May 15, 1945. V. G. VAUGHAN 2,375,967

CIRCUIT

Filed Jan. 24, 1941

FIG. 2.

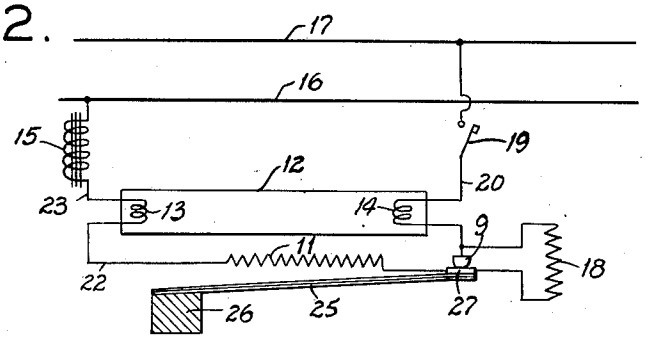


FIG. 1.

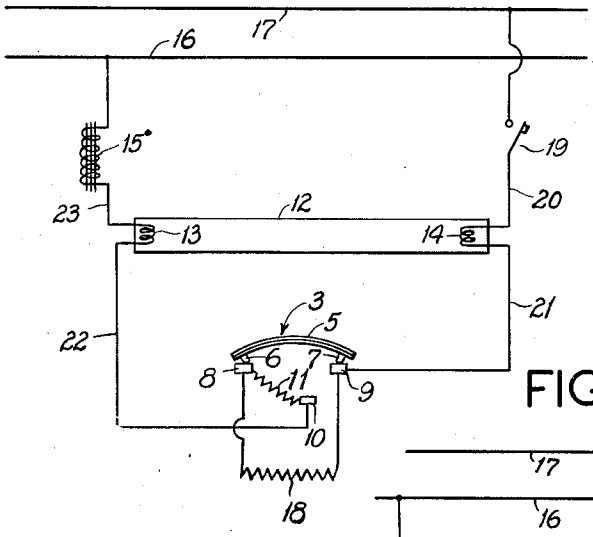


FIG. 4.

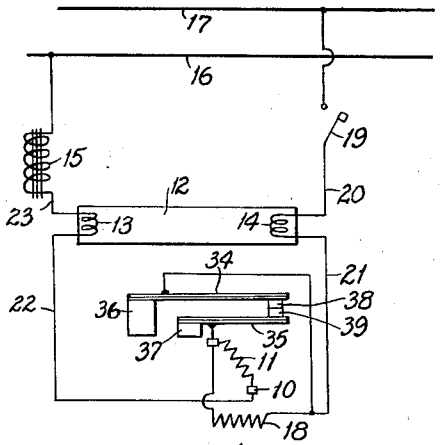
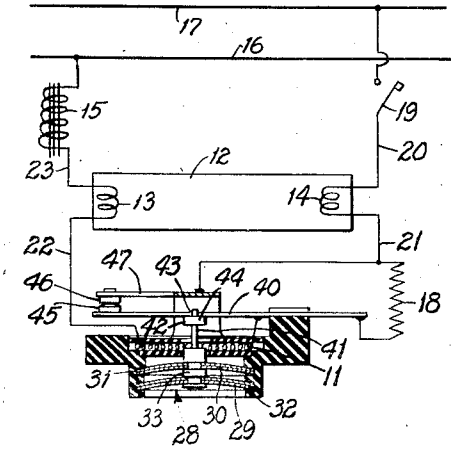


FIG. 3.



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2,375,967

UNITED STATES PATENT OFFICE

2,375,967

CIRCUITS

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4 Claims. (Cl. 315—100)

This invention relates to thermostatically controlled electric circuits, and more particularly to switch circuits for starting fluorescent tube lights.

An object of this invention is to provide a thermostatically controlled starting-switch circuit for starting so-called "fluorescent light" tubes or lamps. Another object of the invention is to provide a circuit wherein only two wires are needed to connect the starting switch to the circuit in order to accomplish the starting of the lamp. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, and arrangements of parts which will be exemplified in the circuit hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which are illustrated several of the various possible embodiments of the invention,

Fig. 1 is a diagram of a circuit embodying the present invention;

Fig. 2 is a diagram of a similar circuit but employing a different type of thermostatic element;

Fig. 3 is a diagram of a similar circuit embodying a still different type of thermostatic element; and,

Fig. 4 is a diagram of a similar circuit but embodying a still different type of thermostatic element.

Similar reference characters indicate corresponding parts throughout the several views of the drawing.

Fluorescent lamps make use of an electric discharge in a sealed tube, the inside walls of which are coated with a fluorescent material. The discharge causes this coating to fluoresce and thus emit light. The lamp usually has two electrodes at opposite ends of the tube within the sealed enclosure. To start the lamp, it is usually necessary first to heat these electrodes. A momentary increase in the impressed voltage across the tube from electrode to electrode starts the electric discharge. To accomplish this momentary increase, the two electrodes are customarily placed in series with a choke coil across the power lines. After a given interval of time necessary to heat the electrodes the interconnection between the electrodes is broken. The voltage "kick" across the electrodes caused by the choke coil gives the necessary voltage increase to start the discharge. The choke coil then acts to limit the current drawn by the tube.

The opening of the interconnection between the electrodes can be done in many ways, but it is the purpose of this invention to provide a simple thermostatic switch circuit for that purpose.

The preferred thermostatic switch for use in this invention is that shown and described in John D. Bolesky's United States Patents 2,199,387 and 2,199,388. However, any thermostatic switch of similar nature can be used to accomplish the purpose of the present invention. Briefly described, the preferred switch is as follows: A base made of electrically insulating material is provided having a circular rim and an upstanding skirt thereon. Mounted on an adjusting screw passing through the center of the base is a thermostatic snap-acting disc such as is described and shown in John A. Spencer's Patent 1,448,240. The disc is mounted on the adjusting post by means of the usual abutments and shoulders so as to provide a secure, yet not binding, mounting of the disc. Contact buttons are welded or otherwise electrically fastened to the disc on diametrically opposite points on its periphery, to cooperate with stationary contacts passing through holes in the base and clamped therein, or otherwise fastened. A third stationary contact is provided and is similarly fastened to the base 1. A heater wire is fastened at one end to the third stationary contact and at its other end to one of the other stationary contacts. This switch and its operation are described in detail in John D. Bolesky's patents above referred to.

Referring now to Fig. 1 of the drawing, numeral 3 indicates generally a thermostatic switch comprising a snap-acting disc 5, movable contacts 6 and 7 mounted on disc 5, and stationary contacts 8 and 9 cooperating with contacts 6 and 7 to open and close the electrical circuit, and stationary contact 10. The heater wire 11 for the thermostat is connected between stationary contacts 8 and 10. Such a switch is fully described in the aforesaid Patents Nos. 2,199,387 and 2,199,388.

Numeral 12 indicates, in general, the outer wall of a conventional type fluorescent lamp. Sealed into the ends of this lamp are the two electrodes 13 and 14. Power line 16 is connected to one side of the electrode 13 through a choke coil 15. Power line 17 is connected to one side of the electrode 14. The other side of electrode 13 is connected to stationary contact 10. The other side of electrode 14 is connected to contact 9. Permanently shunted across stationary contacts 8 and 9 is an external resistance 18.

In this circuit, the choke coil 15 is used for two purposes as described above: First, to provide a momentary high-voltage discharge to ig-

nite the lamp when the thermostatic disc 5 opens, and secondly, to limit the amount of current which flows through the lamp.

The operation of the circuit is as follows: When line switch 19 is closed, current flows through wire 20, electrode 14, wire 21, disc 5, heater wire 11, wire 22, electrode 13, wire 23, choke coil 15, and to the power line 16. The electrodes 13 and 14 commence to heat, and heater wire 11 commences to heat up disc 5. Within two or three seconds, disc 5 snaps to its upward (circuit opening) position, thus opening the interconnection between the electrodes through wires 21 and 22. This opening of the circuit causes a momentary, induced, relatively high voltage to be impressed across the tube from electrode 13 to electrode 14 and starts the gaseous discharge. This discharge between the electrodes causes the fluorescent coating of the tube to glow and give the light for which the lamp is designed. It is to be noted that when the disc 5 is in its closed position, the electrical resistance 18 is shunted out of the circuit since its resistance is relatively very high in comparison to the resistance of the disc 5. However, when disc 5 opens, heater wire 18 is now in the circuit and current now passes through the electrodes, electrical resistance 18, and heater 11. However, resistance 18 is purposely of such value as to reduce the current passing through the electrodes to a very low value. This low current allows heater wire 11 to generate just enough heat to keep the disc 5 in its switch-open position while the tube is lighted. When the switch 19 is opened, the gaseous discharge ceases and the tube no longer fluoresces. Heater 11 now has no current flowing through it, so it cools down, and disc 5 likewise cools to snap back to the switch-closed position. The circuit is then ready for relighting the lamp.

Any other form of simple thermostatic switch may be employed in this invention, as well as ambient compensated types such as shown for example in Harold M. Wilson's United States Patent No. 2,203,558.

A simple strip type composite metal thermostat 25 is shown in Fig. 2. It is mounted at one end in any suitable manner as shown at 26. The opposite end carries a movable contact 27 which cooperates with a fixed contact 9. The relatively high resistance 18 is as before shunted around the contacts, in this instance, movable contact 27 and stationary contact 9. The heater 11 is connected to movable contact 27 as shown and is located so as to control the strip type thermostat 25. The circuit operates in a manner similar to that of the Fig. 1 circuit. Movable contact 27 and stationary contact 9 are held in contact by strip 25 when the device is cold. Upon closing switch 19 the current passes through the contacts 9 and 27 and through heater 11 until strip 25 is heated sufficiently to break the circuit. The current thereupon passes through the high resistance 18 to movable contact 27 and heater 11 at a rate sufficient to cause thermostatic strip 25 to maintain contact 27 away from contact 9.

Fig. 3 illustrates a circuit embodying an ambient compensated type of thermostat such as is shown and described for example in Harold M. Wilson's United States Patent No. 2,203,558. The thermostatic element 28 in this instance is composed of two composite metal snap acting discs 29 and 30. The outer edges of these discs are preferably mounted so as to be relatively immovable as shown at 31 and 32. Such a mounting is, however, arranged to be sufficiently loose so that the discs can snap back and forth freely. The centers of the discs are held together by any suitable means as shown at 33 so that they move together. The discs 29 and 30 are operatively associated with arm 40 which is made of spring metal. The connection 33 between the discs is elongated as shown at 41 so as to contact an insulating sleeve 42 which sets into an opening 43 in the arm 40. Insulating member 42 is headed over as shown at 44 where it contacts portion 41 of connection 33. The arm 40 carries a contact 45 which cooperates with contact 46 mounted on stationary arm 47. The tension in arm 40 is arranged so that the arm tends to move contact 45 out of engagement with contact 46. When the discs 29 and 30 are in the position shown in Fig. 3, however, they, through connecting member 33, and insulating member 42 force arm 40 against the tension thereof into position so that contacts 45 and 46 are in engagement.

When the discs 29 and 30 snap into the opposite position of concavity due to heat from the heater wire 11 the portion 41 of connecting member 33 no longer keeps the arm 40 in a position such that the contacts 45 and 46 are in contact. The inherent tension of arm 40 then separates the contacts 45 and 46. The current then passes through resistance 18. Inasmuch as the construction and operation of an ambient compensating device such as indicated is clearly described and explained in the aforesaid Letters Patent, it will not be repeated here.

It will be noted that the current path is through the wire 21, arm 47, contact 46, contact 45, arm 40, heater 11, and wire 22 when the device is in the Fig. 3 position. When the discs 29 and 30 snap to the opposite position the current path is from wire 21 through resistance 18, arm 40, heater 11, wire 22. The heater 11 is located so as to affect disc 30 more than disc 29. The passage of current through heater 11 causes disc 30 to overbalance disc 29 and open contacts 45 and 46. When the contacts are open, a small amount of curent is carried by resistance 18 to heater 11 and keeps the disc 30 at a relatively higher temperature than disc 29.

A still further embodiment of the invention is illustrated in Fig. 4. This likewise employs an ambient compensated thermostatic switch. The thermostatic switch in this instance comprises two composite metal strips of thermostatic material 34 and 35. They may be mounted in any suitable manner at one end as indicated at 36 and 37. Cooperating contacts 38 and 39 are attached to the opposite ends, that is, the movable ends of the thermostatic strips. Strips 34 and 35 are constructed so that they will maintain the contacts 38 and 39 together during variations in ambient temperature, since they have the same relative response to changes in ambient temperature. Heater 11 however, is positioned so as to affect one of the strips, in this instance 35, to a greater extent than the other strip. Accordingly, when current passes through the circuit when contacts 38 and 39 are together, it passes through the heater 11 likewise, thereby imparting a relatively greater movement to strip 35 than to strip 34. Strip 35 therefore moves a greater distance than strip 34 and separates the contacts 38 and 39. The current is then shunted around the contacts 38 and 39 and passes through resistance 18. It will be noted however, that the current still passes through heater

11 so that strip 35 is kept at a relatively higher temperature than strip 34 and contacts 38 and 39 are maintained apart.

Similarly other forms of thermostatic switches may be employed in this invention with only relatively minor changes in the circuit.

Among the advantages of the invention are (1) the need of only two wires (21 and 22) to connect the starting switch to the lamp, which makes for ease of wiring and installation; and (2) the fact that when the lamp is lighted the heat holding disc 5, strip 25, or the like in circuit-open position is just enough for this purpose; this means that when the main line switch 19 is opened to shut off the lamp, disc 5 immediately cools to circuit-closed position. Thus, the delay necessary before the lamp can be reignited by means of switch 19 is reduced to a minimum.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A circuit comprising a fluorescent light source, a thermostatic switch characterized by having only two lead wires, said switch being connected across the electrodes of said light source, an electrical heating resistance connected in series with said thermostatic switch and adapted to heat said switch, and a relatively high resistance connected across the contacts of said switch, said switch comprising a snap-acting thermostatic element.

2. A circuit comprising a fluorescent light source, a thermostatic switch characterized by having only two lead wires, said switch being connected across the electrodes of said light source, an electrical heating resistance connected in series with said thermostatic switch and adapted to heat said switch, and a relatively high resistance connected across the contacts of said switch, said switch comprising a thermostatic element.

3. A circuit comprising a fluorescent light source, a thermostatic switch characterized by having only two lead wires, said switch being connected across the electrodes of said light source, an electrical heating resistance connected in series with said thermostatic switch and adapted to heat said switch, and a relatively high resistance connected across the contacts of said switch, said switch comprising a creep-type thermostatic element.

4. A circuit comprising a fluorescent light source, a thermostatic switch characterized by having only two lead wires, said switch being connected across the electrodes of said light source, an electrical heating resistance connected in series with said thermostatic switch and adapted to heat said switch, and a relatively high resistance connected across the contacts of said switch, said switch comprising an ambient compensated thermostatic element.

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