

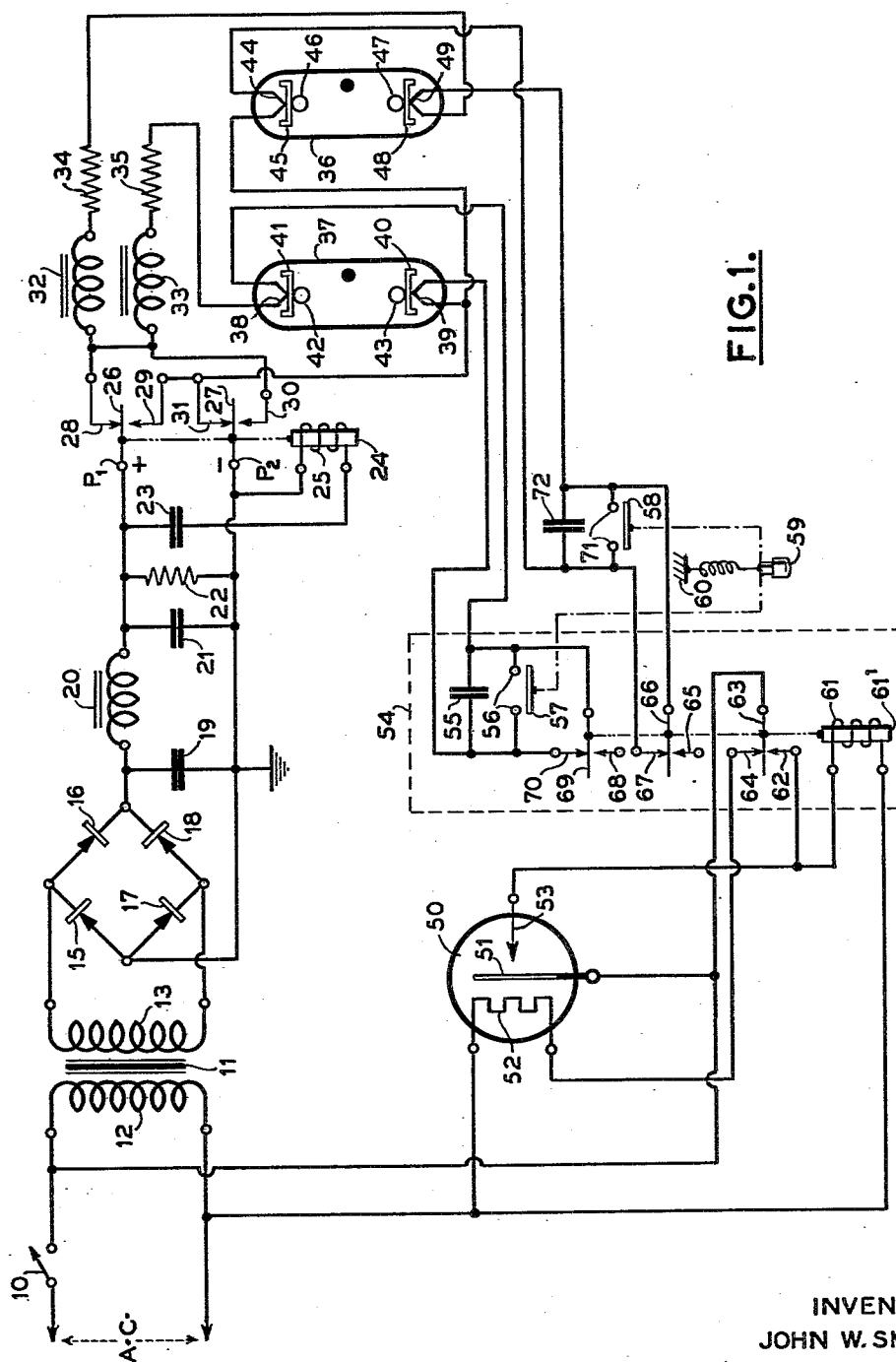
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FLUORESCENT LAMP CONTROL APPARATUS

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FLUORESCENT LAMP CONTROL APPARATUS

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This invention relates to the illumination art and particularly concerns a circuit for controlling the power supplied to one or more fluorescent lamps, particularly those of the type used in illumination of copy in a facsimile scanning system.

In gas filled fluorescent lamps supplied with power from a direct current source, the phenomenon known as mercury pumping occurs in which positive ions gradually drift to and collect at the cathode so that eventually the uniformity of illumination is lost and the lamps even black out. This is especially serious in systems used for scanning graphic copy such as facsimile communications where such a disturbance of the light intensity patterns of the copy illumination lamps results in loss in fidelity of copy transmission.

It has been found that a reversal of the polarity of voltage applied to the lamps at intervals of the order of a few hours will cause the collected positive ions to become detached from the cathode where they are collected so that the light intensity pattern remains substantially undisturbed.

It is therefore a principal object of the invention to provide a means whereby the polarity of a source of direct current applied to a fluorescent lamp may be reversed.

It is a further object to provide means for automatically reversing the polarity of a source of direct current applied to a fluorescent lamp, each time the current is switched on.

It is a further object to provide a circuit for reversing the polarity of a source of direct current applied to one or more fluorescent lamps, with a starting means included in the circuit.

It is a further object to provide an automatic starting means in a circuit for reversing the polarity of voltage applied to one or more fluorescent lamps.

Other and further advantages will become apparent from the following description taken together with the drawing.

Fig. 1 is a schematic diagram of a preferred form of electrical circuit embodying the invention.

The circuit as shown in Fig. 1 includes a pair of input terminals to which A. C. power is applied. The input circuit includes a switch 10 and primary winding 12 of transformer 11. The transformer has a secondary winding 13 connected to a full wave rectifier ring. The rectifier ring consists of rectifier elements 15, 16, 17, 18. The two diagonal terminals of the rectifier are connected to a filter consisting of a pair of shunt capacitors 19, 21 and a low pass inductor 20. A resistor 22 is connected in parallel with capacitor 21 at the output of the filter. Coil 25 of relay 24 is connected across the output of the filter in series with capacitor 23. This relay has a pair of movable contacts 26, 27 movable together when the coil 25 is energized. The relay is a double pole double-throw ratchet type which has two contact positions. The contact positions change each time the coil 25 becomes energized. In one position contacts 26, 28 and 27, 31 are closed. In another position contacts 26, 29

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and 27, 30 are closed. Inductors 32, 33 are connected together to stationary contacts 28, 30. Resistors 34, 35 are connected in series with inductors 32, 33 to filaments 49, 38 respectively of tubular gas filled fluorescent lamps 36, 37. Filaments 39, 44 of the tubes are connected to stationary contacts 29, 31. The several tubes include cathodes 40, 41, 45, 48 and anodes 42, 43, 46, 47. Filament 38 at one end of lamp 37 is in series circuit with filament 39 at the opposite end of the lamp via contacts 69, 70 of relay 54. Filaments 44 and 49 of lamp 36 are in series with contacts 66, 67 of relay 54. Pushbutton 59 operates against the bias of a spring anchored at base 60. The pushbutton applies shorting bars 57, 58 across contacts 56, 71 respectively to short circuit contacts 69, 70 and 66, 67 simultaneously.

Relay 54 has movable contacts 63, 66, 69 gauged together. Normally contact pairs 69-70, 66-67, and 63-64 are closed but are opened when coil 61 wound on core 61 is energized. When the relay coil is energized, contacts 62-63, 65-66, and 69-70 are closed. Stationary contacts 65 and 68 are open circuited. Contact 62 is connected to contact 53 of the thermal delay relay 50. This relay has contacts 51, 53 normally open, but the contacts close after a predetermined time when heater element 52 is heated by passage of current therethrough. The heater is connected between one of the A.-C. input terminals and relay contact 64. Capacitors 55 and 72 are connected across contact 56, 71 respectively.

In operation, A.-C. power is applied at the input terminals of the circuit. When the switch 10 is closed, electric current flows through heater 52 to heat the relay 50. The current is also applied via transformer 11 to the rectifiers 15-18 from which it issues as direct current. The rectified current pulses are smoothed in filter 19-21 and the direct current for operating the lamps appears at terminals P₁, P₂. Terminal P₁ has positive polarity and terminal P₂ has negative polarity. The current flows through two filament heating circuits. In one circuit, the current flows through relay contacts 26, 28, inductor 32 resistor 34, filament 49, contacts 66, 67, filament 44, and relay contacts 31, 27. In the other circuit, the current flows through relay contacts 26, 28, inductor 33, resistor 35, filament 38, relay contacts 69, 70, filament 39 and contacts 31, 27. The current flow heats the lamp filaments while current flows through heater element 52 and relay contacts 63, 64.

In a few seconds after switch 10 is closed the heater element 52 heats sufficiently to cause relay contacts 51, 53 to close. This causes coil 61 to become energized, and relay contacts 63-64, 66-67, 69-70 open while contacts 62-63, 65-66, 68-69 close. This breaks the filament circuits and the inductive action of inductors 32 and 33 causes an arc discharge in each of lamps 36, 37 so that they light up. The current flow in the lamps is now via anode 42 to cathode 40, and via anode 46 to cathode 48. The circuit including relays 50 and 54 thus serves as an automatic starting means for lighting the lamps. If it is desired to light the lamps using a longer starting time than that set by the predetermined timing of relay 50, the pushbutton 59 provides a manual control of starting. When the button 59 is pressed the filaments are heated independently of relays 50 and 54. If the button is held closed for a period longer than the timing of relay 50 and the button 59 is then released, the filament circuits are broken and the lamps light.

Generally in a facsimile scanning system copy is scanned for a few minutes to a few hours at a time. Switch 10 is opened to shut off the lamps after scanning is completed. The next time switch 10 is closed, relay 24 is pulsed, coil 25 is momentarily energized through capacitor 23 contacts 26, 28 and 27, 31 open while contacts 26, 29 and 27, 30 close. This causes a reversal of

polarity of the D. C. voltage applied to the lamps 36, 37. The relay 24 has just two positions and the contacts change from one to the other position each time the relay is pulsed.

If the switch 10 is connected in circuit with a facsimile scanner circuit (not shown), it is possible to arrange that the D. C. power applied to the lamps reverses each time copy signal transmission begins.

The circuit described thus provides a means for reversing polarity of D. C. power applied to gas filled fluorescent lamps subject to loss in intensity and uniformity of illumination.

What is claimed is:

1. A control apparatus for a pair of fluorescent lamps, comprising a source of alternating current, a rectifier connected to said source for converting said current to direct current, a first relay having two contact positions connected to said rectifier, said relay being pulsed from one of said contact positions to another contact position on application of the direct current thereto, and means directly connected to said source for applying a starting current from said source to heat filaments of the lamp, said means including in circuit a thermal relay and another relay, said other relay being operative during heating of the thermal relay to interrupt said starting current, whereby the lamps are fired.

2. A control apparatus for a pair of copy illuminating lamps in a facsimile scanning system, comprising a source of alternating current, a switch in circuit with said source, a rectifier connected to said source for converting said alternating current to direct current and applying the direct current to a first relay, said relay having two contact positions and being changed from one of said contact positions to the other contact position each time said switch is operated, a pair of inductors connected in parallel to said relay for applying the direct current to filaments of the lamps respectively, another relay in circuit with said filaments and arranged to interrupt the direct current applied thereto to cause the inductors to fire the

lamps, the first relay being operative to reverse the polarity of the direct current applied to the inductors and the lamps each time said contact positions are changed, and a thermal delay relay connected between said source and said other relay through said switch to actuate said other relay a predetermined time after said switch is operated.

3. A control apparatus for maintaining uniformity of illumination in fluorescent lamps subject to collection of positive ions at cathodes thereof, comprising a pair of gas filled tubular lamps disposed parallel to each other, said lamps having filaments disposed at opposite ends thereof, a source of alternating current, a switch in circuit with said source and operative to pass said current, a rectifier connected to said source for converting the alternating to direct current, a first relay connected to said rectifier, said relay having two contact positions and being changed from one of said contact positions to the other contact position each time said switch is operated, an inductor and a resistor in series circuit with the filaments of one of the lamps, another inductor and another resistor in series circuit with the filaments of the other lamp, said series circuits being connected in parallel with said relay, said relay being operative to reverse the polarity of the direct current applied to the lamps each time the contact positions are changed, a second relay in circuit with said filaments and arranged to interrupt the direct current applied thereto to cause the lamps to be fired through said series circuits, and a thermal delay relay connected between said source and said second relay through said switch to actuate the second relay a predetermined time after said switch is operated.

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