Nov. 2, 1943. P. R. LEE 2,333,536

THERMOSTATIC SWITCH

Filed May 2, 1942

Fig. 1.

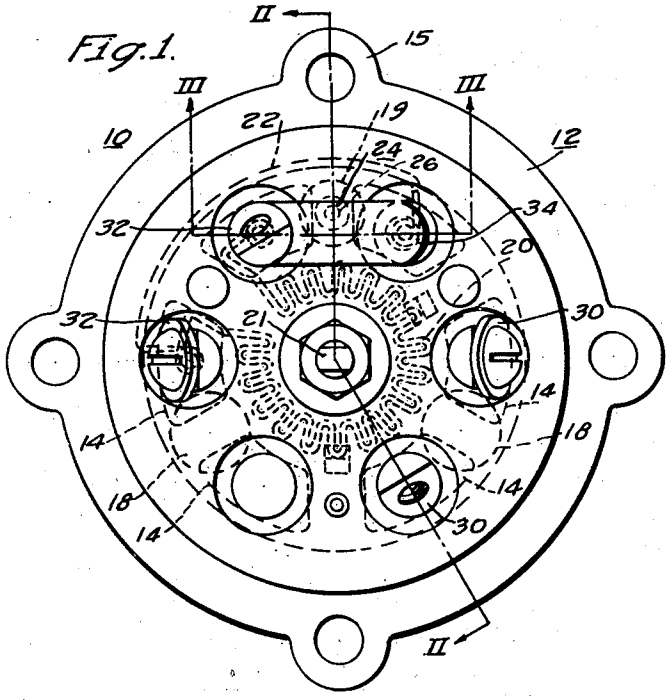


Fig. 2.

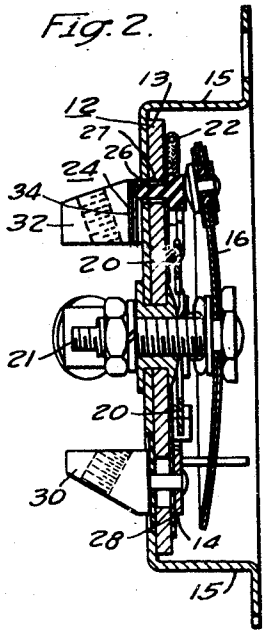


Fig. 3.

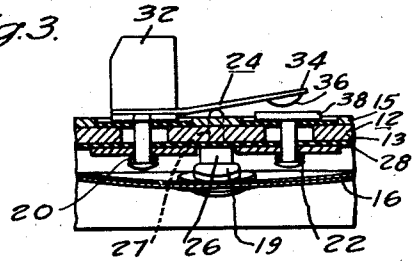
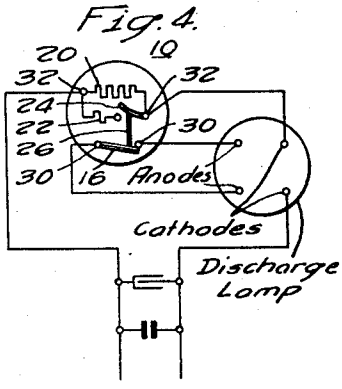


Fig. 4.



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THERMOSTATIC SWITCH

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4 Claims. (Cl. 200—122)

My invention relates to thermostatic switching devices and more particularly to a thermostatic control device for the starting of discharge lamps, for example, sodium lamps used in street lighting installations.

When starting glow or discharge lamps, such as sodium lamps, used in street lighting, it is necessary to heat the cathodes of such lamps for a minimum predetermined time, such as 30 seconds, before the lamp is discharged between the anodes so as to operate or function in the desired manner, and prolong the life of said lamp. With the thermostatic starting switches that are now used in starting such lamps it is necessary to supply sufficient internal heat in the switch structure to cause the switch to open, permitting the lamp to operate in a normal manner. In keeping with established street lighting practice, the starting switch must be permanently connected in series with the cathode of the lamp in order to energize it, without the need of an attendant. Accordingly, the wattage of the heating elements thereof have heretofore been kept relatively low in order to prevent the heat therefrom from overheating the thermal responsive element of the thermostat. One to two minutes have, therefore, been required to start the lamp, with the thermostatic starting switches now known to the art. However, it is desired to have the thermostatic switch connect the discharge lamp to the line in an operating manner within a 30 seconds' time limit.

Accordingly, when using the old thermostats it is necessary to provide abnormally large quantities of heat thereto. To supply such an abnormally large quantity of heat to the thermostatic switch it is necessary to provide a relatively large heating element in association therewith inasmuch as the filaments of the sodium lamp are designed to draw approximately 6.6 amperes. The heating element of the switch, being constantly in series with the sodium lamp, therefore, maintains the switch structure at a high temperature. Accordingly, if for any reason power has been disconnected from the sodium lamp circuit, whereby it is necessary to restart the lamp, an abnormally long cooling period is required, depending on the ambient, before the switch can reenergize the lamp. Said period has heretofore varied from 15 to 60 minutes.

To overcome the operating disadvantages of the previously well known thermostatic switches, I have developed a thermostatic structure which greatly reduces the length of time required to cause the thermostatic switch to move from its closed or starting position, so that the sodium lamp or discharge device may be quickly started and which will quickly return to its closed position upon deenergization so as to permit the lamp to be restarted within a relatively short time, for example, 2 to 15 minutes, depending upon the ambient.

It is therefore an object of my invention to provide a thermostatic device which has a relatively large heating element associated therewith for starting a discharge lamp within the minimum time required and to provide means associated with the heating element for causing said element to produce a relative small quantity of heat when the discharge lamp is in operation.

A further object of my invention is to provide a thermostatic switch having a thermally responsive member, a relatively large heating element for actuating said thermally responsive member and a shunt for bypassing a portion of the current flow through the device when the thermally responsive member is in its open position.

Still a further object of my invention is to provide a thermostatic switch member having a supporting base with an auxiliary switch positioned thereupon and an insulating member positioned between said switch and thermally responsive member whereby said switch is opened in response to the movements of the bimetallic element.

Yet another object of my invention is to provide a control system for starting discharge lamps embodying a thermostatic device having a heating element connected in series with the lamp for actuating a thermal responsive member and a shunting member connected in parallel with the heating element in response to the movements of the thermal member during the normal operation of the lamp.

Other objects of my invention will either be pointed out specifically in the course of the following description of a device embodying my invention, or will be apparent from such description.

In the accompanying drawing

Figure 1 is a top plan view of a thermostatic switch embodying my invention;

Fig. 2 is a sectional view taken along the line II—II of Fig. 1;

Fig. 3 is a sectional view taken along the line III—III of Fig. 1; and

Fig. 4 is a schematic wiring diagram of a discharge lamp circuit having the thermostatic switch embodying my invention associated therewith.

Referring to the accompanying drawing, I show

a thermostatic switching device 10 having a supporting structure 12, stationary contacts 14 insulatedly attached thereto, a bimetallic thermally responsive member 16 rigidly attached to said supporting structure and carrying movable contacts 18 for engaging the stationary contacts, a main heating element 20 for supplying a quantity of heat to actuate the thermally responsive member, a shunting member 22 adapted to be connected in parallel with the main heating element 20 by means of an auxiliary switch 24, and an insulating pin 26 passing through said supporting structure 12 and engageable by the thermally responsive member 16 to actuate the switch in response to the movements of said thermally responsive member.

The supporting structure 12 comprises, in this instance, substantially circular base member 13 having sheets of insulating material 28 positioned upon the lower side thereof to permit the stationary contacts 14 to be insulatedly attached to said structure. The base member 13 is positioned within a cup-shaped sheet metal housing 15. Two terminal members 30 are connected to the main stationary contacts 14 to provide means for opening or closing the main circuit. Two additional terminals 32 are permanently connected to the main heating element 20 and are connected in series with the main circuit as hereinafter described. A centrally located aperture passes through the supporting structure for receiving an adjusting screw 21 which rigidly supports the thermally responsive bimetallic member 16.

The bimetallic member 16 is, in this instance, a snap acting bimetallic disc of well known design. However, it is to be understood that said thermally responsive member may be of any other suitable design. Said bimetallic element 16 has two movable contacts 18 and a third movable contact 19 insulatedly and rigidly attached to the periphery thereof in keeping with established practice. Said movable contacts 18 are adapted to engage the main stationary contacts 14 while contact 19 is adapted to engage the insulating pin 26 to move said pin and actuate the auxiliary switch 24, as hereinafter described. The bimetallic element is attached to the supporting structure by means of the calibrating or adjusting screw 21. Said screw 21 adjusts the opening temperature of the bimetallic element by bodily moving the central portion of the bimetallic element with respect to the supporting structure, in keeping with established practice, and is used primarily as a factory adjustment for the thermostat.

The insulating pin 26 is formed, in this instance, of any suitable insulating material such as a phenolic resin or a ceramic, and is slidably located within a small aperture 27 in base 13. Said pin is a relatively thin elongated member having an enlarged head portion at its lower end for preventing said pin from being moved upwardly through the supporting structure. The enlarged head portion of insulating pin 26, when said pin is positioned within the aperture 27 in the supporting structure is located intermediate the supporting structure 13 and the bimetallic element. The pin 26, therefore, cannot be removed from the supporting structure. However, said insulating pin may be moved through said supporting structure to operate the auxiliary switch in response to the movements of the bimetallic element, as hereinafter described.

The auxiliary switch 24 comprises, in this instance, an elongated spring-like movable contact carrying finger 34 which is rigidly attached to and insulated from the supporting structure by means of one of the terminals 32. A movable contact 36 is located upon the free end of the spring member 34 and is adapted to engage a stationary contact 38 insulatedly attached to the supporting structure. The spring contact carrying finger 34 is positioned, in this instance, above the supporting structure and in line with the aperture 27 so as to be engaged by the insulated pin 26. Said spring finger 34 normally biases the movable contact 36 and insulating pin 26 in a downward direction when the bimetallic member 16 is in its closed position, see Fig. 3. Accordingly, it follows that when the bimetallic element 16 is in an open position, the spring finger 34 moves to a lower position biasing the insulating pin downwardly and permitting the movable contact 36 to be in engagement with the stationary contact 38.

The main heating element 20 is positioned intermediate the supporting structure 13 and the bimetallic element 16 and is connected at each end to the terminals 32. Said heating element 20 is designed to produce a relatively high quantity of heat in response to the flow of current through the discharge lamp, which is normally 6.6 amperes. By having the heating element 20 supply such an abnormally high quantity of heat, it follows that the bimetallic element will be heated in a relatively short time. However, the shunting element or member 22 is connected to the main heating element 20 so as to reduce the heat output of said element when the bimetallic element 16 has moved to its open position. Said shunting member is, in this instance, also positioned intermediate the base 13 and bimetallic element 16. Said shunting member 22 is controlled by the auxiliary switch 24.

It will be noted, primarily from Fig. 3, that the stationary contact 38 of the auxiliary switch 24 is connected to one end of the shunting member 22 whereas the movable spring finger 34 is attached to one end of a main heating element and a terminal 32. In addition, the second end of the shunting member 22 is connected to the other terminal 32 and to the other end of the radiant heater.

It therefore follows that when the auxiliary switch 24 is open, that is when the bimetallic element 16 is closed, the entire flow of current through the thermostatic switch passes through the radiant heater 20. However, when the auxiliary switch 24 is closed in response to the movements of the bimetallic element 16 and the insulating pin 26, the resistance or shunting member 22 is connected in parallel with the main radiant heater 20 so as to reduce the amount of current flowing therethrough.

When operating the thermostatic switch 10 embodying my invention, and referring to Fig. 4, the terminals 30 are connected to the anodes of the discharge lamp while one of the cathodes of the discharge lamp is connected to one of the terminals 32. The second cathode terminal of the sodium lamp and the second terminal 32 are then connected to the power supply (not shown). It follows therefore that when the bimetallic member 16 is in its closed position, whereby the auxiliary switch 24 is open, so as to disengage the shunt, the radiant heater 20 is connected in series with the cathodes. Then when the radiant heater 20 has increased the temperature of the thermally responsive device 10 to its pre-

determined operating value, the said bimetallic element **16** snaps to an open position, disconnecting the electrical connection between the anodes, causing a breakdown in the lamp and permitting said lamp to glow and operate in its normal manner. As the bimetallic element **16** snaps to its open position the insulating pin **26** is moved downwardly in response to the biasing action of the spring contact finger **34** of the auxiliary switch **24**. The auxiliary switch **24** is therefore closed connecting the shunting resistance member **22** in parallel with the radiant heater **20**. Accordingly, the amount of heat produced by the radiant heater **20** is then substantially reduced, depending upon the relative resistance between the radiant heater and the shunt member. The quantity of heat then produced by the radiant heater is then merely that value necessary to prevent the bimetallic thermally responsive member **16** from cooling to its closing temperature (substantially 175° F.).

It therefore follows that if for any reason whatsoever the discharge lamp be deenergized, the bimetallic element **16** will rapidly cool and return to its closed position. The amount of time normally required for such a closure is substantially 2 to 15 minutes depending upon the outside ambient. Accordingly, it follows that the discharge lamp may therefore be restarted within this relatively short period after having been deenergized.

In addition, it is obvious that I have provided a thermostatic switch for controlling the operation of a discharge lamp which will start said lamp in a minimum length of time and will permit said lamp to be restarted in a relatively short time after any power interruptions.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire therefore that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. A thermostatic switch comprising a thermal responsive member movable from a normal position to another operating position, a heating element for actuating said member, a shunt, switch means biased toward its closed position and operable therein for connecting said shunt in parallel with the heating element, and means responsive to the movement of the thermal responsive member to its normal position for opening said switch, said responsive means being actuated by said biased switch means to permit closure thereof when said thermal responsive member moves into said other of its operating positions.

2. A thermostatic switch comprising, in combination, a supporting structure, a bimetallic element movably mounted thereon, a heating element for supplying an actuating heat to said bimetallic element, a shunt, switching means biased towards its closed position and operable therein for connecting said shunt in parallel with the heating element, and a movable insulating member engageable by the bimetallic member for opening the switch means in opposition to its biasing action when said bimetallic member is in a closed position.

3. A thermostatic switch comprising, in combination, a supporting structure, a bimetallic element movably mounted thereon, a heating element for said bimetallic element, a shunt, switching means biased towards its closed position and operable therein for connecting said shunt in parallel with said heating element, and a movable member extending through said supporting structure and adapted to loosely contact said switching means and said bimetallic element at its respective ends, thereby to hold said switching means in its open position in opposition to its biasing action when said bimetallic element is in a closed position and to permit said switching means to occupy its closed position when said bimetallic element moves away from said switching means to its open position.

4. A thermostatic switch comprising, in combination, a supporting structure, a bimetallic element movably mounted on one side thereof and normally occupying a closed position near said structure, a heating element for said bimetallic element, a shunt, switching means biased towards said structure to its closed position and operable therein for connecting said shunt in parallel with said heating element, said switching means being mounted on the opposite side of said structure from said bimetallic element, and a movable member extending through said supporting structure and adapted to loosely contact said switching means and said bimetallic element at its respective ends, said movable member forcing said switching means to its open position against the bias thereof when said bimetallic element is in its closed position and said movable member itself being forced to follow the movement to open position of said bimetallic element upon predetermined heating thereof by said heating element, whereby said switching means moves into its closed position.

PAUL R. LEE.