

- [54] **CONTROL DEVICE FOR USE IN COPYING MACHINES**
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- [58] Field of Search.....**355/27-29, 42, 355/50, 64, 74; 352/170, 172**
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[57] **ABSTRACT**  
Means for controlling a copying machine as it exhausts its paper supply are provided in which a switch adapted to detect slack in the paper supply is connected to a control circuit which automatically deenergizes after slack has occurred. Means are provided within the circuit for allowing the copying machine to complete at least the printing cycle under way upon deenergization of the control circuit after which the control circuit shuts down the copying machine.

6 Claims, 2 Drawing Figures

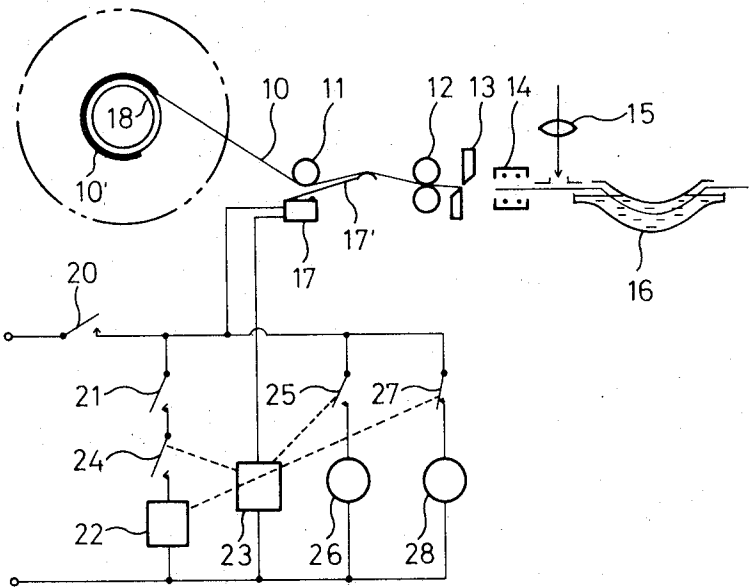


Fig. 1

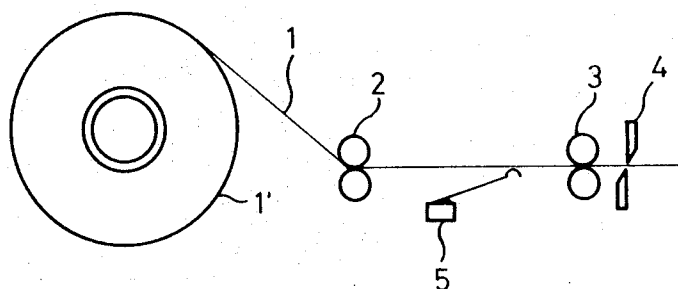
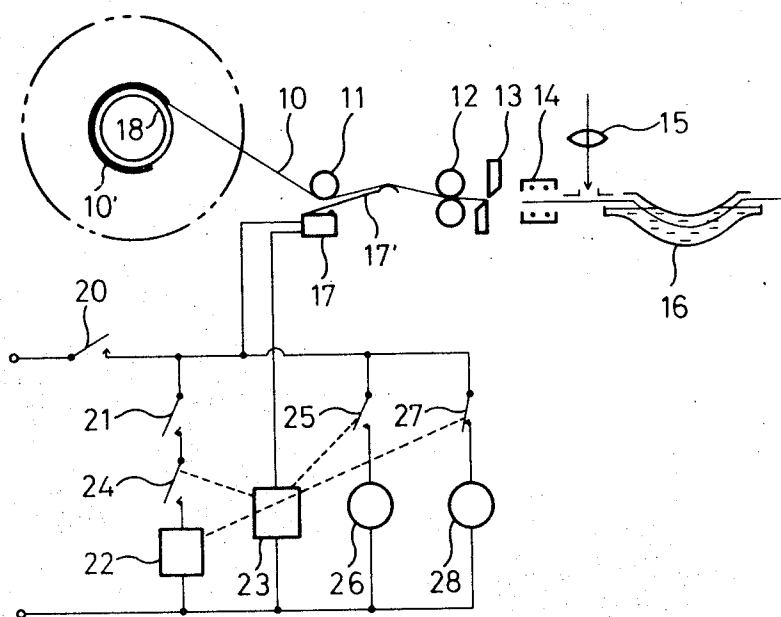


Fig. 2



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# CONTROL DEVICE FOR USE IN COPYING MACHINES

This invention relates to a control device for use in a copying machine, and more particularly, a control device which is capable of warning the run-out of copying paper stock and stopping the operation of a copying machine having copying paper roll set therein, when the supply of paper is exhausted.

FIG. 1 shows a built-in detector of exhaust of copying papers in a control device of a conventional copying machine, and

FIG. 2 diagrammatically shows a copying machine having a control device according to the present invention.

Hitherto, control device of this kind has been so arranged, as shown in FIG. 1, that copying paper roll loaded in a copying machine is passed without any slack through a pair of first rollers 2 and then through a pair of second rollers 3 located behind said first rollers and is cut to a predetermined size by means of a cutter 4 to be ready for copying. A warning of paper exhaust is given by a lamp or a buzzer located on the control panel by means of a micro-switch to detect any slack of paper 1 passing between the first rollers and the second rollers when the tailend of paper leaves the first rollers.

In the conventional copying machine, however, the end of copying paper can be first detected only when it has passed through the first rollers 2, and therefore it occasionally happens that the rest of paper stock at the time of the warning is not sufficient in length for intended copying. Inside a copying machine, for example, an electrostatic copying machine, there are provided a number of units for copying treatment, including those for charging, exposing, developing and fixing. Thus, the passage for copying paper through these units is so complicated that a paper conveying mechanism is required to be adjustable precisely and minutely. Especially, copying machines designed to obtain a fixed size copy allow very exactly-cut paper only to pass through the passage, without any trouble, and any copying paper, larger or smaller than the fixed size, usually can not be passed through each unit smoothly. Consequently, if any paper having a size out of a fixed range appears in a conventional machine as mentioned above, it can not proceed on its way smoothly, thereby causing the machine to be out of order.

This invention is intended to eliminate such defects as encountered in the conventional machine. The present invention will now be explained in full detail with reference to the embodiment as shown in FIG. 2.

In FIG. 2 showing an electrostatic copying machine, 10 is copying paper; 11 is a guide roller; 12 is a pair of conveying rollers through which the copying paper is passed; 13 is a cutter for cutting the copying paper to a predetermined size; 14 is a means for effecting corona discharge; 15 is an exposure means to project original image (not illustrated) to copying paper, and 16 is a developing means to make copied image visible.

It has already been known that original images can be reproduced on the copying paper 10 through the treating means 14-16. An end 10' of the copying paper is wound around the reel 18 loosely without fixing. The actuator 17' coupled with the micro-switch 17 is in contact with the surface of the copying paper 10. When the copying paper 10 becomes scarce on the reel 18,

causing some slack between the rollers 12 and the reel 18, the actuator 17' is held up as shown in FIG. 2.

20 is a main switch; 21 is a print switch; 22 and 23 are relay switches, of which 22 is a keep relay switch; a switch 27 is incorporated in the relay 22, while switches 24 and 25 in the relay 23. 26 is a warning device such as a lamp or a buzzer. 28 shows totally the part corresponding to the cutter 13, the corona discharger 14 and a lamp for exposure. When the switches 20, 21 and 24 are closed, the keep relay 22 is energized to close the switch 27. This keep relay does not break the switch 27 immediately but keeps it in a closed position until one copying cycle is over, even when the switch 24 opens. The switch 27 will open only when the copying cycle is completed. The relay 23 closes the switch 24 and at the same time, opens the switch 25 while the relay circuit is kept closed, whereas it opens the switch 24 and closes the switch 25 when the relay circuit is kept open.

The control mechanism, as explained above, operates as follows:

- a. In the case the copying paper is left so sufficient around the reel that the actuator 17' for the micro-switch 17 is positioned even and the micro-switch closes:

When the main switch 20 and the print switch 21 are both closed, the relay 22 is energized to close the switch 27, because the switch 24 is closed by the relay 23. Thus, the copying units 28 are energized to start their operating. At the time, the switch 25 is kept open as mentioned above so that the warning device does not operate.

- b. In the case the copying paper is left scarce around the reel so that the actuator 17' for the micro-switch 17 is allowed to come up and the micro-switch opens:

The micro-switch 17 opens and then, the relay circuit including the relay 23 opens, too. The relay 23 makes the switch 24 open and the switch 25 close. Thus, operates the warning device 26 which lets an operator know that the copying paper remains scarce. In this case, the switch 27 does not open immediately, as explained above, by the action of the keep-relay 22 but is kept closed until the copying cycle, under the operation of the micro-switch 17 is over. When the copying cycle is over, the switch 27 opens. Even if the operator tries to make another copying by switching the print switch 21 on, the machine will not operate.

It is of a special importance to this control device that the micro-switch 17 is not in a location subjected to the movement of the copying paper that has already passed through the roller 2 as shown in FIG. 1 but in a location to reach directly the surface of the copying paper just unwound from the reel, that is, to be directly affected by the condition of the copying paper wound around the reel. This specially designed location of the micro-switch enables the actuator 17' to come up as shown in FIG. 2, when the copying paper 10 begins to get unrolled and slide around the surface of the reel 18 which now has a small supply of copying paper. In this case, however, it is to be understood that the copying paper 10 still remains enough around the bobbin 18 to effect another copying even at the time the micro-switch 17 operates. Consequently, there is no worry at all about such nuisances as seen in the above-mentioned conventional machine.

Now, in the above-mentioned example, when the micro-switch 17 opens, the switch 25 is closed by the action of relay 23. In other words, when the supply of the copying paper is exhausted, the warning device is actuated immediately after the detection by the micro-switch. However, it should be understood that the present invention is not limited to the above-mentioned embodiment. In another embodiment of the present invention, for example, the switch 25 may be incorporated in the keep-relay 22. In this embodiment, it is quite feasible that even when the micro-switch 17 detects the end part of the copying paper 10, it does not energize the warning device 26 until the copying cycle corresponding to the operation of the micro-switch 17 is over, through the keep action of the keep-relay 22. As mentioned in the above, this invention provides a control device to reduce troubles in the paper carrying portions, as compared with any conventional device.

What we claim is:

1. A copying machine having a roll of copying papers self-contained therein, characterized by that the said machine is provided with a control device which comprises a micro-switch having an actuator being in contact with the copying paper withdrawn from the said roll at such a position of the paper conveying passage that it is directly affected by the condition of copying paper wound around the reel, the said micro-switch being a part of the control circuit by which the copying machine is permitted to complete at least the single copying cycle underway at the time of actuation of said micro-switch.

2. A copying machine having a roll of copying papers self-contained therein, characterized by that the said machine is provided with a control device which comprises a micro-switch having an actuator being in contact with the copying paper withdrawn from the said roll at such a position of the paper conveying passage that it is directly affected by the condition of copying paper wound around the reel, the said micro-switch being a part of the control circuit by which the copying machine is permitted to complete at least the single copying cycle underway at the time of actuation of said micro-switch, the said control circuit being provided with a warning device for indicating the exhaust of the copying paper by the actuation of the said micro-switch.

3. A copying machine comprising a paper carrying roll, the end of the paper being slidable on said roll when a predetermined amount of paper has been

removed therefrom, a micro-switch mounted adjacent said paper said micro-switch having an actuator mounted thereof for contacting the underside of said paper said actuator being movable from a first position defined by the paper before the paper has begun to slide on said roll in which the micro-switch is closed and a second position defined by the paper after it has begun to slide on said roll in which the micro-switch is opened by said actuator, a single roller positioned before said paper carrying roll such that the paper is permitted to slacken in the region of said actuator as the paper nears complete removal from said roll, a control circuit connected to said micro-switch, said control circuit being energized to permit the copying machine to operate when said actuator is in said first position and to de-energize the control circuit when said actuator is in the second position, means in said control for permitting the copying machine to complete at least the single copying cycle being carried out when said control circuit is de-energized, a pair or pressure rollers positioned after said actuator, a means for cutting said paper positioned after said pressure rollers, and means for copying positioned after said cutting means all of said elements being aligned on substantially the same horizontal line such that smooth transfer of copying paper is facilitated.

4. The copying machine specified in claim 3 further comprising means for providing a warning signal when said paper begins to slide on said roll, the warning signal means being connected in said control circuit, and means for energizing said warning signal means when said actuator is moved to said second position.

5. The copying machine specified in claim 3 wherein the means for permitting completion of at least the single copying cycle comprises a keep relay.

6. In a copying machine having a roll of copy paper thereon, which paper is fed into said copying machine, the improvement comprising means for permitting slack to occur in said paper as it is moved between said roll and said copying machine when the paper nears the end of the roll, means for detecting the occurrence of slack in said paper, a normally energized control circuit connected to said slack detecting means, said control circuit being deenergized by said slack detecting means upon the occurrence of slack in said paper, and means for permitting completion of at least the copying cycle the machine is in when the said control circuit is deenergized.

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