

[54] **AUTOMATIC SHUT-OFF CIRCUIT FOR
COPYING MACHINE**

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[56] **References Cited**

UNITED STATES PATENTS

3,169,476 2/1965 Fielding 101/247

3,421,005	1/1969	Baker	250/206
3,401,265	9/1968	Dotto	250/206
3,593,065	7/1971	Domalski et al.	250/206 X
3,584,222	6/1971	Nesbitt	250/206 X

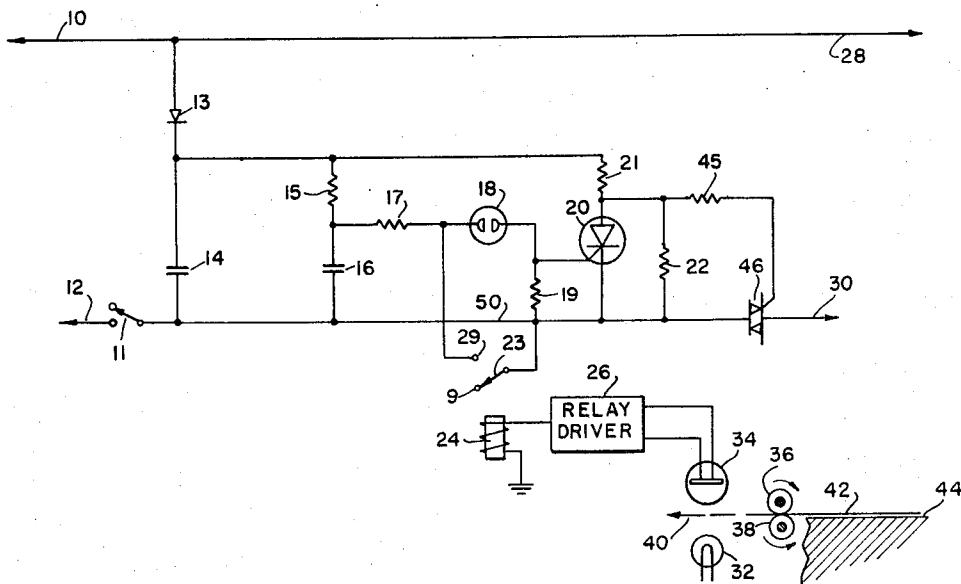
Primary Examiner—Walter Stolwein

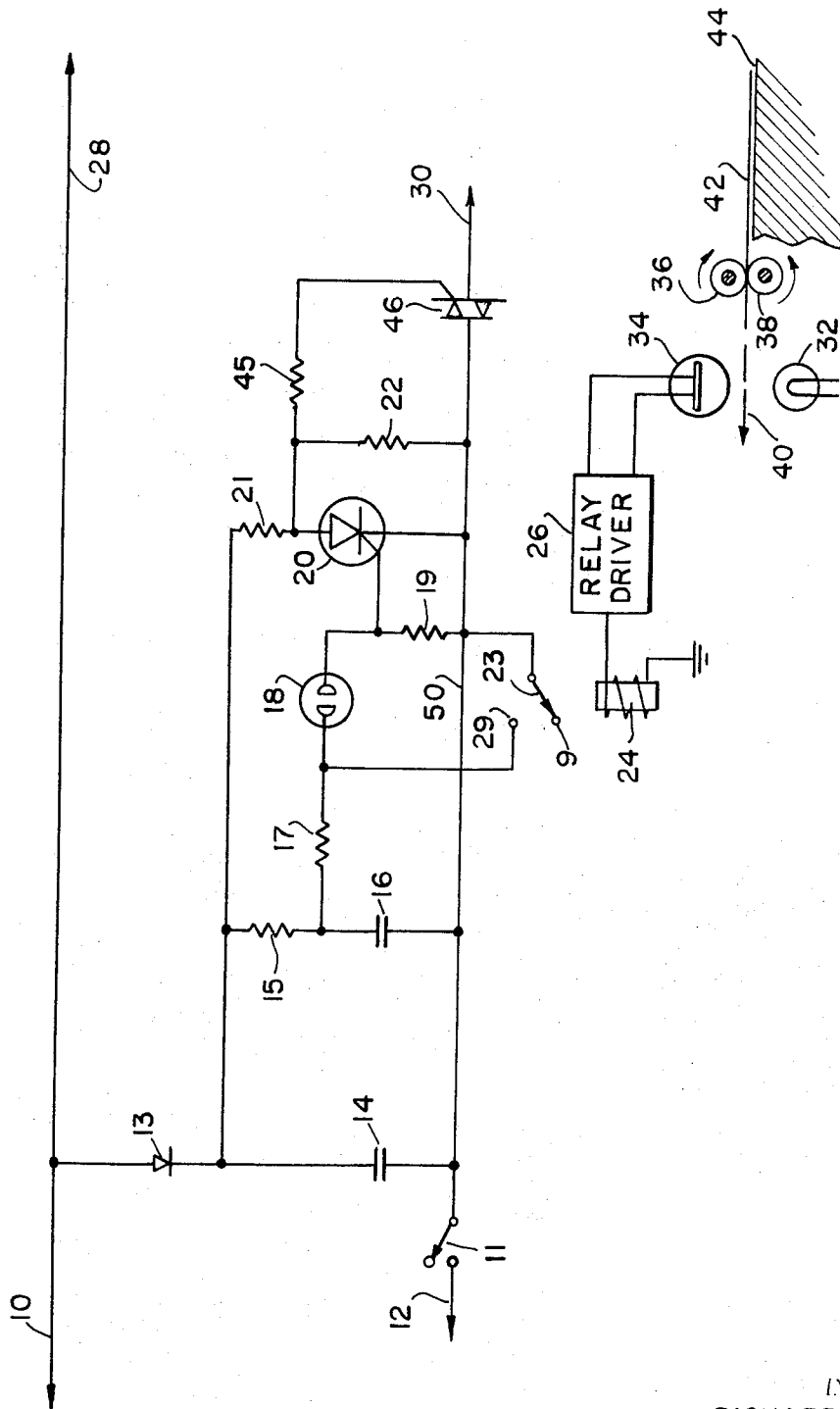
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[57] **ABSTRACT**

An automatic shut-off circuit for a copying machine. A Triac is included in one of the two power leads extended to the machine. A control circuit, connected across the power line, includes a 60-second timing circuit and an SCR. The SCR is triggered at the end of the 60-second timing period and causes the Triac to turn off, thus cutting off power to the machine. Whenever an original document inserted into the machine is detected, the timing circuit is reset. Only if no new document has been fed into the machine for a period of 60 seconds is the machine automatically shut off.

9 Claims, 1 Drawing Figure





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AUTOMATIC SHUT-OFF CIRCUIT FOR COPYING MACHINE

This invention relates to automatic shut-off circuits, and more particularly to such circuits for use with copying machines.

Many present-day office copying machines are constructed such that once the main power switch is turned on, the machine remains on until the switch is turned off. Typically, the machine remains on for the duration of the business day. Since during much of the day the machine is not in use, it is apparent that there is a waste of power and an unnecessary wear of parts.

There are many automatic shut-off mechanisms which have been designed for various equipments. Generally speaking, such mechanisms are not suited for use on a copying machine because they do not provide for a proper determination to be made as to when the machine should be shut off. In the compending application of T. F. Aasen, Ser. No. 19,994 filed on Mar. 16, 1970, there is disclosed an electromechanical automatic shut-off mechanism for a copying machine. However, the mechanism disclosed in the Aasen application is relatively costly and requires the use of a timing motor and mechanical levers. For maximum reliability it would be highly desirable to provide an electronic circuit for automatically shutting off a copying machine after a predetermined period of non-use.

It is a general object of my invention to provide an automatic shut-off circuit for a copying machine.

Briefly, in accordance with the principles of my invention, a Triac is included in one of the two power leads extended to the machine. Across the power line there is placed a circuit which includes an RC timing circuit and an SCR. Normally the SCR does not conduct and a control potential is extended to the Triac to allow it to pass current in either direction. At the end of the 60-second timing period, however, the SCR is turned on; conduction of the SCR decreases the control potential extended to the Triac and it no longer conducts current. The timing circuit is reset each time an original document is fed into the machine. Thus only if a document is not fed into the machine for a period of 60 seconds does the Triac turn off. When the SCR turns on, it stays on. In order to turn the SCR off and to cause the Triac to conduct once again, the main power switch must be turned off and then on again.

It is a feature of my invention to provide an electronic control circuit across the power leads to a copying machine for controlling the turning off of a semiconductor switch included in one of the power leads when no new original document has been fed into the machine for a predetermined time interval.

It is another feature of my invention to provide for the resetting of the control circuit (which allows power to be delivered once again to the machine) by the turning off and then on again of the main power switch of the machine.

Further objects, features and advantages of my invention will become apparent upon consideration of the following detailed description in conjunction with the drawing which depicts schematically an illustrative embodiment of my invention.

The schematic drawing shows only those elements of a copying machine necessary for an understanding of the principles of the invention. The machine is provided with a flat bed 44 on which an original document 42 to be copied is placed. The document is fed into the nip of rollers 36, 38 which are controlled to turn in the directions of the arrows shown in the drawing. The rollers cause document 42 to move in the direction of arrow 40. As the document passes between lamp 32 and photodetector 34, the light from the lamp to the detector is blocked. The sensing of the document, a conventional technique, can be used for a number of purposes. For example, it can be used to start the feed of the copy paper. It can also be used to cut a shut of copy paper from a roll to exact size; when the trailing edge of the original document 42 passes the lamp and photo-detector, the energization of the photo-detector can cause the knife to cut a sheet from the copy roll. The various functions controlled by the sensing elements are

not necessary for an understanding of the present invention. As far as the present invention is concerned, all that is important is to note that the output of the photo-detector is extended to relay driver 26. The relay driver, which controls the operation of relay 24, is energized when the photo-detector detects light; contact 23 is normally open (the relay is normally operated) to break the connection of the junction of resistor 17 and neon lamp 18 to bus 50. However, whenever an original document passes between lamp 32 and photo-detector 34, the blocking of light from the photo-detector de-energizes relay driver 26. At this time contact 23 closes (moves from terminal 9 to terminal 29) and the junction of the resistor and neon lamp is clamped to bus 50.

Conductors 10, 12 are contained in the power line of the machine and it is over these conductors that power is supplied to the machine. The control circuit of the invention is connected across conductors 10, 12 at the input of the machine. Conductors 28, 30 are extended to the other elements in the machine. Conductor 10 is connected directly to conductor 28. However, conductor 12 is not connected directly to conductor 30. Only if main on-off power switch 11 is closed and Triac 46 conducts can current flow from conductor 12 to conductor 30. As shown in the drawing, contact 11 is in its open position corresponding to the off position of the main on-off switch. When the switch is first closed, Triac 46 conducts and power is delivered to the rest of the machine. Power is cut off if either switch 11 is manually opened, or Triac 46 turns off under control of the timing circuit. Once the Triac turns off, in order to enable it to conduct once again it is necessary to open switch 11 and to then close it once again. The closing of the switch not only connects conductor 12 to bus 50, but also provides an enabling potential to the Triac to turn it on once again as will be described below.

When switch 11 is closed, current flows from conductor 10 through diode 13 and capacitor 14 to conductor 12. The diode serves to half-wave rectify the current and thus a DC voltage appears at the junction of the capacitor and the diode. The capacitor smooths the voltage although there is a ripple on it.

The DC potential at the junction of diode 13 and capacitor 14 is extended through resistors 21 and 45 to the gate terminal of Triac 46. As long as SCR 20 does not conduct, the potential at the gate terminal of the Triac is high enough to enable the Triac to conduct in either direction. With switch 11 closed and the Triac enabled to conduct, current can flow through conductors 28, 30 to the other elements in the machine. The Triac is essentially a semiconductor switch which conducts current in both directions when a turn-on control signal is applied to its gate terminal.

The DC potential at the junction of diode 13 and capacitor 14 also causes current to flow through resistor 15 and capacitor 16. The potential across capacitor 16 thus starts to increase when switch 11 is first closed. Resistors 17 and 19, and neon lamp 18, are connected in series across capacitor 16. The neon lamp does not conduct until the potential across it exceeds a breakdown value. As capacitor 16 continues to charge, eventually the potential across the capacitor is sufficient to cause breakdown of the neon lamp. Current flows from the capacitor through resistor 17, lamp 18 and resistor 19. The positive potential developed across resistor 19 is sufficient to turn on SCR 20. When the SCR turns on, resistor 45 is effectively connected directly to bus 50. The DC potential at the junction of resistors 21 and 45 is now insufficient for enabling conduction of the Triac. The Triac turns off and no more power is delivered to the machine. The Triac is kept off because SCR 20 stays on. Once neon lamp 18 breaks down, current continues to flow through diode 13, resistor 21, and the SCR.

The function of resistor 22 is simply to drop the voltage at the junction of resistors 21 and 45 when SCR 20 does not conduct. The potential at the junction of diode 13 and capacitor 14 is almost at the peak of the line voltage. Such a large potential is not necessary at either the gate terminal of Triac 46 to keep it on (when SCR 20 is off) or to keep SCR 20 on when it

conducts. Resistors 21 and 22 serve as a voltage divider so that the potential at the junction of the resistors is less than the potential appearing across capacitor 14.

When the machine is first turned on with the closing of switch 11, if an original document is not fed into the machine relay 24 is energized. With contact 23 connected to terminal 9, the junction of resistor 17 and lamp 18 is not shorted to bus 50. Consequently, the potential across capacitor 16 starts to increase and if relay 24 is not de-energized after 60 seconds lamp 18 breaks down and Triac 46 turns off. However, when an original document is fed into the machine relay 24 de-energizes. Contact 23 moves to terminal 29 to short the junction of resistor 17 and lamp 18 to bus 50. Resistor 17 is relatively small in magnitude compared to resistor 15. Consequently, capacitor 16, even if it has already charged to a relatively high potential, discharges through resistor 17 and is then maintained at a potential determined by the relative magnitudes of resistor 15 and 17. As long as the original document keeps relay 24 de-energized, the capacitor potential is kept at a low value.

When the original document no longer blocks light from photo-detector 34, relay 24 energizes once again. Although lamp 18 is no longer connected through contact 23 to bus 50, the lamp does not break down because the potential across capacitor 16 is too low. But because resistor 17 is no longer shorted to bus 50, the capacitor voltage starts to rise once again. After 60 seconds have elapsed following the energization of relay 24, if no new document has been fed into the machine lamp 18 breaks down and Triac 46 turns off.

Once the Triac turns off, it is held off because SCR 20 remains conducting and the Triac gate terminal remains connected through resistor 45 (of small magnitude) and the SCR to bus 50. In order to turn the Triac on once again, it is necessary to turn the main on-off switch 11 to the off position. When the switch is moved to the position shown in the drawing, current no longer flows between conductors 10 and 12. The voltage across capacitor 14 decays rapidly until it is no longer sufficient to maintain current flow through resistor 21 and SCR 20. The SCR turns off when the current through it becomes less than the holding current. When switch 11 is then closed once again, although a DC potential is developed across capacitor 14, since the SCR is no longer conducting the Triac can conduct current.

When the machine (the other elements, not shown, connected to conductors 28 and 30) turns off after SCR 20 turns on, current continues to flow through diode 13, resistor 21 and SCR 20. However, this current is of very small magnitude and thus there is a negligible waste of power compared to the power wasted were Triac 46 to continue to conduct and supply power to the rest of the machine. It should be noted that when the Triac turns off and power is no longer delivered to the rest of the machine, relay 24 must necessarily de-energize and contact 23 then connects the junction of resistor 17 and lamp 18 to bus 50. This is the position which ordinarily prevents turn-on of the SCR. However, once the SCR has fired, the shorting of the SCR gate terminal to bus 50 has no effect; the SCR remains on until the current through it falls below the holding current.

Although the invention has been described with reference to a particular embodiment, it is to be understood that this embodiment is merely illustrative of the application of the principles of the invention. Numerous modifications may be made therein and other arrangements may be devised without departing from the spirit and scope of the invention.

What I claim is:

1. An automatic shut-off circuit for a copying machine, said copying machine including a main power line having on-off switch means therein and means for detecting the feeding into the machine of an original document to be copied, said shut-off circuit comprising semiconductor switch means having a control terminal connected in said power line, voltage breakdown means coupled to the control terminal of said semiconductor switching means, means for normally maintaining said

voltage breakdown means in a non-conducting condition to enable conduction of said semiconductor switching means, means for controlling conduction through said voltage breakdown means after a predetermined time interval, said voltage breakdown means thereafter remaining on to prevent conduction through said semiconductor switching means independent of said controlling means, means for resetting said controlling means responsive to the detection by said detecting means of an original document being fed into said machine, and means responsive to the opening of said on-off switch means for turning off said voltage breakdown means for thereafter enabling the conduction of said semiconductor switching means responsive to the closing of said on-off switch means.

2. An automatic shut-off circuit for a copying machine in accordance with claim 1 wherein said voltage breakdown means is connected across said power line following said on-off switch means such that the opening of said on-off switch means cuts off current flow from said power line through said voltage breakdown means.

3. An automatic shut-off circuit for a copying machine in accordance with claim 2 wherein said controlling means includes a capacitor, means for charging said capacitor, means responsive to the voltage across said capacitor reaching a predetermined value for causing said voltage breakdown means to turn on, and means responsive to the detection by said detecting means of an original document fed into said machine for preventing the charging of said capacitor above a value which is substantially below that value which causes said voltage breakdown means to turn on.

4. An automatic shut-off circuit for a copying machine in accordance with claim 3 wherein said detecting means includes photo-detecting means and lamp means for illuminating said photo-detecting means across the path followed by an original document fed into the machine.

5. An automatic shut-off circuit for a copying machine in accordance with claim 1 wherein said controlling means includes a capacitor, means for charging said capacitor, means responsive to the voltage across said capacitor reaching a predetermined value for causing said voltage breakdown means to turn on, and means responsive to the detection by said detecting means of an original document fed into said machine for preventing the charging of said capacitor above a value which is substantially below that value which causes said voltage breakdown means to turn on.

6. An automatic shut-off circuit for a copying machine in accordance with claim 5 wherein said detecting means includes photo-detecting means and lamp means for illuminating said photo-detecting means across the path followed by an original document fed into the machine.

7. An automatic shut-off circuit for a copying machine, said copying machine including a main power line having on-off switch means therein and means for detecting the feeding into the machine of an original document to be copied, said shut-off circuit comprising semiconductor switch means connected in said power line to be energized thereby and to supply power to said machine, a normally non-conducting element connected to said power line, voltage breakdown means for energizing said normally non-conducting element and for de-energizing said semiconductor switch means to thereby turn off the supply of power to said machine, means for controlling conduction through said voltage breakdown means after a predetermined time interval, means for resetting said controlling means responsive to the detection by said detecting means of an original document being fed into said machine and means responsive to the opening of said on-off switch means for turning off said voltage breakdown means.

8. An automatic shut-off circuit for a copying machine in accordance with claim 7 wherein said controlling means includes a capacitor, means for charging said capacitor, means responsive to the voltage across said capacitor reaching a predetermined value for causing said voltage breakdown means to turn on, and means responsive to the detection by

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said detecting means of an original document fed into said machine for preventing the charging of said capacitor above a value which is substantially below that value which causes said voltage breakdown means to turn on.

9. An automatic shut-off circuit for a copying machine in accordance with claim 7 wherein said resetting means includes a normally open switch, a relay for closing said switch

responsive to the detection by said detecting means of an original document being fed into said machine, closure of said switch being operable to discharge said controlling means and thereby prevent conduction through said voltage breakdown means.

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