(12) UK Patent Application (19) GB (11) 2 104 673 A

(21) Application No 8222351
(22) Date of filing 3 Aug 1982
(30) Priority data
(31) 56/122320
(32) 3 Aug 1981
(33) Japan (JP)
(43) Application published 9 Mar 1983
(51) INT CL³ G03B 27/72
(52) Domestic classification G2A 301 310 BH C23 C3 C5
(56) Documents cited
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(58) Field of search G2A
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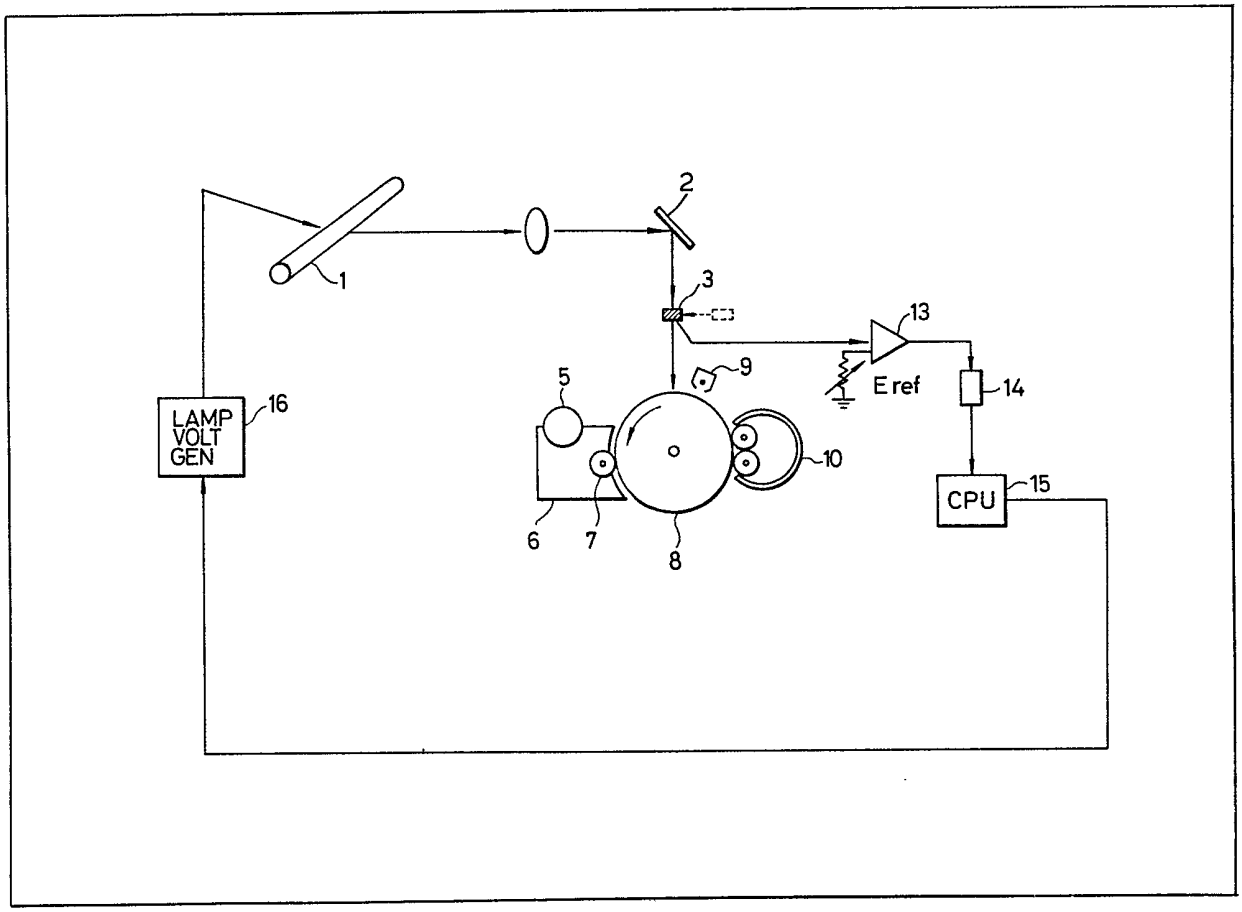
(54) Controlling light intensity

(57) The intensity of light emitted by a lamp 1 and passing through an optical system to a photosensitive drum 8 of a photocopying machine is sensed by a detector 3 which is periodically moved into the light path. An output signal of the detector 3, which is dependent upon the intensity thus sensed, is compared by an operational amplifier 13 with a reference voltage representing the optimum light intensity, and an output signal of the amplifier is used to control a voltage regulator 16 which in turn controls the voltage applied to the lamp 1. In the event that the lamp intensity decreases or components of the optical system become contaminated, which would otherwise reduce the amount of light reaching the drum 8, the sensor 3 and the regulator 16 operate to adjust the intensity of the lamp 1 to compensate for this.



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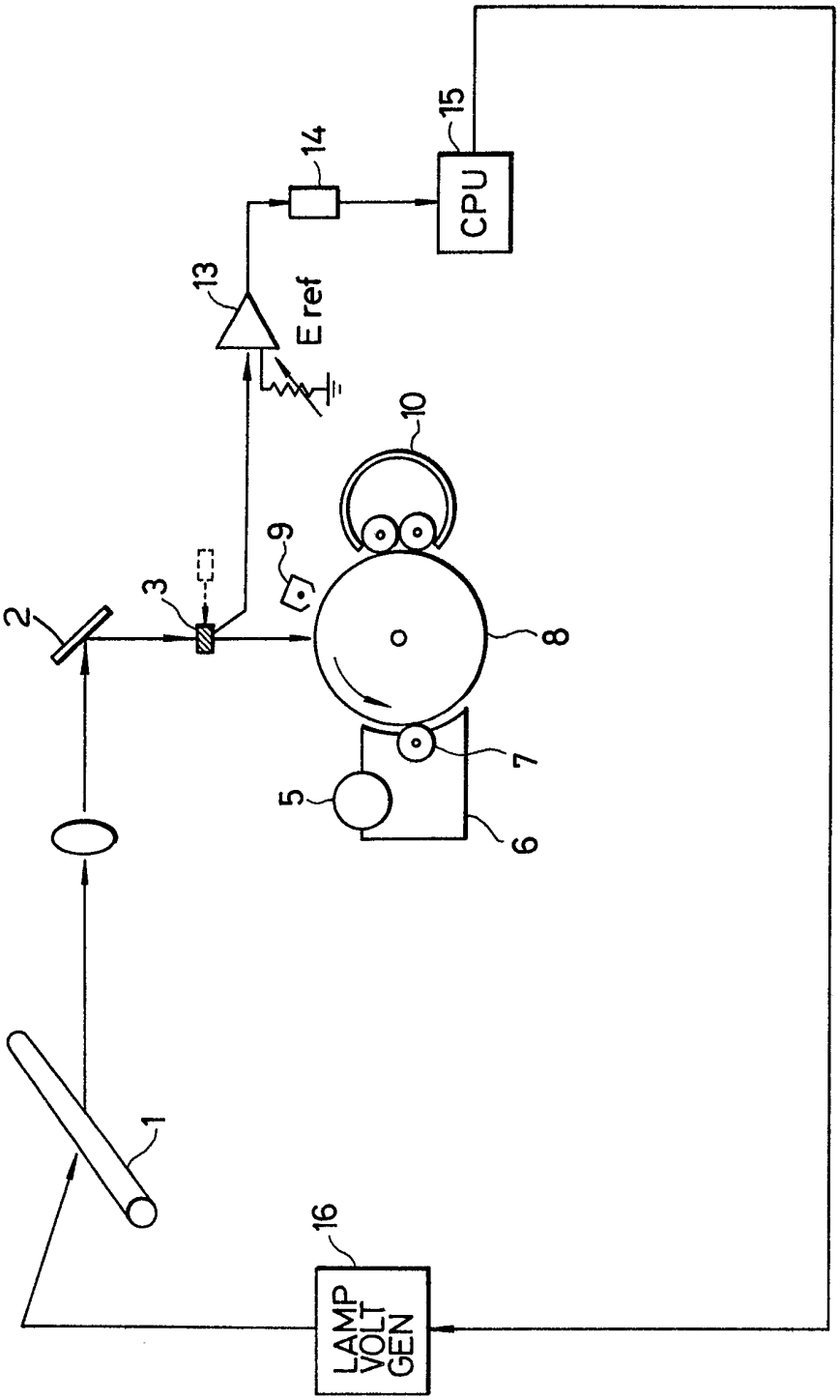
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SPECIFICATION

Automatic exposure control in a photocopying machine

This invention relates to automatic exposure control in a photocopying machine.

In a typical photocopying machine, the amount of light produced by an exposure lamp is liable to vary with time, and the surfaces of a light-collecting lens and a mirror which are utilized to apply the light to a photosensitive drum, are liable to become dirty. Both of these factors contribute to a variation in light quantity or the degree of contamination, i.e. the degree of deterioration of the optical system. These factors in turn depend upon the frequency of operation of the photocopying machine as well as the environmental conditions surrounding the machine. Thus, the light-producing system of a conventional copying machine is disadvantageous in that different copying machines vary in the degree of deterioration of the optical systems thereof and, accordingly, vary in the frequency at which maintenance work is required.

It is an object of the present invention to overcome this particular problem.

According to a first aspect of the present invention, there is provided a photocopying machine comprising a light source which provides light in an optical path to a photosensitive drum to record an image, a light sensor which senses the intensity of said light in the optical path and produces an output signal in accordance therewith, and control means which operates to vary the intensity of said light as a function of said output signal. In this way, the amount of light emitted by the exposure lamp can be automatically controlled to an optimum value, so that the frequency at which maintenance work is required can be decreased.

According to a second aspect of the present invention, there is provided a method of controlling exposure in a photocopying machine wherein a light source provides exposure light through a light providing system, the method comprising the steps of sampling the exposure light provided through the light providing system, and altering the intensity of the exposure light automatically to maintain an optimum level of exposure.

The invention will now be further described, by way of example only, with reference to the single figure of the accompanying drawing, which is a diagram of an optical system of a photocopying machine according to the invention.

The illustrated photocopying machine comprises generally an exposure lamp 1 which projects light by way of a light-concentrating lens and a mirror 2 to a rotatable drum 8 having a photosensitive surface made of selenium. This optical system projects onto the drum 8 an image of an original to be copied in a conventional manner, the image being developed by a developing unit 6 which contains a toner supply motor 5 and a bias electrode 7. Reference numeral 9 denotes a charge corotron (charging), while reference numeral 10 designates a cleaning unit.

The present invention is based on the recognition that, at a suitable time during the use of the copying machine, an optical intensity sensor 3 can be set within the optical path between the mirror 2 and the drum 8, such that the output of the sensor 3 can control the intensity of the exposure lamp 1, increasing the intensity to the point where copying operations can be effected satisfactorily even under conditions of deterioration of the optical system as described above. The optical intensity sensor 3 is so designed as to be movable into and out of the optical path by means of solenoid (not shown).

The quantity of light applied to the drum is detected by the sensor 3, which latter produces an output signal dependent upon the quantity of light thus detected. This output signal is applied to an operational amplifier 13 where it is compared with a reference voltage E_{ref} determined from the optimum intensity of the light with respect to the sensitivity of the photosensitive drum (the reference voltage being determined by experimentation). An analogue output signal of the operational amplifier 13 is converted into a digital signal by an A/D converter 14, the output of which is applied to a central processing unit (CPU) 15. The output of the CPU is used to drive a voltage controller 16 which controls the voltage applied to the lamp 1 and thereby controls the intensity of the light emitted thereby. A suitable CPU can be chosen from any number of commercially available processors.

The amount of light which is actually applied to the drum can be detected in the manner described above. Accordingly, the device can automatically correct or compensate for either a decrease in the intensity of the lamp or contamination of the optical system. As a result, the frequency at which manual maintenance work is needed can be reduced. Furthermore, if the light intensity of the lamp is too great, it can be rediced by controlling the reference voltage of the operational amplifier.

CLAIMS

1. A photocopying machine comprising a light source which provides light in an optical path to a photosensitive drum to record an image, a light sensor which senses the intensity of said light in the optical path and produces an output signal in accordance therewith, and control means which operates to vary the intensity of said light as a function of said output signal.

2. A photocopying machine as claimed in claim 1, wherein the light sensor is periodically inserted into and removed from the optical path.

3. A photocopying machine as claimed in claim 1 or 2, wherein the control means includes means which compares the output signal of the light sensor with a signal corresponding to an optimum level to light intensity in the optical path.

4. A photocopying machine as claimed in claim 3, wherein said optimum level signal is generated as a function of the optimum light intensity for the

proper operation of the photosensitive drum.

5. A photocopying machine as claimed in claim 3 or 4, wherein the control means further comprises an analogue-to-digital converter, a central processing unit and a voltage-controlled lamp regulator.

6. A method of controlling exposure in a photocopying machine wherein a light source provides exposure light through a light providing system, the method comprising the steps of sampling the exposure light provided through the light providing system, and altering the intensity of the exposure light automatically to maintain an optimum level of exposure.

7. A method as claimed in claim 6, wherein the intensity of the exposure light is altered by regulating a voltage which is applied to the light source.

8. A photocopying machine substantially as hereinbefore described with reference to the accompanying drawing.

9. A method of controlling exposure in a photocopying machine, substantially as hereinbefore described with reference to the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1983. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.