United States Patent [19]

Sprague

[11] **3,783,235**

[45] **Jan. 1, 1974**

[54] **FUSER LOW VOLTAGE SENSOR FOR PHOTOCOPY MACHINE**

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[22] Filed: **Oct. 31, 1972**

[21] Appl. No.: **302,588**

[52] **U.S. Cl.** **219/216**

[51] **Int. Cl.** **H05b 1/00,** G03g 15/20

[58] **Field of Search** ..... 219/216, 210, 501, 219/502, 388; 263/6 E, 227–228; 250/65 T, 65 ZE, 317–319

[56] **References Cited**

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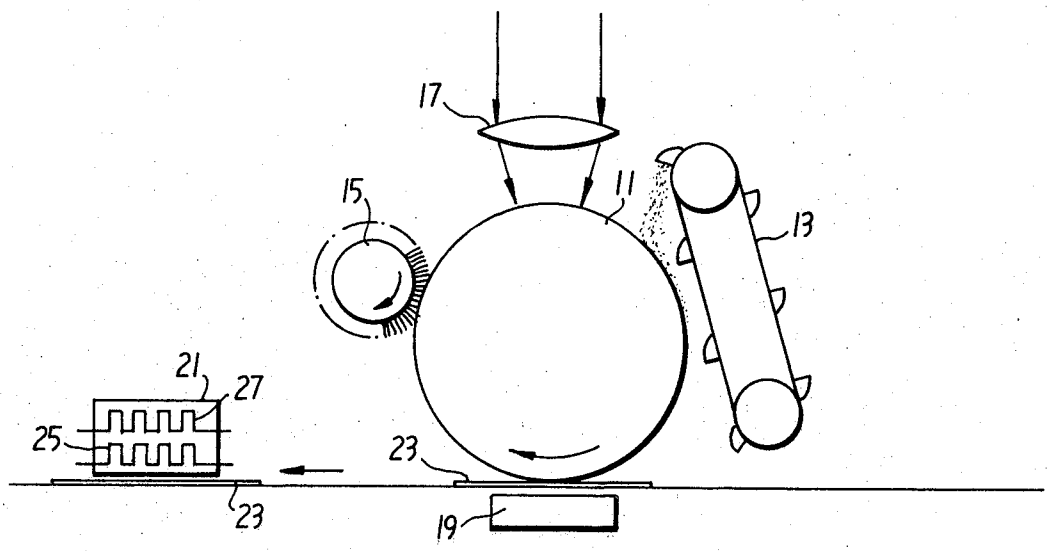
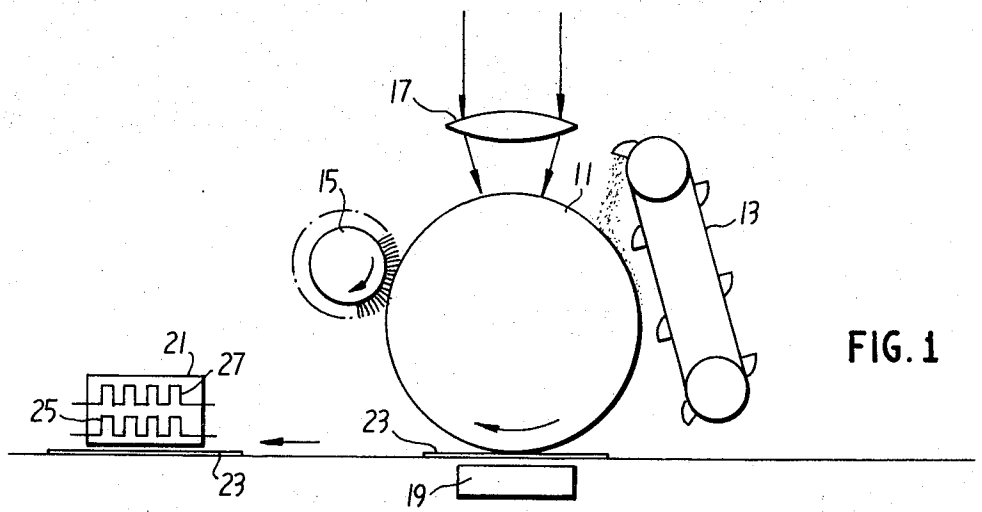
[57] **ABSTRACT**

A fuser system for a xerographic photocopy machine. The fuser system comprises primary and secondary fuser heating resistors connected in parallel legs across an A.C. line voltage. The primary fuser heating resistor is connected directly across the line voltage and continuously produces fusing heat. A triac is connected in series with the secondary fuser resistor and a monitoring-and-controlling circuit is connected in parallel with the first and second parallel legs, across the line voltage, for monitoring the line voltage and controlling the triac so as to cause electrical current flow through the secondary fuser heating resistor when the line voltage drops below a predetermined value. The monitoring-and-controlling circuit comprises a lamp and a photoconductor, each being connected in parallel across the line voltage. Light from the lamp controls the voltage across the photoconductor and the voltage across the photoconductor is used to control current flow through the triac.

5 Claims, 2 Drawing Figures




17
15
11
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23
19

FIG. 1

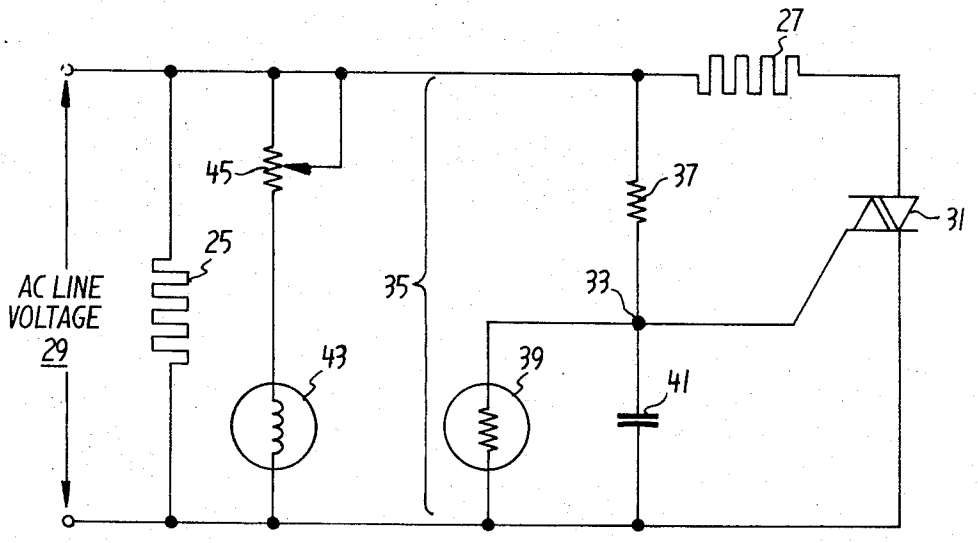
27
45
37
31
25
AC LINE
VOLTAGE
29
35
33
43
39
41

FIG. 2

FUSER LOW VOLTAGE SENSOR FOR PHOTOCOPY MACHINE

BACKGROUND OF THE INVENTION

This invention relates broadly to the art of photocopying machines and more specifically to photocopying machines which employ fuser heating units for fusing developer powder to copy sheets.

It is normally necessary that fuser heating units of xerographic-type photocopying machines produce heating temperatures which fall within fixed ranges. In this regard, if the heating temperatures are unduly high they may damage copy sheets which are processed by the fuser heating units. On the other hand, if temperatures are excessively low they do not produce the proper fusing of developer powder to the copy sheets.

A problem which is sometimes encountered in the use of photocopying machines is that A.C. line voltages decrease, thereby causing heating resistors of fuser heating units to radiate decreasing amounts of heat, which, in turn, produces decreasing fusing temperatures. In one photocopying machine, for example, it has been found that when a line voltage, which is normally 120 volts, drops below 105 volts a fuser heating unit produces insufficient heat to effect proper fusing.

It is therefore an object of this invention to provide a fuser heating system for a photocopying machine which produces sufficient heat to effect proper fusing of developer powder to copy sheets at decreasing line voltages.

It is a further object of this invention to provide such a fuser heating system which is relatively uncomplicated and inexpensive to manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention in a clear manner.

FIG. 1 is a simplified side elevation of a photocopying machine which employs a fuser heating system of this invention; and,

FIG. 2 is a schematic diagram of the electrical circuit of the fuser heating system of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown a simplified side elevation of a xerographic photocopying machine comprising a photoconductive drum 11, a developer-powder unit 13, a cleaning brush 15, an optical system 17, an image transfer unit 19, and a fuser heating unit 21. The manner in which the xerographic photocopying machine of FIG. 1 produces developer-powder images on copy sheets 23 is well known in the art and therefore not explained here. The copy sheets 23, having developer-powder images thereon, are transported under the fuser heating unit 21 which applies heat for fusing the developer powder to the copy sheets 23. It should be particularly noted that the fuser heating unit 21 has a primary heating element 25 and a secondary heating element 27.

Turning now to the schematic electrical diagram of FIG. 2, it can be seen that the primary heating element 25 and the secondary heating element 27 are connected in parallel legs across an A.C. line voltage 29. Connected in series with the secondary heating element 27 is an electronic valve 31 in the form of a triac.

Current flow through the electronic valve 31 is controlled by the voltage appearing at a valve-control voltage point 33. The voltage appearing at the valve-control point 33 is established by a voltage divider and control circuit 35 which comprises a fixed resistor 37, and a photoconductor 39 and capacitor 41 connected in parallel. The conductance of the photoconductor 39 is increased by increasing the light radiating upon the photoconductor.

A lamp 43 is also connected across the A.C. line voltage 29. The lamp senses or monitors the line voltage and produces lumination proportional to the magnitude of the line voltage. A potentiometer 45 is connected in series with the lamp 43 for adjusting the sensitivity of the lamp 43. It can be seen in FIG. 2 that the lamp 43 and the photoconductor 39 are positioned relative to each other such that light from the lamp 43 falls on the photoconductor 39 and thereby causes an increase in conductance of the photoconductor 39.

In operation, when the line voltage 29 is at a normal magnitude the primary heating element 25 conducts a normal current and thereby dissipates a planned amount of energy in the form of heat; thus, the fuser heating unit 21 provides a desired amount of heat for fusing developer powder to copy sheets 23. At this magnitude of line voltage the lamp 43 produces a sufficient amount of light to make the conductance of the photoconductor 39 relatively high so that the peaks of the voltage control signal at the valve-control voltage point 33 are at relatively low amplitude. At these levels the electronic valve (triac) 31 is not "fired" during A.C. cycles in either direction and, therefore, no current flows through the secondary heating element 27.

As the line voltage 29 decreases the lamp 43 provides less light on the photoconductor 39 and the resistance of the photoconductor increases. This causes the peak amplitudes of the voltage control signal at the valve control voltage point 33 to increase. At some specified value of line voltage, say 107 volts, the voltage at control voltage point 33 fires the electronic valve (triac) 31 and current flows through the secondary heating element 27, element 27 therefore dissipates energy which is added to the energy dissipated by the primary heating element 25 to increase the amount of heat produced by the fuser heating unit 21. Thus, when the line voltage drops near a value at which element 25 is unable to generate sufficient heat, the triac is turned on so that element 27 may generate additional heat. It should be appreciated that the fuser heating system of this invention provides an uncomplicated and relatively inexpensive arrangement for compensating for decreases in line voltage.

It should be noted that in the present invention the control of triac 31 is essentially binary or ON-OFF in character. Over a 1 or 2 volt variation in the A.C. line voltage, in the region of about 108 volts, the triac 31 may, as is well known, be fired for only a portion of the cycle. However, the components of the monitoring and controlling circuit are chosen such that the range of line voltages over which this type of operation takes place is limited. Thus, in a typical embodiment there

may be no current flow through element 27 when the line voltage is above about 108 volts, but there will be current flow through the element 27 throughout each cycle when the line voltage is below 107 volts.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A fuser heating system for a photocopying machine comprising:

two line voltage leads for connecting said fuser heating system across a line voltage;

primary and secondary fuser heating elements connected respectively in first and second parallel legs across said line voltage leads;

an electronic valve connected in series with said secondary fuser heating element in said second parallel leg;

a monitoring-and-controlling circuit connected in parallel with said first and second parallel legs across said line voltage leads for monitoring said line voltage and controlling said electronic valve so as to cause an increase in electrical current flow through said valve in response to a decrease in line voltage.

2. A fuser heating system as claimed in claim 1 wherein said monitoring-and-controlling circuit comprises a lamp which is connected across said line voltage leads, and a photoconductor, the conductance of which varies in response to light emitted by said lamp, connected across said line voltage leads.

3. A fuser heating system as claimed in claim 2 wherein said electronic valve is a triac.

4. A fuser heating system as claimed in claim 3 wherein said monitoring-and-controlling circuit further comprises a resistor in series with said photoconductor, a capacitor in parallel with said photoconductor, and means for applying a voltage developed at the junction point between said photoconductor, said resistor, and said capacitor, to said triac as a control voltage.

5. A fuser heating system as claimed in claim 1 and including an AC voltage source for supplying said line voltage.

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