Nov. 12, 1929. H. E. WHITE 1,735,225

THERMAL RELAY

Filed Aug. 7, 1926

Fig. 1.

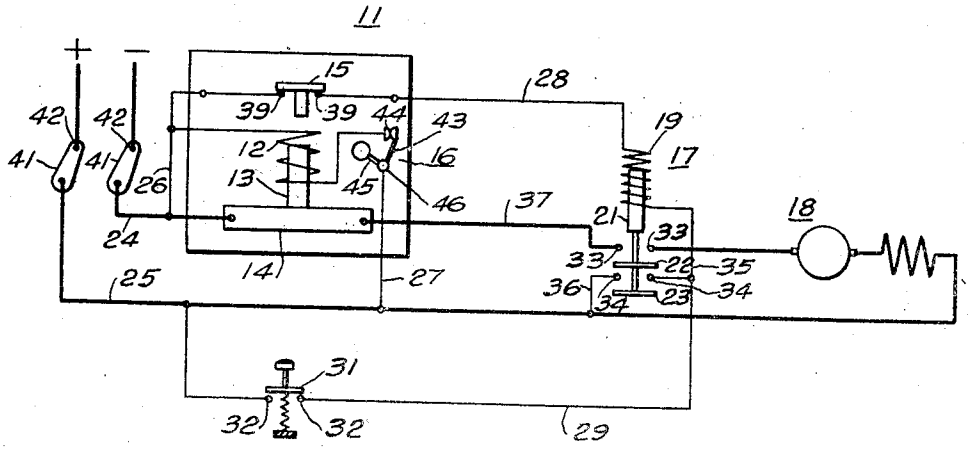
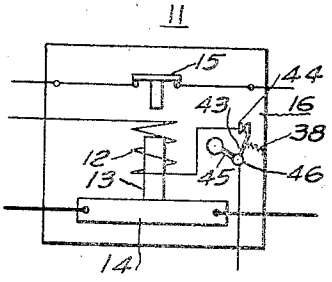


Fig. 2.



WITNESSES:

E. A. McCloskey.

G. B. Zjoflat

INVENTOR

Harold E. White.

BY Wesley St. Cox

ATTORNEY

Patented Nov. 12, 1929 1,735,225

UNITED STATES PATENT OFFICE

HAROLD R. WHITE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

THERMAL RELAY

Application filed August 7, 1926. Serial No. 127,751.

My invention relates to thermal relays and particularly to thermal relays that are subjected to shock or vibration.

An object of my invention is to provide a protective device for an electric circuit that shall be operable to control the circuit in response to predetermined conditions therein under normal conditions of shock or vibration.

Another object of my invention is to provide a thermal protecting device for an electric circuit that shall be responsive to predetermined conditions therein and that shall be inoperative when subjected to abnormal conditions of shock or vibrations.

In practicing my invention I provide a thermal protective relay for electric circuits which are particularly adapted for use on such applications as battleships. The relay comprises an electro-magnetically controlled switch, means for causing the switch to be normally in an inoperative position and a means for rendering the electro-magnetically operable switch inoperative when subjected to abnormal conditions of shock, vibration or a combination thereof.

The electro-magnetically operable switch comprises in general, a magnet coil, a core member actuable thereby and a magnetic member for normally maintaining the core member in engagement therewith. The magnetic member is adapted to be heated by a current traversing the circuit to be protected and is of such character that it loses its magnetic properties at a certain predetermined temperature. When the magnetic member has lost its magnetism, the core member is actuated by the electro-magnet coil to open a circuit control switch.

If the operating temperature necessary to make the magnetic member non-magnetic has not been attained, and a severe shock is transmitted to the thermal relay, which may be caused by gun fire on a battleship, an auxiliary switch is provided for controlling the coil which is responsive to predetermined shock conditions to deenergize the coil and to thereby prevent the core member from becoming disengaged from the magnetically reversible member.

In the accompanying sheet of drawings:

Figure 1 is a diagrammatic view illustrating an application of the device embodying my invention, and

Fig. 2 is a diagrammatic view illustrating a modification of the thermal relay shown in Fig. 1.

A thermal circuit-protecting device 11 comprises a magnet coil 12, a core 13 therefor, a magnetically reversible member 14 which is normally in engagement with the core 13, a switch member 15, and a shock-responsive switch 16. The circuit-protecting device 11, as illustrated in Fig. 1, is operatively connected to a switch mechanism 17 for controlling an electric translating device 18, such as an electric motor. The switching device 17 comprises a magnet coil 19, a core member 21 and contact bridging members 22 and 23.

The coil 12 is energized from the supply conductors 24 and 25 through conductors 26 and 27 and the switch 16.

The coil 19 is energized from the supply lines 24 and 25 through conductor 26, switch 15, conductor 28, conductor 29, and switch 31 when closed to engage contact members 32. Upon the energization of the coil 19, the contact bridging member 22 engages contact members 33, and the contact bridging member 23 is moved to engage the contact members 34 whereby the coil 19 is energized from conductor 28 to conductor 35, contact bridging member 23, conductor 36 to supply line 25. When the contact bridging member 22 is in engagement with the contact members 33, the motor 18 is energized from the supply conductor 24, the magnetically reversible member 14, conductor 37, switch member 22, through motor 18 to conductor 25.

In Fig. 2 a modification of the switch member 16 is illustrated. In this modification, a spring member 38 is provided for positively maintaining the switch in the closed position as illustrated.

The magnetically reversible member 14 may be made of a nickel-steel alloy. A particular alloy comprising substantially 35% nickel and 65% iron with traces of other materials has been found to be very useful

in the operation of my device. This material ceases to be magnetic when heated to about 150° C. and becomes magnetic again when cooled to a slightly lower temperature. Other nickel-iron alloys having low transformation points are well known and may be used for my purpose. The device comprising the thermal relay 11 is an improvement on the relay which is described in my U. S. Letters Patent No. 1,561,386.

The switch member 16 comprises, in general, a pivotally mounted contact member 43, a cooperating stationary contact member 44, and a gravity actuated member 45 that is operatively associated with the member 43 so as to maintain it normally in engagement with the stationary contact member 44. The members 43 and 45 are angularly disposed and pivotally mounted on a common pivot member 46. In the modified form of the switch member 16, illustrated in Fig. 2, the spring member 38 is employed to bias the member 43 into engagement with the contact member 44.

The operation of the device illustrated in Figs. 1 and 2 is dependent upon the magnetic properties of the magnetically reversible member 14 that is in circuit with the circuit or translating device to be protected. At temperatures below the transformation points of the magnetic member 14, the core member 13 is normally maintained out of engagement with the contact member 15. If a heavy overload or a continued overload of smaller value is applied to the translating device 18, the temperature of the member 14 is caused to increase until the magnetic properties thereof have disappeared, thereby causing the core member 13 to disengage the switch member 15 from contact members 39, whereupon the coil 19 is deenergized to open the circuit of the translating device 18.

When the member 14 has cooled sufficiently, the core member 13 may be made to engage the member 14 by deenergizing the coil 12. The coil 12 may be deenergized either by manually opening the switch 16 or by disengaging switch members 41 from contact members 42.

When my device is employed on battleships, where severe shocks may be transmitted thereto from such causes as gun fire, the core member 13 may possibly be disengaged from the member 14 before the magnetic properties thereof have disappeared. To preclude this operation the switch member 16 is provided in circuit with the coil member 12 to deenergize the coil in response to such shocks. Upon the cessation of gun fire shocks or other concussive disturbances, the switch member 16 is caused to reclose on account of the gravity actuated member 45 which is pivotally mounted on the pivot member 46 and operatively connected to the contact member 43.

By my invention, I have provided a thermoprotective relay which is responsive to control an electric circuit in accordance with a predetermined thermal condition. In order to make my device applicable to conditions which are subjected to severe shocks, such as may occur on battleships, I have provided an additional element for my relay that renders it inoperative when subjected to severe shocks and that automatically makes it operative upon the disappearance of such shocks.

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

I claim as my invention:

1. In combination, a protective device comprising an electromagnet coil and a movable magnetizable core member therefor, means associated with the coil to constitute a magnetic circuit containing a current-traversed magnetically reversible member serving normally to restrain the movable member against movement by the actuating coil, and means for automatically deenergizing said magnet coil during intervals of abnormal conditions of shock and vibration.

2. The combination with a control device for an electric circuit comprising an actuating member, an operating coil therefor and a current traversed magnetically reversible member influenced thereby to restrain the actuating member against movement by the operating coil under predetermined conditions in the circuit to be controlled, of means for rendering said operating coil inoperative only during abnormal conditions of shock and vibration to which said control device may be subjected.

3. In combination, an electromagnet coil, a movable core member therefor, means for normally restraining the core member against movement by the actuating coil, and means for automatically maintaining said coil in an inoperative condition during abnormal conditions of shock and vibration.

4. The combination with a thermal relay for controlling an electric translating device comprising an electromagnet coil, a movable core member therefor, means in circuit with said translating device for normally maintaining said core member in engagement therewith and for releasing said member when predetermined current conditions exist in said translating device, of means for rendering said electromagnet coil inoperative during predetermined conditions, comprising a switch member in circuit therewith, said switch being normally closed and adapted to open the circuit of said coil when subjected

to predetermined conditions of shock and vibration and to reclose said circuit when said conditions have subsided.

5. The combination with an electric translating device, an electromagnetically operable switch, and means for controlling said switch in accordance with predetermined conditions of said translating device comprising an electromagnet coil, a core member therefor, and magnetic means in circuit with said translating device for maintaining said core member in a predetermined position, said means becoming non-magnetic in response to a predetermined current flow therethrough to release said core member to cause said switch to deenergize the translating device, of a switch member for controlling said electromagnet coil in response to predetermined conditions of shock and vibration.

6. A controlling device for an electric circuit comprising an actuating member, an operating coil therefor, a current traversed magnetically reversible member influenced by the operating coil to restrain the actuating member against movement by the operating coil under predetermined conditions in the circuit to be controlled, and means responsive to predetermined conditions of shock and vibration for rendering said coil inoperative.

7. In an electric circuit protector, the combination with an electromagnet having a movable core member associated therewith, a member adapted to lose its magnetism at a predetermined temperature, for normally holding said core member in an inoperative position, of means for controlling said coil to prevent movement of said core member during abnormal conditions of shock to which said circuit protector may be subjected.

8. In an electric circuit protector, the combination with an electromagnet coil energized from a circuit, a movable core member actuated thereby, a magnetically reversible member heated in accordance with a current flowing in the circuit to be protected for normally maintaining said core in an inoperative position and for actuating said core member to an operative position when the reversible member has been heated to a predetermined degree, of means for automatically deenerigzing said coil when said circuit protector is subjected to abnormal conditions of shock and to again energize said coil when said conditions are normal.

9. A protecting device for an electric circuit comprising a magnetically reversible member adapted to be heated in accordance with the current traversing said circuit, a magnet coil, a movable core member actuable thereby and normally engaging said magnetically reversible member and adapted to be disengaged therefrom under predetermined conditions in said circuit, and means so responsive to abnormal conditions of shock as to render said coil inoperative and to make said coil operative when the shock conditions have become normal.

10. A circuit protecting device for an electric circuit comprising, a control switch for controlling said circuit, an electromagnet coil, a core member therefor actuable by said coil for controlling said switch, means for normally maintaining said core member in an inoperative position, said means being responsive to predetermined conditions in said circuit to render the core member operative to control said switch, and means responsive to abnormal conditions of shock for controlling said coil to prevent movement of said core member thereby.

In testimony whereof, I have hereunto subscribed my name this 5th day of August, 1926.

HAROLD E. WHITE.