United States Patent

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[54] PHOTOGRAPHIC COPYING APPARATUS

4 Claims, 1 Drawing Fig.

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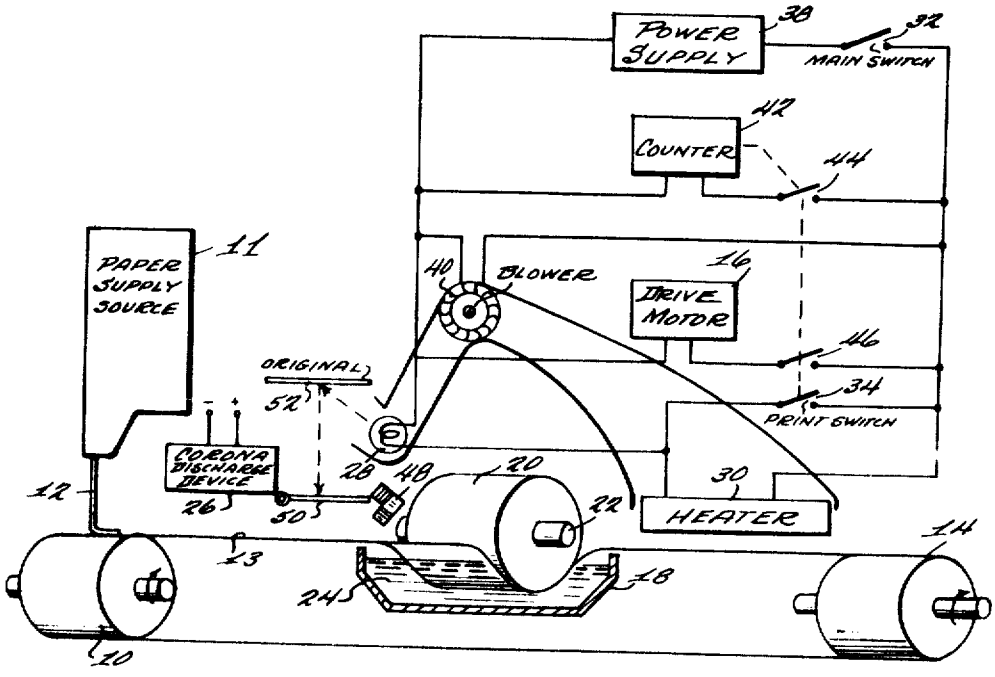
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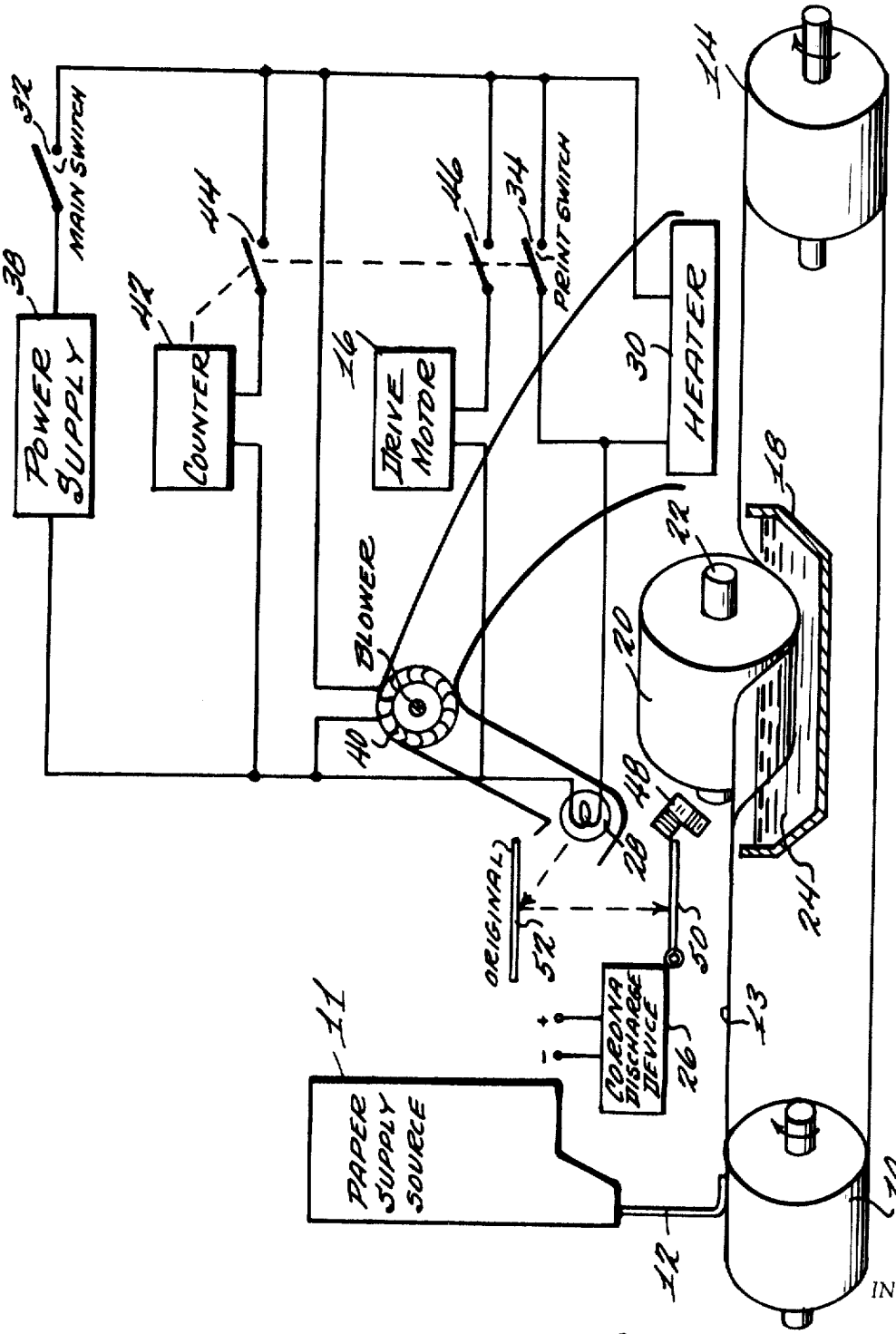
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ABSTRACT: Photographic copying apparatus having a heater employed in conjunction with a lamp for drying the recording element or copying paper and wherein the heater is in circuit with the lamp to permit the preliminary heating of the lamp prior to full lighting thereof so as to reduce the inrush of current to the lamp when full voltage is applied thereto.



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PHOTOGRAPHIC COPYING APPARATUS

This application is a continuation-in-part of application, Ser. No. 644,140, filed June 7, 1967, for Auxiliary lighting Apparatus For Iodine Lamp, now abandoned.

This invention relates to photographic copying apparatus and more particularly to such apparatus which utilizes a halogen lamp in circuit with a heater. The heater is employed in the drying of the recording element or copying paper and first and second switch means are provided in circuit with the lamp and the heater whereby a preliminary, low voltage heating of the lamp occurs so as to reduce the inrush of current thereto when full voltage is applied to the lamp.

An object of the present invention is the provision of a photographic copying apparatus which includes a halogen lamp and heater in circuit whereby the substantially instantaneous full lighting of the lamp is achieved when full voltage is applied thereto and whereby the lamp is protected from the inrush of current produced by the lighting thereof, which rush of current would otherwise occur if the lamp were not preliminarily heated by a low voltage and current.

Another object of the invention is to provide a photographic copying apparatus which preliminarily heats the halogen lamp to result in a great increase in the life of the lamp as compared to the life of the lamp without the provision of the preliminary heating thereof.

The flashing which would occur in the halogen or iodine lamp, for example, if an initial surge of current were permitted to flow through the filament would cause a serious reduction in the life of the lamp and without the feature of this invention whereby the lamp is preliminarily heated the full lighting of the lamp would occur over a much longer time period and the initial inrush of current to the lamp would be greatly increased without the preliminary heating feature.

Accordingly, a purpose of this invention is to increase the life of the lamp and to enable the substantially instantaneous full lighting thereof when desired by means of providing a preliminary low voltage to the lamp. This is accomplished by the application of a voltage to the lamp which is approximately 10 percent of the rated voltage of the halogen lamp prior to the full lighting thereof. The present invention accomplishes this by the use of the heater which is normally used solely to dry the paper or recording element in the photographic copying apparatus.

Other objects and features of this invention will become apparent to those of ordinary skill in the art as the disclosure is made in the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings in which:

The FIGURE is a diagrammatic view of a preferred embodiment of the invention.

With reference now to the FIGURE, there is shown means for moving a recording element or copy paper along a predetermined path from a first to a second position. This includes, for example, a first roller 10 on which a conveyor or other type of device 13 is located for moving the recording element or paper 12 along a predetermined path after the paper has been provided by the paper supply source 11, which is conventional. The paper follows the predetermined path to a second roller 14 which can be driven in a conventional manner by the motor 16. The paper 12 in moving along the predetermined path passes through developing means which includes, for example, a developer tray 18 and an applicator roller 20 which rotates about the axis 22. Developer liquid 24, for example, known in the art is located in the tray 18.

A device 26 can be located adjacent to the path of travel of the copy paper 12 and may include a corona discharge device well known in the art which causes a substantially uniform electrostatic charge to be deposited on at least a portion of the copy paper 12 as the paper passes by the device 26. A halogen lamp 28 is also located in operative relationship with respect to the path of the paper 12 for exposing the charged portion

thereof to light in order to form a latent image on the paper 12. The heater 30, which is used to dry the paper 12, is connected to the lamp 28 in series and a first switch means 32, which is closed for the auxiliary or preliminary lighting of the lamp, is also in series therewith. A full lighting switch or second switch means 34 is shunted across the heater 30 and power source 36 is coupled between the lamp 28 and the first switch 32. In addition, a blower 40 is connected to the power supply 38 through the main switch 32, and a counter 42 having a switch 44 in circuit therewith is connected to the power supply 38. Also, the motor 16 has a switch 46 in circuit therewith and operative in a known manner with respect to counter 42 whereby the motor stops automatically when switch 46 is opened when the number of copies set into the counter has been reproduced. The copying machine also has an optical mans 48 or lens system which moves over the paper on which the image is to be copied in order to give the image of an original with slit exposure on the conveyor 13 in the dark compartment shaded with roll blind 50.

In the operation of the apparatus of this invention the recording element or copy paper 12 moves along a predetermined path between rollers 10 and 14 when the roller 14 is driven by the action of motor 16 and when switch 32 is closed. The paper 12 first moves by the corona discharge device 26 which charges the paper in a known manner with a substantially uniform electrostatic charge. The paper then moves to the exposure section where it is exposed to light from the halogen lamp 28 therefor forming latent images on the copy paper 12 in accordance with the original material 52 being copied. The paper is then moved through the developing section and into the tray 18 which contains the developer liquid 24. The paper moves between the tray 18 and the applicator roller 20 so that the developer liquid is evenly spread over the paper 12. The paper then emerges from the developing section and passes adjacent to the heater 30 where the paper is dried and the paper is then moved to a position adjacent the roller 14.

When the paper 12 is initially placed on the conveyor 13 from the paper supply 11 the switch 32 is closed so that the rated voltage of the lamp 28 is first applied to the series circuit of the lamp 28 and the heater 30. V_L represents the rated voltage of the halogen lamp, v_L represents the voltage actually applied to the lamp initially and v_H represents the voltage applied to the heater. Thus, $V_L=v_L+v_H$. When the resistance of the heater 30 is selected so as to satisfy the equation $v_L=$(10 percent to 20 percent) V_L, the lamp 28 is placed in the auxiliary lighting condition, or in other words, a preliminary low voltage heating of the lamp occurs. As the paper 12 moves adjacent to the lamp 28 so that the light therefrom impinges upon the paper 12 the second switch or print switch 34 is also closed so that the heater 30 is shunted or short circuited and the lamp 28 is provided with the rated voltage V_L to fully light the lamp. The paper then moves through the developing section of the device and between the roller 20 and the tray 18 where the developing liquid 24 is applied to the paper. From here the paper moves on to the drying section and the switch 34 is again opened so that the heater 30 is heated by the application of voltage (90 percent to 80 percent) V_L to dry the photographic paper together with a fan 40.

Thus, when the paper reaches the exposure section the switch 34 is closed and the lamp 28 is fully lighted. After the paper moves on from the exposure section the switch 34 can be opened when the paper 12 moves into the drying section adjacent the heater 30 so that current passes through the heater as well as through the lamp. In the event that more than one copy is to be reproduced and where a plurality of papers 12 are fed continuously along the conveyor 13, exposure of each new sheet is started while an already developed sheet is still in the drying section. In this situation the lamp 28 lights fully and remains fully lighted by the closure of switch 34 in order to provide full exposure to the pages in the exposure section. As a result, the heater 30 is continuously shunted and ceases to operate so that drying of the paper at the drying sec-

tion must be accomplished by hot air which is generated by fan **40** that obtains the hot air from the lamp **28**. It should be noted that the copy paper **12** is never located in the drying section when the machine is initially started. This avoids any possibility of the paper being burned with the absence of the wet developer liquid thereon.

In the past it has been necessary to provide a transformer to obtain the low voltage to be applied to the lamp **28** in order to obtain the auxiliary lighting or the low voltage heating of the lamp and mechanisms for transition of the lamp from the low voltage heating state to the full voltage and fully lighted state have been very complicated. However, the present invention provides for this auxiliary lighting or low voltage heating of the lamp and for the transition to the full lighting of the lamp by very simple means through application of the heater normally provided with the photographic copying apparatus.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What I claim is:

1. A photographic copying apparatus comprising:

means for moving a recording element along a predetermined path from a first to a second position;

means oriented with respect to said path for charging the recording element and for causing a substantially uniform electrostatic charge to be deposited on at least a portion of the recording element;

a halogen lamp in operative relationship with said path for exposing the charged portion of the recording element to light to form a latent image on the recording element;

developing means located with respect to said path for developing the latent image on said recording element;

heater means in position adjacent to said path for drying the developed recording element;

a power source;

first switch means in series circuit relationship with said lamp and said heater means and said power source for subjecting said lamp to a preliminary low voltage when said first switch means is closed; and

second switch means in shunted circuit relationship with said heater means and in series circuit relationship with said power source and said first switch means and said lamp for subjecting said lamp to a second voltage when said first switch means is closed and said second switch means is closed, whereby the lamp is substantially instantaneously fully lighted upon the closure of said second switch means and whereby the inrush of current to said lamp is controlled to provide longer lamp life.

2. Apparatus as in claim **1** wherein the lamp is an iodine lamp.

3. Apparatus as in claim **2** wherein said preliminary low voltage is below the rated voltage of said lamp and wherein said second voltage is substantially equal to the rated voltage of said lamp.

4. Apparatus as in claim **3** wherein said preliminary low voltage is substantially 10 percent of the rated voltage of said lamp.