of feed rolls 2,2' provided with an electromagnetic clutch 3 there is used a screening plate projecting in the direction crossing the passage for feeding a copy sheet as the mechanism for effecting the feeding of a copy sheet, and if a copy sheet is jammed in any of the treating zones, the copy sheet-feeding passage is positively screened by the screening plate by the function of the switch mechanism detailed by referring to FIG. 4.

FIG. 3 illustrates more specifically an embodiment of the apparatus of this invention. A copy sheet contained in a sheet pack 1 is fed in the apparatus by a sheet-feeding mechanism comprising a roll 2 intermittently rotated by a sheet-feeding clutch 3, and it is forwarded to a charging zone 4, a light-exposing zone 5, a developing zone 9 and a drying zone 10 successively by the continuously driven forwarding mechanism including rotating rolls 11a to 11e, following which the copy sheet is withdrawn to a copy receiver 12. Two detecting mechanisms S_1 and S_2 are arranged at the first and last nip points, respectively, of the forwarding mechanism in the same manner as described above, and they detect the transit of the copy sheet.

An original 7' placed on an original support 7 is reciprocated right and left from the home position in synchronism with the delivery of the copy sheet by a roll 7'' for driving the original support 7, and returned to the home position. Thus, one step is completed. During this step, while the original is moved in the left direction in FIG. 3, it is exposed to light emitted from a light source lamp 8 and the slit light scanning is conducted on the light-exposing zone 5 through an optical system including a mirror 6' and a lens 6. The switch S_5 is turned on only when the original support 7 stands still in the home position, and its function will be described below.

In this embodiment, functions of the first detecting mechanism S_1 , the second detecting mechanism S_2 and the electromagnetic clutch 3 are similar to those explained with reference to FIG. 4. As is illustrated in FIG. 4, an alarming member L is connected with the terminal of the relay switch Ra through the switch S_5 . In conducting the copying operation, when the original support 7 has completed the reciprocating movement shown by arrows in FIG. 3 and is stopped in the home position, a projection 7''' mounted on the lower side of the original support 7 presses a plate of the switch S_5 to close it. Accordingly, in case the copy sheet does not arrive at the last nip rolls 11e during one reciprocating movement of the original support 7, since no signal is transmitted from the second detecting mechanism, the relay Ra is kept in the a-c closed state. Therefore, in this state, even if the actuating switch S_3 is in the closed state, the clutch 3 is not actuated, and at the same time, since in such state the switch S_5 is closed, jamming of the copy sheet is indicated by the alarming member L.

Instead of the switch mechanism of the above-mentioned hold-in relay type, there may be employed other switch mechanism of a self-holding type for controlling the action of the mechanism for effecting the feeding of a copy sheet.

FIG. 5 illustrates an embodiment of the switch mechanism of a self-holding circuit type where a known flip-flop circuit of semiconductors is used. In FIG. 5, the first detecting mechanism S_1 and the second detecting mechanism S_2 each a normally open switch, and switch Ra of relay R has a normally closed contact c-b. The

electrical connection of the relay switch Ra, the actuating switch S_3 and the solenoid C of the mechanism for effecting the feeding of a copying sheet is the same as illustrated in FIG. 4.

When the switch S_1 of the first detecting mechanism is closed by the pressing of a copy sheet, a positive pulse of a voltage V is generated by a trigger condenser C_1 , and the base voltage V_{BE2} of a transistor T_2 becomes positive and the transistor T_2 becomes non-conductive. As the transistor T_2 is thus in the open state, the voltage V_{BE2} is applied as negative potential on the collector side of the transistor T_2 . Thus, the base voltage V_{BE1} of a transistor T_1 becomes negative and the transistor T_1 becomes conductive.

An electric current I_{T1} is passed through the main circuit of the transistor T_1 and the relay R inserted in series is actuated. Thus, in the same manner as explained by referring to FIG. 4, the contact b-c of the relay switch Ra is opened and solenoid C the clutch 3 is de-energized.

When switch S_2 of the second detecting mechanism is closed by the transit of the copy sheet, the transistor T_2 is made rapidly conductive by a trigger condenser C_2 , and the conductivity of the transistors T_1 and T_2 is inverted. Namely, the transistor T_2 is in the "on" state and the transistor T_1 is in the "off" state. Thus, the relay R inserted in series to the transistor T_1 is broken off, and the original state is restored.

In FIG. 5, a direct electric current source 15 for transistors T_1 and T_2 (about 10 - 20 volts) is connected or cut by the main switch S_4 .

As is seen from the above explanation, in the embodiment illustrated in FIG. 5, the holding circuit is composed of two interactive transistors in a flip-flop circuit of a set-reset type for holding the interaction of the transistors.

FIG. 6 illustrates an embodiment where a holding circuit utilizing a controlled rectifier such as a gas discharge tubes is employed as the hold-in circuit of the switch mechanism. The first detecting mechanism includes a normally open switch S_1 and the second detecting mechanism includes a normally closed switch S_2 . As is shown in FIGS. 4 and 5, the relay R has a normally closed contact c-b of the switch Ra.

A gas discharge tube has such property that when under a direct electric current the main discharge between A-K is initiated, even if a current I_G of a circuit of a grid G is broken off, a current I_M of the main discharge is retained. Accordingly, when, as shown in FIG. 6, the first detecting switch S_1 is provided on the grid circuit and the second detecting switch S_2 is provided on the main current circuit, the switch S_1 applies an electric power to the grid to thereby ignite the gas discharge tube V and actuate the relay R. Even if the switch S_1 is turned off afterwards, the action of the relay R is held. The extinction of the discharge tube V is accomplished by opening switch S_2 inserted into the main current circuit I_M .

When the detecting switches S_1 and S_2 are disposed in the above-mentioned positions and the relay R is closed, relay switch Ra effects control in the same manner as explained above by referring to FIG. 4.

A direct electric current source 16 (about 150 - 200 volts) for the discharge tube circuit is connected or cut by the input switch S_4 in the same manner as in the circuit shown in FIG. 5.

Instead of the above-mentioned switches actuated by the contact pressure of a copy sheet, there may be used photoelectric switches as first and second detecting mechanisms. For instance, a light source and a light detector are disposed in a manner such that a passage for the delivery of a copy sheet will be interposed therebetween and the advance and transit will be detected by these members. FIG. 7 illustrates one embodiment of such detecting mechanism. The arrangement shown in FIG. 7 is particularly designed so that it will make the functions of the above-mentioned pressing switches S_1 and S_2 . In FIG. 7, PC designates a photo-semiconductor such as Cds or photo-transistor which is connected with the base of a transistor T_3 in the branched state as well as a resistance R_1 . The main current circuit from a power source V_B is connected in series to a resistance R_2 , the transistor T_3 and a relay R_s to form an amplification circuit.

A light $h\nu$ is radiated to the photo-semiconductor PC, and in this state the resistance of the photo-semiconductor PC is reduced, the transistor T_3 is in the non-conductive state and the relay R_s is not actuated. Accordingly, the connection contact $a-c$ of the relay switch R_{sa} is in the "off" state. When the light $h\nu$ radiated to PC is screened by a copying sheet O, the relay R_s is energized and the contact $a-c$ of the relay switch R_{sa} becomes in the "on" state.

In case the above arrangement is used as a normally closed switch such as the second switch mechanism S_2 in FIG. 6, the $c-b$ contact of the relay switch R_{sa} is utilized. In case the relay contact switch R_{sa} of the above circuit is used as first and second detecting mechanisms S_1 and S_2 , it is possible to conduct the detection without employing any switch member.

This invention has been detailed only by referring to the electrophotographic copying machine, but as is seen from the foregoing description, it is apparent that this invention may be applied to other copying machine of the type where a copy sheet is delivered through treatment zones in the machine.

What we claim is:

1. In copying apparatus including a treatment zone for forming a visible image on a copy sheet, a forwarding mechanism for moving a copy sheet along a forwarding passage through the treatment zone from an initial nip to a discharge nip, and a copy sheet feeding mechanism for delivering single copy sheets to the initial nip of the forwarding mechanism, the improvement comprising:

first detecting means generating a first signal in response to delivery of a copy sheet at the initial nip of the forwarding mechanism;

second detecting means generating a second signal in response to arrival of a copy sheet at the discharge nip of the forwarding mechanism; and

control means for controlling the copy sheet feeding mechanism having a first state inhibiting operation of the copy sheet feeding mechanism and a second state enabling operation of the copy sheet feeding mechanism, said control means being placed in said first state in response to said first signal and being placed in said second state in response to said second signal whereby said control means is in said first state when a copy sheet is in the forwarding passage to inhibit the feeding of another copy sheet to the initial nip of the forwarding mechanism and prevent successive jamming of copy sheets.

2. The improvement as recited in claim 1 wherein said control means includes normally closed contact means connected in series with actuating means for the copy sheet feeding mechanism, said control means being opened when said control means is in said first state in response to said first signal.

3. The improvement as recited in claim 1 wherein said control means includes actuating means for operating the copy sheet feeding mechanism, double throw switch means having first contact means connected in series with said actuating means and second contact means, and alarm means connected in series with said second contact means, said first contact means being open and said second contact means being closed when said control means is in said first state and said first contact means being closed and said second contact means being open when said control means is in said second state.

4. The improvement as recited in claim 3 wherein said control means includes alarm switch means connected in series with said second contact means and said alarm means, said alarm switch means being closed after completion of a copying cycle to energize said alarm means if said control means is not in said second state in response to said second signal.

5. The improvement as recited in claim 1 wherein said control means includes actuating means for operating the copy sheet feeding mechanism and relay means having hold-in contact means and contact means normally closed when said control means is in said second state and connected with said actuating means, said first detecting means includes normally open switch means generating said first signal when closed and connected to energize said relay means when closed to open said normally closed contact means to prevent energizing of said actuating means, and said second detecting means includes normally closed switch means generating said second signal when opened to deenergize said relay means and close said normally closed contact means to permit energization of said actuating means.

6. The improvement as recited in claim 1 wherein said control means includes a bistable circuit having input means and output means, switch means responsive to said output means, and actuating means for operating the copy sheet feeding mechanism connected with said switch means, said bistable circuit receiving said first and second signals at said input means and being responsive to said first signal to provide a signal at said output means opening said switch means to deenergize said actuating means and being responsive to said second signal to provide a signal at said output means closing said switch means to permit energization of said actuating means.

7. The improvement as recited in claim 6 wherein said switch means includes a relay having a winding connected with said bistable circuit output means and controlling contact means in series with said actuating means, said contact means being open when said control means is in said first state and being closed when said control means is in said second state.

8. The improvement as recited in claim 1 wherein said control means includes actuating means for operating the copy sheet feeding mechanism, a controlled rectifier having an anode-cathode circuit and a control electrode, and relay means having a winding connected in said anode-cathode circuit and controlling contact

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means connected in series with said actuating means, said first detecting means includes normally open switch means connected with said control electrode and closed to generate said first signal to trigger said controlled rectifier and energize said winding to open 5 said contact means to inhibit energization of said actuating means, and said second detecting means includes normally closed switch means connected in said anode-cathode circuit of controlled rectifier and opened to generate said second signal to render said controlled 10 rectifier non-conductive and deenergize said winding to close said contact means to permit energization of

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said actuating means.

9. The improvement as recited in claim 1 wherein said first and second detecting means each includes switch means disposed in the forwarding passage and actuated by contact with a copy sheet.

10. The improvement as recited in claim 1 wherein said first and second detecting means each includes an optical detector having a light source directing light across the forwarding passage and a light responsive circuit actuated when a copy sheet intercepts light across the forwarding passage.

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