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THERMOSTATICALLY CONTROLLED SWITCH

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Fig. 1.

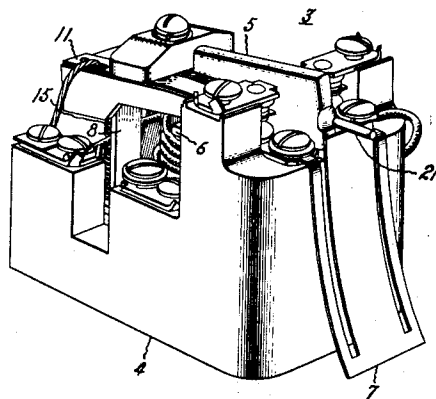
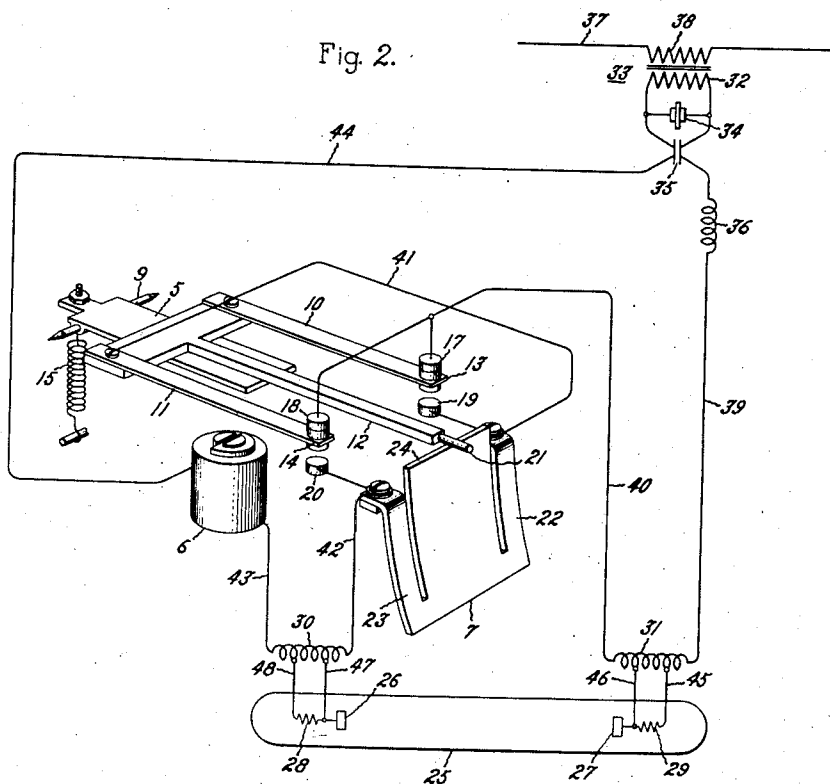


Fig. 2.



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THERMOSTATICALLY-CONTROLLED
SWITCH

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6 Claims. (Cl. 200—88)

My invention relates to thermostatically-con-
trolled switches, and more particularly to an im-
proved thermostatic latch for delaying the oper-
ation of a magnetic switch for a predetermined
5 time after energization of the switch operating
coll.

One object of my invention is to provide a
simple switch timing mechanism for electric dis-
charge lamps in which the cathodes are pre-
heated before the discharge path is opened sub-
sequent to each current interruption to the lamp.

Another object of my invention is to provide a
thermostatic switch timing mechanism in which
the time period is dependent upon the current
15 flowing through the switch.

Another object of my invention is to provide a
thermostatic latch which is capable of immedi-
ately resetting after failure of current in the
lamp.

20 For a better understanding of my invention,
together with other and further objects thereof,
reference is had to the following description,
taken in connection with the accompanying
drawing, and its scope will be pointed out in the
25 appended claims.

The accompanying drawing illustrates in Fig.
1 a magnetically-operated switch provided with
a thermostatic latch built in accordance with my
invention, and Fig. 2 illustrates diagrammati-
cally the switch of Fig. 1 connected to an electric
30 discharge lamp such as a sodium vapor lamp for
example.

Referring to the drawing in detail, the switch
3 comprises a base 4, a movable switch member
35 5, an operating magnet 6 and a thermostatic
latch 7. The movable switch member is pivota-
lly mounted on a pair of brackets 8, of which
only one is shown in Fig. 1, projecting from the
base 4. It is provided with a pivot pin 9, a pair
40 of contact arms 10 and 11 and a latching arm 12.
The contact arms 10 and 11 are resilient and
carry contacts 13 and 14 on their respective ends.
The switch arm 5 is normally biased by a spring
15 and by the magnet coil 6 when the latter is
45 energized.

When the switch arm 5 is biased by the spring
15, the contacts 13 and 14 are held in engage-
ment with one pair of stationary contacts 17 and
18. When the coil 6 is energized it tends to move
50 the contacts 13 and 14 into engagement with
stationary contacts 19 and 20. The movement
of the contacts into the latter position is, how-
ever, subject to the operation of the thermostatic
element 7. This element normally engages a pin
55 21 projecting from the end of the latching arm

12 when the switch element 5 is in the upper
position and prevents the movement of the
switch element with its contacts to the lower
position. When current begins to flow through
the contacts the thermostatic element is heated
and moves out of engagement with the pin and
permits the switch member 5 to move to its lower
position.

The thermostatic latch 7 in accordance with
my invention comprises a rectangular piece of
10 bimetallic sheet metal having a slightly arcuate
shape at normal room temperature. Two paral-
lel slots are cut in from one end of the sheet so as
to form two relatively narrow strips 22 and 23
15 along the sides. The ends of these two strips
are bent at right angles to the body of the strips
and fastened to the base 4, this being the means
of support for the element. The ends of the
narrow strips 22 and 23 are electrically connected
20 respectively to the contacts 19 and 20 and the
wide part 24 of the element, which for conven-
ience may be called a tongue, engages the pro-
jecting pin 21 on the latching arm 12.

When current flows through the switch con-
tacts, it also flows through the narrow strips 22
25 and 23 and thereby heats them. The metal of
the element is so arranged that when it heats,
the ends of the strips, that is, the ends at which
they are joined to the tongue 24, bend down-
wardly and lift the free end of the tongue 24
30 adjacent the pin 21, until it passes over the end
of this pin. As soon as this happens the ener-
gized coil 6 draws the contacts to the lower
position at which the thermostatic element is
shunted or disconnected and immediately cools.
35 If the current flow should be interrupted the
coil becomes deenergized and the spring immedi-
ately pulls the contacts towards their upper posi-
tion. The thermostatic element 7 having cooled
immediately after the movement of the contacts
40 to the lower position presses its tongue 24 against
the pin 21 and the end thereof slips thereunder
as soon as the contacts reach their upper posi-
tion. With this arrangement, therefore, only a
momentary interruption of current flow relatches
45 the switch in its upper position. And even if
such interruption occurs immediately after the
movement of the switch to its lower position, this
latching takes place since the movement of
tongue 24 is not more than just past the end of
50 the pin and the element cools so rapidly that
even a moment after its operation it is cooled
enough to prevent a reclosure of the switch.

The thermostatic element is also independent
of ambient temperature; that is, the time ele- 55

ment in the operation of the thermostatic element is the same under all temperatures within the normal range of outdoor temperatures. This is due to the action of the strips 22 and 23 and the tongue 24 of the element. Since each of these parts is subject to the same ambient temperature variations, they are equally flexed. The difference in area of the members does not cause a change in the flexure of the members since the average temperature changes are sufficiently slow to enable all parts to assume the same temperature. The flexing of the members 22 and 23 moves the tongue 24 since it is attached to the ends of these members. The flexure of the tongue 24 on the other hand, moves the free end of the tongue which is adjacent to pin 21. Since the members are practically of the same length, the movement of the joined ends of 22 and 23 is substantially the same as the movement of the free end of 24. These movements are opposite to each other because of the manner in which they are supported. As stated above when the members 22 and 23 become heated, they flex downwardly and in doing so lift the opposite end of tongue 24. The tongue 24, however, also flexes due to ambient temperature and also bends its free end downwardly in response to a rise in ambient temperature. The movement of the tongue 24 imparted to it by the flexing of strips 22 and 23 is neutralized by the flexing of the end of 24 in the opposite direction and the result is that the end of the tongue always engages the pin 23 at the same point.

The operation of this device will be explained by reference to Fig. 2 which discloses the diagram of connection for a sodium electric discharge lamp controlled by the switch shown in Fig. 1.

Fig. 2 illustrates diagrammatically a sodium lamp 25, provided with two anodes 26 and 27 and two filamentary cathodes 28 and 29. The cathodes are connected to autotransformers 30 and 31, which are in turn connected to the secondary winding 32 of a series transformer 33. The winding 32 is provided with a film cut-out device 34 and a radio frequency filter comprising a condenser 35 and a choke coil 36. When current flows in the main series circuit 37 and primary winding 38 of the transformer 33 is energized, current will flow from winding 32 through conductor 39 to transformer 31, from the transformer through conductor 40 to contacts 17 and 18. At this time the spring 15 biases the switch arm 5, and the contacts 13 and 14 engage the contacts 17 and 18. Current, therefore, flows through the engaged contacts to the contact arms 10 and 11, which are connected in multiple, conductor 41, through the narrow strips 22 and 23 of the element 7, conductor 42, autotransformer 30, conductor 43, coil 6, and through conductor 44 to the other side of the winding 32.

The current flowing in the narrow strips 22 and 23, heats these strips and they lift the tongue 24 so that the end of the latter slides along the pin 21 and allows the energized coil 6 to move the switch arm 5 into its lower position as soon as it slides off the end of this pin. The timing obtained is dependent on the heating current flowing in the strips 22 and 23 and is independent of the ambient temperature, as explained above.

In the latter position of the switch the element 7 is disconnected from the transformer circuit and is shunted by the movable switch member. It therefore cools immediately. The circuit during this latter position of the switch arm may be

traced from the transformer winding 32, through conductor 39, autotransformer 31, conductors 45 and 46, to cathode 29, anode 27, across the discharge path to anode 26, cathode 28, conductors 47 and 48 to autotransformer 30, conductor 43, coil 6, conductor 44 to the other side of winding 32. In this position of the switch therefore the connection between the autotransformers is broken and current is forced across the discharge path in the lamp 25.

The lamp 25 is of a type now known in the art and commonly referred to as a sodium lamp. It is provided with a pair of filamentary cathodes which are heated so as to vaporize the charge of sodium which is placed in this lamp. Although these lamps may be started at low temperatures and sufficiently high voltage, it is not advisable to start them in this manner because of the sputtering of the electrodes and the depositing of the opaque electrode material upon the enclosing glass container. This materially reduces the efficiency of the lamp.

The cathodes 28 and 29 are connected to their respective autotransformers 30 and 31 by the leads 45, 46, 47, and 48 in such manner that a higher current is obtained for heating the cathodes during the preheating period than during operation of the lamp. When switch 3 closes its circuit, the autotransformers are connected in series with each other so as to utilize the full primary windings thereof and thereby obtain the largest possible transformation ratio. The maximum current therefore flows through the secondary circuit and energizes the filaments to the preheating temperature. When the switch 5 opens the circuit between the transformers, a portion of the primary winding of each transformer is cut out so as to reduce the transformation ratio. Since the transformer 33 is connected to a constant current circuit, the secondary current for energizing the filament is reduced and the cathodes are heated to a lower temperature. Thus, referring to Fig. 2, when the circuit between conductors 40 and 42 is broken, the transformer windings between leads 46 and 47 become inactive. Consequently, the current in the windings remaining the same, the transformation ratio is reduced and a smaller current than before flows in the secondary circuit.

I claim:

1. In a thermally controlled switch the combination of a movable contact member and a stationary contact, means for normally biasing said member toward said stationary contact to close a circuit through said switch, a thermostatic element normally biased to latch said member in said circuit closing position, means including a coil energized when current flows through said contacts tending to open said switch, means for heating said thermostatic element energized by current flowing through said switch contacts whereby said thermostatic element is moved to effect an unlatching of said switch member a predetermined time interval after each energization of said heating means, said heating means being deenergized at the instant said switch opens whereby the thermostatic element cools and tends to return to latching condition immediately after the opening of said switch and relatches said movable contact member as soon as it returns to closed circuit position.

2. In a thermostatic switch, the combination of a movable switch member, means for normally biasing said switch member to a closed circuit position, a thermostatic element normally biased

to latch said switch member in said closed circuit position, means arranged to bias said movable switch member to open circuit position energized simultaneously with the beginning of current flow through said switch, means for heating said thermostatic element only during the closed circuit position of said switch member whereby said thermostatic element unlatches said switch member after a predetermined time period subsequent to the beginning of current flow through said switch and immediately cools so as to relatch said switch member in the closed circuit position when said member returns to this position responsive to its normal bias.

3. In a thermostatic switch, the combination of a movable switch member, a stationary contact, means for normally biasing said switch member so as to engage said stationary contact and thereby close a circuit through said switch, a thermostatic element connected in series with said movable switch member, a magnet coil energized at the instant at which current begins to flow through said switch arranged to bias said movable switch element to open the circuit through said thermostatic element, and means including said thermostatic element for latching said movable switch element in the closed circuit position until a predetermined interval of time subsequent to the instant of energization of said coil, said movable switch element being arranged to disconnect said thermostatic element and thereby cool it so that it will immediately move to relatch said switch in the closed position at the interruption of current flow through said coil.

4. In a switch, the combination of a movable contact member, a thermostatic latch comprising a rectangular bimetallic element having a pair of slots cut therein to form a pair of strips and a tongue supported at the joined ends of said strips, means for supporting said strips at their free ends and for connecting them in circuit with said contact member, said tongue being normally biased into the path of said movable contact member to prevent its movement, and means responsive to current flowing through said switch

and said thermostatic strips for moving said contact member, said tongue delaying the movement of said contact for a predetermined time after the beginning of said current flow.

5. In a switch, the combination of a movable contact member, a thermostatic latching element comprising a rectangular thermally responsive sheet having a pair of slots cut therein thereby forming a pair of strips and a tongue supported at the joined ends of said strips, means for supporting said element at the free ends of said strips, the free end of said tongue being normally biased to latch said switch member in closed circuit position, the bias of said free end being unaffected by ambient temperature variations due to the equal and opposite effect of the warping of said strips and said tongue in response to ambient temperature variations, and means for applying additional heat to said strips whereby the free end of said tongue is moved to unlatching position directly responsive to changes in the temperature of said strips caused by said additional heating means and independently of ambient temperature changes.

6. In a switch, the combination of a stationary contact and a movable contact member normally biased to engage said stationary contact to close a circuit through said switch, a thermostatic element comprising a rectangular bimetallic element having slots cut therein to form a pair of strips and a tongue supported at the joined end of said strips, means for supporting said thermostatic element at the free ends of said strips in circuit with said switch contacts, so that the free end of said tongue normally moves under the end of said movable contact member when said contact member is in closed position, means for moving said movable contact member to open circuit position including a coil energized when current flows through said switch, said thermostatic element holding said switch closed for a predetermined period of time subsequent to the beginning of current flow, said period being unaffected by ambient temperature variations.

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