Aug. 8, 1944. R. M. SMITH ET AL 2,355,476

FLUORESCENT LAMP STARTER

Filed June 24, 1942

Fig. 1.

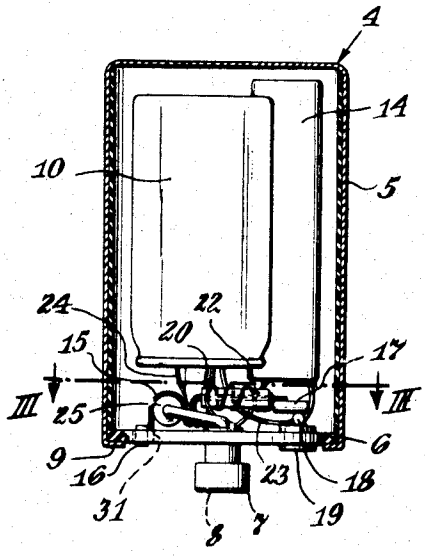


Fig. 2.

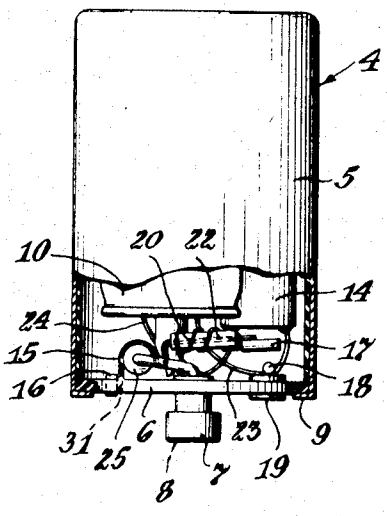


Fig. 3.

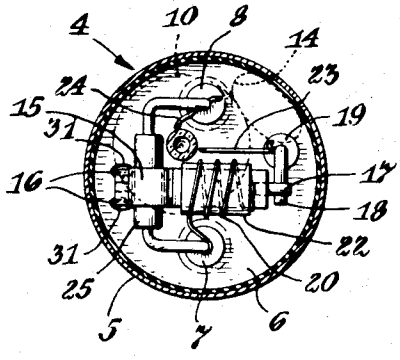
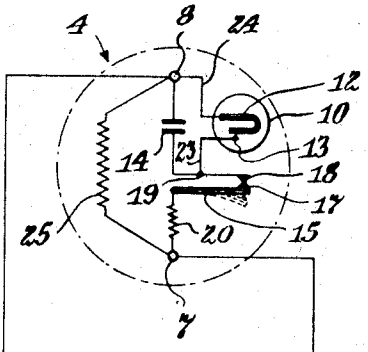
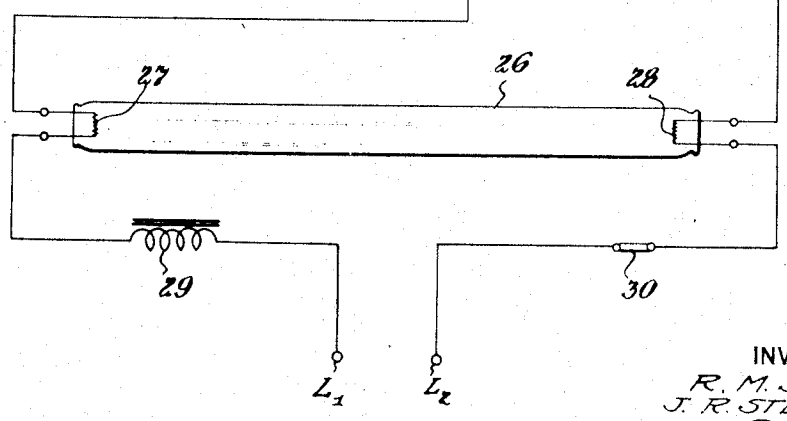


Fig. 4.





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FLUORESCENT LAMP STARTER

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8 Claims. (Cl. 315—100)

The present invention relates to gaseous discharge lamps and particularly to a relay for the starting and operating of such lamps of the fluorescent type from the usual source of electrical energy of the customary domestic potential.

It is customary with lamps of this type to connect the filamentary electrodes in series with an inductance element across the domestic source of supply, and a relay device such as shown in Patent 2,200,443, issued May 14, 1940, to E. C. Dench, is employed to first connect the filamentary electrodes in a series heating circuit to raise the temperature thereof to electron emissivity, after which the relay operates to interrupt the series heating circuit and causes a high voltage surge from the series-connected inductance, which thus initiates a discharge between the preheated electrodes.

The difficulty with such circuit arrangement resides in the fact that if the discharge lamp becomes defective, such as by loss of the electron-emissive material from the electrodes, and the discharge accordingly fails to start for any reason, the relay continues to operate indefinitely, thus not only shortening its useful life but since it repeatedly completes and interrupts the series heating circuit of the filamentary lamp electrodes, the latter will intermittently glow and constitutes a source of annoyance to the user with attendant waste of electrical energy.

It is accordingly an object of the present invention to provide a starting and operating arrangement for a gaseous discharge lamp wherein a relay unit is employed to initiate a discharge in the lamp while consuming an insignificant amount of energy during operation of the latter, and which relay unit operates to prevent glowing of the lamp electrodes by "locking out" the lamp in the event a discharge is not initiated therein after several operations of the relay.

Another object of the present invention is the provision of a relay unit for starting and operating a gaseous discharge lamp which can be readily inserted in the starter socket and is operable to initiate a discharge in the latter while consuming an insignificant amount of energy once such discharge is started; but in the event the lamp becomes defective, the relay operates to "lock out" the lamp and is automatically returned to its normal position upon replacement of the defective lamp.

Still further objects of the present invention will become obvious to those skilled in the art by reference to the accompanying drawing wherein:

Fig. 1 is a sectional view in elevation of the relay unit of the present invention and showing the relative arrangement of the various parts:

Fig. 2 is a fragmentary sectional view of the relay unit of the present invention identical to Fig. 1 except that it shows the position of the various parts when the relay is in the lamp "lock-out" position;

Fig. 3 is a sectional view taken on the line III—III of Fig. 1 and looking in the direction indicated by the arrows, and

Fig. 4 is a schematic diagram of the starting and operating circuit for a discharge lamp and employing the novel relay unit of the present invention.

Referring now to the drawing in detail, the relay unit 4 shown in Fig. 1 comprises a casing 5 of a plastic material or light metal permanently closed at one end and having its other end closed by an insulating cap 6 provided with a pair of socket terminals 7 and 8 and held in place as by bent lugs 9 protruding from the casing 5. Disposed within this casing is a glow switch 10 of the type shown in Patent 2,228,210, issued January 7, 1941, to R. F. Hays, Jr., comprising a vitreous envelope provided with an ionizable medium at a suitable pressure and having a pair of electrodes 12 and 13 (Fig. 4), one of which 12 is a bimetallic element. A radio frequency suppressing condenser 14 is also housed within the casing 5 and is connected in shunt across the glow switch 10.

In addition, a thermal relay is supported within the casing 5 by the insulating cap 6. This thermal relay comprises a bimetallic element 15 anchored at one end to the insulating cap as by projections 16 thereon passing through apertures 31 gripping that portion of said cap therebetween. The element 15 is bent upon itself to form a corrugation, with its other end carrying a contact 17 normally engaging a contact 18, the latter of which is supported by an eyelet or the like 19 passing through the insulating cap 6. A low resistance heater element 20 is wound about the bimetallic element 15, but insulated therefrom by a sleeve of heat resistant material such as asbestos or the like 22, with one end of this low resistance heater element being connected directly to the socket contact terminal 7, while its remaining end is connected directly to the bimetallic element 15, as can be appreciated from Fig. 4.

The stationary contact terminal 18 is in turn connected to the electrode 13 of the glow switch by a conductor 23, while the bimetallic electrode 12 of the glow switch is connected to the remaining socket contact terminal 8 by a conductor 24. A high resistance heater element 25 is disposed beneath the corrugation formed in the bimetallic

element with its ends connected respectively to the socket contact terminals 7 and 8, which thus disposes the high resistance heater element normally in a shunt circuit with the glow switch 12, condenser 14, bimetallic element 15 together with the contacts 17 and 18, as well as the low resistance heater element 20.

Referring now more particularly to Fig. 4, a starting and operating circuit is shown for initiating a discharge in a discharge lamp and employing the relay of the present invention as above described. The discharge lamp 26 is provided with filamentary electrodes 27 and 28. As shown, one end of the filamentary electrode 27 is connected through an inductance element 29 to one side L1 of a source of customary domestic potential of 115–230 volts. Likewise, one end of the filamentary electrode 28 is connected through a switch 30 to the other terminal of the supply source L2. The remaining ends of the filamentary lamp electrodes 27 and 28 are connected together by the relay unit 4. Upon closure of the switch 30, a series heating circuit for the filamentary lamp electrodes 27 and 28 is completed from the supply source L1 through the inductance element 29, filamentary electrode 27, to the socket terminal 8, and thence through the glow switch 10, normally closed contacts 17 and 18, bimetallic element 15, low resistance heater element 20 to the socket terminal 7, and thence through filamentary electrode 28 and switch 30 back to the other supply terminal L2.

Thus, substantially the full potential of the supply source L1—L2 is impressed across the electrodes 12 and 13 of the glow switch 10, which voltage is sufficient to initiate a glow discharge between the electrodes 12 and 13. This discharge accordingly heats the bimetallic electrode 12, causing it to deflect into engagement with the electrode 13, thus positively completing a series heating circuit to the filamentary lamp electrodes 27 and 28, allowing them to be very rapidly raised to an electron-emitting temperature.

By the time these latter electrodes have reached an electron-emitting temperature, the bimetallic electrode 12 of the glow switch 10 will have cooled, disengaging the electrode 13 and returning to its normal position. Disengagement of the glow switch electrodes 12 and 13 will cause a high voltage surge or kick from the inductance 29, which thus initiates a discharge across the preheated lamp electrodes 27 and 28. If for any reason a discharge is not initiated in the discharge lamp 26 upon initial operation of the glow switch 10, it will repeat its operation a number of times until such discharge is finally initiated. Once such discharge is initiated, only lamp voltage is impressed across the electrodes 12 and 13 of the glow switch 10 which is insufficient to again cause a glow discharge, with the result that the entire glow relay unit 4 consumes very little energy during operation of the lamp.

If the discharge lamp 26 has become defective, such as by the filamentary lamp electrodes 27 and 28 having lost their electron-emissive coating, the glow switch 10 will continue its repetitious operation for a predetermined period of time. The continued application of substantially the full potential of the source of supply L1—L2 to the glow switch 10 for this predetermined period of time will cause the low resistance heater element 20 to gradually heat the bimetallic element 15 through the asbestos insulation 22. When the bimetallic element 20 reaches the proper temperature, it deflects and opens the contacts 17 and 18, as shown in Fig. 2, which thus interrupts the series heating circuit for the filamentary electrodes 27 and 28, as well as the circuit to the glow switch 10 and the low resistance heater element 20.

The high resistance heater element 25 which was formerly in a shunt circuit with the glow switch 10 and low resistance heater 20 is now impressed with substantially the full potential of the source of supply L1—L2, and while it draws negligible current, nevertheless sufficient heat is produced by this high ohmic resistance heater 25 to heat the bimetallic element 15 and maintain the contacts 17 and 18 in an open position, thus "locking out" the defective lamp 26.

Interruption of the circuit to the glow switch 10 by maintaining the contacts 17 and 18 in an open position prevents continued operation of the glow switch 10 in a futile attempt to initiate a discharge in the defective lamp 26. However, upon replacement of the defective lamp, the circuit is then broken to the high ohmic resistance heater element 25 which thus allows the relay unit to return to its normal position preparatory to performing its cycle of operation to initiate a discharge in the lamp 26 in the manner above described.

It thus becomes obvious to those skilled in the art that a simple yet efficient circuit arrangement is provided by the present invention wherein a relay unit is employed for the starting and operating of a discharge lamp, particularly of the fluorescent type. Moreover, when the lamp becomes defective and will accordingly not start after a predetermined period of time following initial operation of the relay unit, the latter automatically operates to "lock out" the defective lamp, which thus in effect disconnects the latter from the source of supply, thereby preserving the useful life of the relay unit and at the same time eliminating annoyance of continued glowing of the filamentary lamp electrodes. Furthermore, the amount of energy consumed by the relay while in its "lock-out" position is negligible regardless of the time such relay remains in its "locked-out" position until the defective lamp is replaced.

Although one specific embodiment of the present invention has been shown and described, it should be understood that other modifications thereof may be made without departing from the spirit and scope of the appended claims.

We claim:

1. In combination, a gaseous electric discharge lamp containing a thermionic cathode and a cooperating electrode, and a starting and operating circuit therefor comprising an inductance, means connecting one end of said thermionic cathode and said cooperating electrode across the terminals of a current source in series with said inductance, and a relay device connected across the opposite end of said thermionic cathode and to said electrode for initiating a discharge in said lamp and for locking out said lamp in the event the same becomes defective comprising a glow discharge device operable to initiate a discharge in said lamp, a relay including actuating means included in series with said glow discharge device and a pair of normally closed contacts for completing a circuit to said actuating means and to said glow discharge device and operable by said actuating means only upon continued operation of said glow discharge device for a predetermined period of time to cause opening of said contacts, means normally connected in a shunt

circuit with said glow discharge device and said actuating means and operable upon opening of said contacts to maintain said contacts in an open position and interrupt the circuit to said glow discharge device when said discharge lamp becomes defective, and said last mentioned means being automatically operable to cause closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

2. In combination, a gaseous electric discharge lamp containing a thermionic cathode and a cooperating electrode, and a starting and operating circuit therefor comprising an inductance, means connecting one end of said thermionic cathode and said cooperating electrode across the terminals of a current source in series with said inductance, and a relay device connected across the opposite end of said thermionic cathode and to said electrode for initiating a discharge in said lamp and for locking-out said lamp in the event the same becomes defective comprising a glow discharge device operable to initiate a discharge in said lamp, a relay including actuating means included in series with said glow discharge device and a pair of normally closed contacts for completing a circuit to said actuating means and to said glow discharge device and operable by said actuating means only upon continued operation of said glow discharge device for a predetermined period of time to cause opening of said contacts, a high resistance heater element normally connected in a shunt circuit with said glow discharge device and said actuating means and operable upon opening of said pair of contacts to maintain said contacts in an open position and to interrupt the circuit to said glow discharge device to prevent operation of the same in a futile attempt to start said discharge lamp when the latter becomes defective, and said high resistance heater being automatically operable to cause closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

3. In combination, a gaseous electric discharge lamp containing a thermionic cathode and a cooperating electrode, and a starting and operating circuit therefor comprising an inductance, means connecting one end of said thermionic cathode and said cooperating electrode across the terminals of a current source in series with said inductance, and a relay device connected across the opposite end of said thermionic cathode and to said electrode for initiating a discharge in said lamp and for locking-out said lamp in the event the same becomes defective comprising a glow discharge device operable to initiate a discharge in said lamp, a relay including a bimetallic element and a resistance heater therefor together with a pair of normally closed contacts for completing a circuit to said resistance heater and to said glow discharge device and operable by said resistance heater only upon continued operation of said glow discharge device for a predetermined period of time to cause opening of said contacts, a high resistance heater element normally connected in a shunt circuit with said glow discharge device and said actuating means and operable upon opening of said pair of contacts to heat said bimetallic element and maintain said contacts in an open position to interrupt the circuit to said glow discharge device to prevent operation of the same in a futile attempt to start said discharge lamp when the latter becomes defective, and said high resistance heater being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

4. In combination, a gaseous electric discharge lamp containing a thermionic cathode and a cooperating electrode, and a starting and operating circuit therefor comprising an inductance, means connecting one end of said thermionic cathode and said cooperating electrode across the terminals of a current source in series with said inductance, and a relay device connected across the opposite end of said thermionic cathode and to said electrode for initiating a discharge in said lamp and for locking-out said lamp in the event the same becomes defective comprising a glow discharge operable to initiate a discharge in said lamp, a thermal relay including a low resistance heater element in series with said glow discharge device and a pair of normally closed contacts and operable only upon continued operation of said glow discharge device for a predetermined period of time to heat said thermal relay and cause opening of said contacts with interruption of the circuit to said glow discharge device, a high ohmic resistance heater normally connected in a shunt circuit with said glow discharge device and said low resistance heater and operable upon opening of said contacts to heat said thermal relay and maintain said contacts in an open position to interrupt the circuit to said glow discharge device to prevent operation of the same in a futile attempt to start said discharge lamp when the latter becomes defective and said high resistance heater being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

5. In combination, a gaseous electric discharge lamp containing a thermionic cathode and a cooperating electrode, and a starting and operating circuit therefor comprising an inductance, means connecting one end of said thermionic cathode and said cooperating electrode across the terminals of a current source in series with said inductance, and a relay device connected across the opposite end of said thermionic cathode and to said electrode for causing the initiation of a discharge in said lamp and for locking-out said lamp in the event the same becomes defective comprising a glow switch provided with electrodes one of which is a bimetallic element adapted to be heated by the ensuing glow discharge upon the application of the voltage of said current source therebetween, said bimetallic electrode being operable to deflect into engagement with the other electrode of said glow switch to complete a series heating circuit for said thermionic cathode and to extinguish said glow discharge and operable upon cooling thereof to interrupt said series heating circuit and cause a high voltage surge from said inductance across the electrodes of said lamp with attendant initiation of a discharge therebetween, and a thermal relay comprising a heat-responsive member normally closing a pair of contacts and a resistance heater element included in said series heating circuit and operable only upon repetitious operation of said glow switch for a predetermined period of time to heat said heat-responsive member and cause opening of said normally closed contacts and disconnection of said resistance heater element from said circuit, a high ohmic resistance heater element normally connected in a shunt circuit with

said glow switch and first mentioned resistance heater and operable upon opening of said contacts to heat said heat-responsive member and maintain said contacts in an open position to interrupt the circuit to said glow switch to prevent operation of the same in a futile attempt to start said discharge lamp when the latter becomes defective and said high resistance heater being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

6. A relay unit for starting and operating a discharge lamp comprising a casing, a glow switch disposed in said casing provided with electrodes therein one of which is a bimetallic element and between which a glow discharge occurs upon the application of the potential of the source of supply for the discharge lamp, said bimetallic electrode being operable to deflect into engagement with the other electrode of said glow switch and cause the initiation of a discharge in said lamp, actuating means in said casing connected in series with said glow switch and having a pair of normally closed contacts for completing the circuit to said glow switch and to said actuating means, and said contacts being operable by said actuating means to open the circuit to said glow switch and said actuating means upon the continued application of substantially the full potential of the source of supply for said discharge lamp to said glow switch for a predetermined period of time, means normally connected in a shunt circuit with said glow switch and said actuating means and operable upon opening of said contacts to maintain said contacts in an open position and to prevent continued operation of said glow switch in a futile attempt to initiate a discharge in said lamp when the latter becomes defective and said last mentioned means being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

7. A relay unit for starting and operating a discharge lamp comprising a casing, a glow switch disposed in said casing provided with electrodes therein one of which is a bimetallic element and between which a glow discharge occurs upon the application of the potential of the source of supply for the discharge lamp, said bimetallic electrode being operable to deflect into engagement with the other electrode of said glow switch and cause the initiation of a discharge in said lamp, a low resistance heater element in said casing connected in series with said glow switch and having a pair of normally closed contacts for completing the circuit to said glow switch and to said low resistance heater element, and said contacts being operable by said low resistance heater element to open the circuit to said glow switch and said heater element upon the continued application of substantially the full potential of the source of supply for said discharge lamp to said glow switch for a predetermined period of time, a high resistance heater element normally connected in a shunt circuit with said glow switch and said low resistance heater element and operable upon opening of said contacts to maintain said contacts in an open position and to prevent continued operation of said glow switch in a futile attempt to initiate a discharge in said lamp when the latter becomes defective, and said high resistance heater being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

8. A relay unit for starting and operating a discharge lamp comprising a casing, a glow switch disposed in said casing provided with electrodes therein one of which is a bimetallic element and between which a glow discharge occurs upon the application of the potential of the source of supply for the discharge lamp, said bimetallic electrode being operable to deflect into engagement with the other electrode of said glow switch and cause the initiation of a discharge in said lamp, a low resistance heater element and a bimetallic member in said casing connected in series with said glow switch and said bimetallic element being normally operable to maintain closure of a pair of contacts for completing the circuit to said glow switch and to said low resistance heater element, and said low resistance heater element being operable to heat said bimetallic element to open the contacts and interrupt the circuit to said glow switch and said heater element upon the continued application of substantially the full potential of the source of supply for said discharge lamp to said glow switch for a predetermined period of time, a high resistance heater element normally connected in a shunt circuit with said glow switch and said low resistance heater element and operable upon opening of said contacts to heat said bimetallic element and maintain said contacts in an open position to prevent continued operation of said glow switch in a futile attempt to initiate a discharge in said lamp when the latter becomes defective, and said high resistance heater being automatically rendered inoperative with attendant closure of said contacts and restoration of said relay device for normal operation upon replacement of the defective lamp.

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Disclaimer

2,355,476.—*Roy M. Smith*, Fairfield, and *John R. Steegstra*, Bridgeport, Conn. FLUORESCENT LAMP STARTER. Patent dated Aug. 8, 1944. Disclaimer filed June 14, 1951, by the assignee, *The Bryant Electric Company.*

Hereby enters this disclaimer to claims 6, 7, and 8 of said patent.

[*Official Gazette July 10, 1951.*]

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2,355,476.—*Roy M. Smith*, Fairfield, and *John R. Steegstra*, Bridgeport, Conn. Fluorescent Lamp Starter. Patent dated Aug. 8, 1944. Disclaimer filed June 14, 1951, by the assignee, *The Bryant Electric Company.*

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