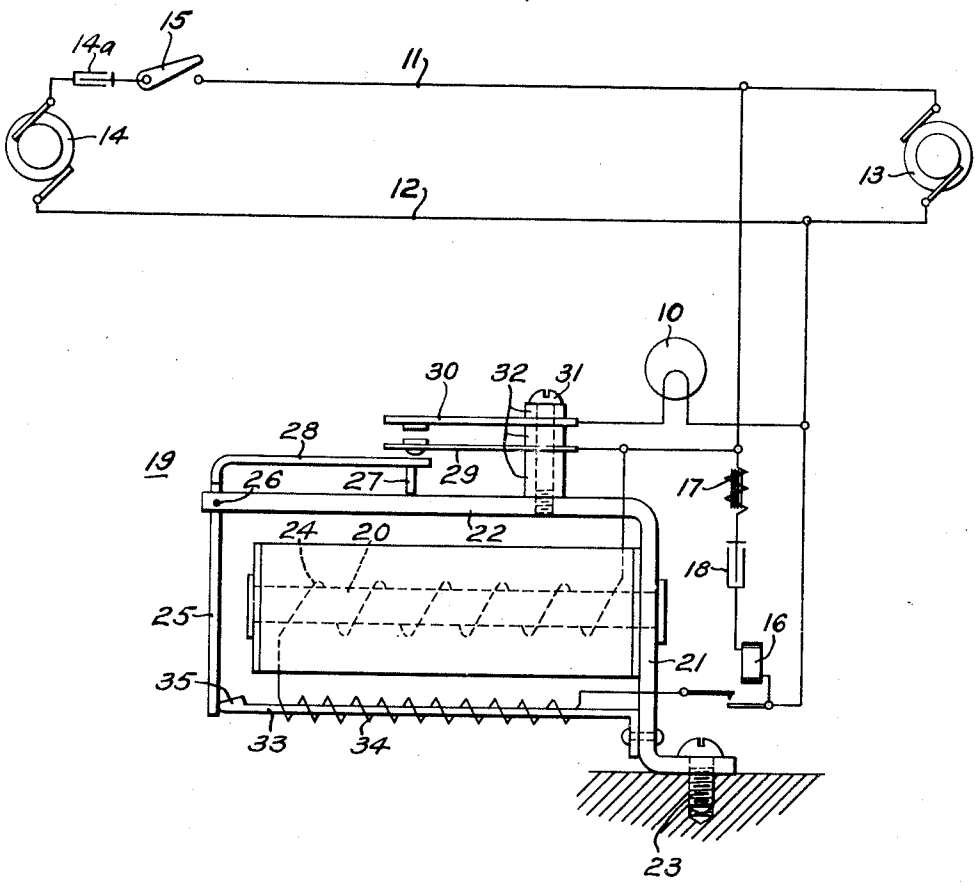
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LATCHING RELAY

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## LATCHING RELAY

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My invention pertains, in general, to control relays and, in particular, to a control relay having an armature which is adapted to be latched in both the attracted and retracted positions.

The principal object of my invention is to provide a relay having a contact-controlling armature which shall not be subject to operation by accidental or transient energization.

A further object of my invention is to construct a relay having an attractable armature and a positive, mechanical lock to prevent the movement of the relay armature in either direction and to permit such movement only when desired.

A further object of this invention is to utilize a thermally-responsive element as a latching member for maintaining the relay armature in either of its positions.

Further objects of the invention will become apparent as the description thereof progresses.

Control relays, as known to the prior art, are subject to the disadvantage that they are liable to be operated by accidental or transient energization. It has often happened furthermore, in systems including a number of control relays adapted to be simultaneously energized, that some of the relays failed to operate when energized and failed to release when deenergized. It has been proposed to employ a relay of the induction-disc type to avoid this difficulty. Induction-disc relays, however, are bulky and expensive and it is an object of this invention to provide a substitute which shall be equally effective, very much less expensive and smaller in size.

In accordance with my invention, I propose to employ a thermally-responsive element such as a bi-metallic strip, having a suitable heating coil, as a latch or stop to prevent the attraction of the relay armature when the stop or thermal element is at its normal temperature. I propose to utilize the same stop to permit attraction of the relay armature and to lock it in the attracted position, as well as to release it therefrom when desired. The details of my invention by which the foregoing results may be accomplished, will now be pointed out in detail by reference to the accompanying drawing, in which,

The single figure is a side elevation of the relay of my invention, certain auxiliary apparatus being illustrated diagrammatically.

Although the relay of my invention was designed particularly for use in connection with systems of remote control, such as those utilized for controlling an entire system of street lamps from a central point, it is obvious that numerous other applications exist for such device and the description thereof in connection with a street lighting system is intended merely as an example.

As shown in the drawing, the relay of my invention is adapted to control the connection of an electrical device such as a lamp 10 to a supply circuit indicated at 11—12. Alternating current of commercial frequency or direct current may be supplied to the circuit 11—12 by a generator 13 or other suitable source. An auxiliary, control generator 14 is adapted to be connected to the circuit 11—12 in series with a blocking condenser 14*a* by means of a switch 15 or other equivalent control apparatus. The function of the auxiliary generator 14 is to supply a high-frequency control current to the circuit for the operation of a relay such as that illustrated at 16 which is connected in a tuned circuit comprising the inductance 17 and the capacitance 18, across the circuit 11—12. The condenser 14*a* prevents the flow of current from the generator 13 through the generator 14. The function of relay 16 is to control the energization of the lamp relay indicated generally at 19. The relay 16, obviously may be so designed that an additional inductance such as 17 may be omitted.

The relay 19 comprises a core 20 secured to one arm 21 of an L-shaped bracket 22 which is adapted to be supported from any suitable surface, horizontal or vertical, by any convenient means such as the screw or bolt 23. A magnetizing winding 24 (illustrated diagrammatically in dotted lines surrounding the core), is provided to cause the core 20 to attract an armature 25 which is pivotally supported at 26 on the end of the bracket 22 in any convenient manner.

A horizontal extension 28 of the armature 25 is adapted to actuate a flexible contact 29 to cause it to engage a fixed contact 30 when the armature of the relay is attracted by the core. The contact members 29 and 30 are secured to the bracket 22 by means of machine screws 31 and insulating washers 32. The projection 27 on the extension 28 limits the movement of the armature 25 away from the core of the electromagnet of the relay.

A thermal element 33, such as a bimetallic strip, is secured in any convenient manner to the bracket 22, e. g., to the vertical portion 21 thereof, and is provided with a heating coil 34 which may preferably be connected in series with the magnetizing coil 24 of the relay. The thermal element 33 is adapted, when at normal temperature, to engage the lower end of the armature 25 to prevent the movement of the armature in response to the energization of the magnetizing coil 24. The stop 33, however, is so designed that, when heated to a predetermined temperature, it is deflected slightly to permit the armature 25 to be attracted by the electromagnet of the relay. When the armature is attracted, however, it will be latched in the attracted position by the projection 35 of the member 33, as a result of the spring action of the latter. When the latch 33 is heated by the energization of the heating coil 34 to a still higher temperature, it will be deflected sufficiently to withdraw the projection 35 from the path of the armature 25. The armature 25 is thereby released and will be restored to its normal position when the magnetizing coil 24 is deenergized. The armature is restored to its normal position by the weight of the extension 28 thereof and the spring action of the flexible contact 29. It will be apparent that the member 33 may be so designed that changes in the ambient temperature will not actuate it to either of its operative positions.

The operation of the relay of my invention will probably be apparent from the foregoing description thereof, but it is deemed advisable to incorporate a brief description thereof in connection with the control system for which it was designed.

When it is desired that the lamp 10 be connected to the supply circuit 11—12, it is necessary to connect the auxiliary generator 14 to the circuit for a predetermined period of time to energize the relay 16 which, in turn, energizes the heating and magnetizing coils of the relay 19. The heating coil 34, after a predetermined time, causes the latch 33 to be withdrawn from its normal position to permit the armature 25 to be attracted and latched by the projection 35. It will be observed that the latch 33 normally prevents the attraction of the armature 25 as a result of accidental or transient energizations of the magnetizing coil 24. Until the latch 33 has been heated to a temperature at which it permits the armature 25 to be attracted, the operation of the relay is positively prevented.

When the control frequency has been supplied to the circuit 11—12 and the heating and magnetizing coils of the relay 19 energized for the necessary time interval, the latching member 33 will be deflected slightly so that the armature 25 may be attracted. The movement of the extension 28 of the armature will cause the engagement of the contacts carried by the contact members 29 and 30, to connect the lamp 10 directly to the supply circuit 11—12. As the armature 25 is attracted, however, it deflects the latch 33 further to pass the projection 35 thereof, and when the armature passes the projection, the flexible member 33 is slightly retracted and, by the projection 35, retains the armature in its attracted position. The auxiliary generator may now be disconnected from the circuit and the lamp 10 will remain connected thereto, receiving its energy from the main supply source, such as the generator 13.

Now when it is desired to disconnect the lamp 10 from the circuit 11—12, the auxiliary generator 14 is again connected to the circuit to energize the relay 16 for a longer period than before. As a result, the heating coil 34 and magnetizing coil 24 of the relay 19 are again energized from the circuit 11—12. When the heating coil 34 has been energized for a sufficient length of time, the bimetallic member 33 will be deflected still further and the projection 35 will be withdrawn from engagement with the armature 25 to permit the restoration thereof to its normal position when the magnetizing and heating coils are deenergized. The cooling of the thermal member 33 is sufficiently slow to permit the armature 25 to be retracted when the relay coils are deenergized by the release of the armature of relay 16, before the thermal element 33 returns to its normal position. When the armature 25 is released by the opening of the switch 15 and the consequent deenergization of relay 16, the lamp 10 is disconnected from its supply circuit.

The chief advantages of the relay of my invention are its extreme simplicity and reliability, as well as its unusually low cost. It functions in the manner above described to prevent the energization of a remote electrical device as a result of accidental or transient conditions such as inductive surges. It also maintains the device connected to the circuit, although its magnetizing coil is entirely deenergized. It includes, furthermore, means for disconnecting the electrical device from the circuit whenever such action is desired and reduces to a negligible minimum the chances for any relay to get out of step with other similar relays simultaneously energized.

Various changes and modifications in the

details of the relay of my invention will, no doubt, occur to those skilled in the art and, for this reason, I do not wish to be limited to the exact embodiment thereof shown and described herein, but intend to cover as well, as wide a range of equivalents as is permitted by the scope of the appended claims.

I claim as my invention:

1. The combination with a relay having a contact-closing armature and a magnetizing coil adapted, when energized, to attract said armature, of a thermally responsive latching member having a heating coil, adapted, when at normal temperature, to prevent the attraction of said armature by said magnetizing coil, when at a predetermined temperature, to permit the armature to be attracted and latched, and, when at a different temperature, to release said armature to permit it to return to its normal position.

2. A thermal magnetic relay comprising an armature, a magnetizing coil therefor, a thermally-responsive latch for maintaining said armature in attracted or retracted position and a heating coil for said latch whereby the latch may be actuated to prevent attraction or retraction of said armature and to permit attraction and retraction thereof.

3. In a relay having an attractable armature, a thermal element for latching said armature in attracted and retracted positions.

4. A relay having an armature and a single stop comprising a bi-metallic member and a heating coil for maintaining said armature in either the attracted or retracted positions.

5. An electro-responsive device including a movable-armature contact means, actuating means therefor, and means for locking the armature in both the open and closed positions in accordance with predetermined time intervals of energization of said electro-responsive device.

6. An electro-responsive device including an attractable armature and a thermally-actuated means for controlling the movement of said armature from the attracted and retracted positions thereof in accordance with predetermined time intervals of energization of said electro-responsive device.

7. A control relay comprising a plurality of contact members, a pivotally mounted armature for actuating said contact members, an electromagnet for effecting the operation of the armature, and a bi-metallic latching member for controlling the movements of the armature, said latching member being provided with a heating coil, the energization of which is dependent upon the energization of the electromagnet, said latching member being disposed, when in an unheated condition, to prevent actuation of the armature by the electromagnet, when heated to a predetermined degree to permit free movement of the armature, and when heated to an intermediate degree to retain the armature in its actuated position.

In testimony whereof, I have hereunto subscribed my name this first day of December 1928.

PAUL F. SHUEY.