June 17, 1930. H. E. WHITE 1,764,374

THERMAL RELAY

Filed Aug. 6, 1927

Fig. 1.

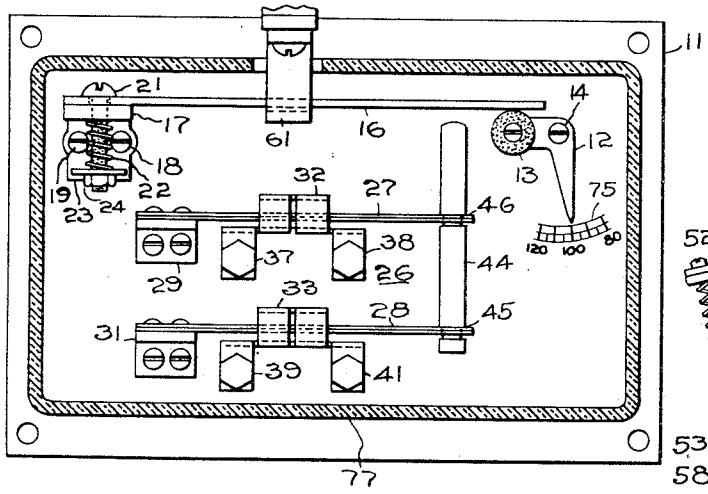


Fig. 2.

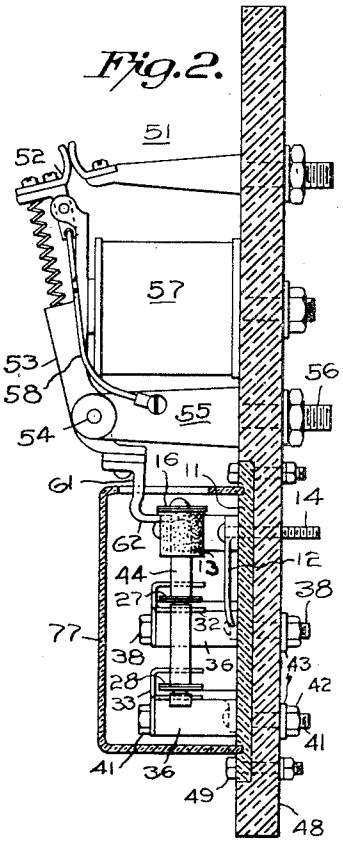
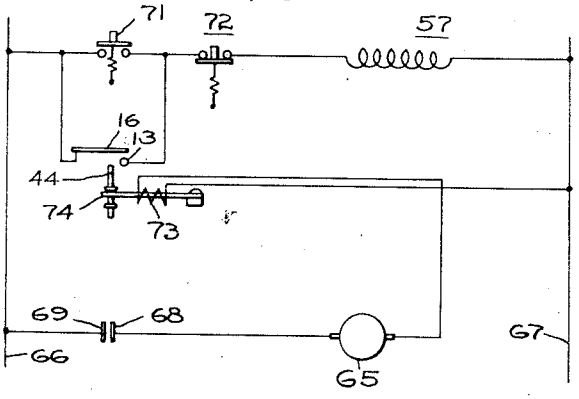


Fig. 3.



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UNITED STATES PATENT OFFICE

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THERMAL RELAY

Application filed August 6, 1927. Serial No. 211,050.

My invention relates to electric energy translating devices and particularly to overload protective relays therefor.

An object of my invention is to provide a thermal relay for an electromagnetically operable circuit interrupter that shall be operable both as an auxiliary switch for controlling a magnet coil of the circuit interrupter and as an overload protective relay.

A further object of my invention is to provide a thermally actuable device that shall control the interlock for an electromagnetic switch in accordance with the current traversing the switch and to preclude the closing of the interlock until a time interval has elapsed after the operation of the thermally responsive device.

A still further object of my invention is to provide an interlock for a magnet coil of an electromagnetic circuit interrupter that shall be operable both by the interrupter itself, and by a device that is responsive to the current traversing the electric energy translating device controlled by the interrupter.

A still further object of my invention is to provide a protective relay that shall be simple in construction, easily manufactured and adjustable.

In practicing my invention, I provide a circuit interrupter, an actuating coil therefor, means for temporarily energizing the coil, an interlock or auxiliary switch for permanently maintaining the coil energized subsequent to the closing of the interrupter, and a device responsive to the current traversing the circuit interrupter for actuating the interlock to effect deenergization of the coil when said current reaches a predetermined value.

For a fuller understanding of my invention, reference may be had to the following description taken in conjunction with the accompanying drawings, in which,

Figure 1 is a top plan view, partially in section, of a relay for protecting electric energy translating devices against overloads,

Fig. 2 is a view, in side elevation, partially in section, of the overload relay illustrated in Fig. 1 and an electromagnetic circuit interrupter controlled thereby, and

Fig. 3 is a schematic illustration of circuits and apparatus embodying my invention.

In the drawings, an overload protective device is illustrated that comprises a base 11 on which is mounted a bell-crank lever 12 having a contact member 13 secured thereto. The contact member 13 may be of such material as graphite or an alloy consisting chiefly of graphitic material. The bell-crank lever 12 may be of current-conducting material and may be secured to the base by a terminal bolt 14 that extends through the base 11.

The contact member 13 is provided with a cooperating movable contact member 16 that comprises a strip or bar of electric-conducting material. The member 16 may be yieldingly mounted on a bracket 17 of substantially L-shape that is secured to the base 11 by screws 18 and 19, the screw 19 extending through the base to constitute one terminal for the contacts 13 and 16, the bolt 14 being the other terminal therefor.

In order that the contact member 16 may be biased towards engagement with the contact member 13, the member 16 is yieldingly secured to the bracket 17 by means of a bolt 21 and a spring 22 that is mounted on the bolt 21 and held in position thereon by a washer 23 and a nut 24.

The contact member 16 is provided with a thermally responsive actuating device 26 that comprises a plurality of spaced bimetallic strips 27 and 28, each having one end thereof secured to brackets 29 and 31, respectively, that are mounted on the base. The bimetallic strips 27 and 28 are provided with slotted resistor heating elements 32 and 33 of substantially U-shape, respectively, that are supported on tubular bushings 36 and secured thereto by terminal bolts 37 and 38, and 39 and 41, respectively. The terminal bolts extend through the base and may be secured thereto by cooperating nuts 42 and lock washers 43.

The free ends of the bimetallic strips 27 and 28 are provided with a push-rod 44 having shoulder portions 45 and 46 that rest upon the bimetallic elements, as shown in

Fig. 1. The upper end of the push-rod 44 is adapted to engage the contact member 16 and to actuate it out of engagement with the contact member 13, when the temperature of either one or both of the bimetallic strips has reached a predetermined value. The temperature at which the bimetallic strips are operable to cause disengagement between the contact members 13 and 16 may be controlled by adjusting the clearance between the contact member 16 and the upper end of the push-rod 44. This clearance may be adjusted by turning the bell-crank lever 12 either in a clockwise or counter-clockwise direction, depending upon the temperature or the terminal condition that shall obtain in the strips 27 and 28 in order that disengagement of the contacts 13 and 16 be effected.

The thermo-responsive actuating device 26 is shown and described in copending applications, Serial Nos. 125,220 and 89,604 to which reference may be had for a more specific illustration thereof.

The application of the device illustrated in Fig. 1 is illustrated more particularly in detail in Fig. 2. As there shown, the base 11 is mounted on a panel 48, of suitable insulating material, and secured thereto by suitable bolts 49. The relay may be utilized for controlling an electromagnetic circuit interrupter.

The circuit interrupter comprises a stationary contact member 51 and a spring-biased contact member 52 that is carried by an armature 53. The armature is pivotally supported at 54 on a bracket 55 having a terminal portion 56 extending through the panel 48. The armature 53 may be held in the position shown in Fig. 2 of the drawings, by means of a magnet coil 57 that is mounted on the panel 48. If the magnet coil 57 is in a deenergized condition, the armature 53 will move downwardly from the coil to effect disengagement between the contacts 51 and 52.

In order to relieve the pivot point of the armature 53 from current-carrying duty, a shunt 58 may be provided that connects the spring-biased contact member 52 to the bracket 55.

The armature 53 is provided with an interlock or auxiliary switch actuating member 61, of substantially L-shape, having a portion 62 thereof that is located beneath the interlock or contact member 16. Thus, when the coil 57 is in a deenergized condition, the armature 53 is released to cause the member 61 to actuate the contact member 16 out of engagement with the contact member 13.

The circuit interrupter illustrated in Fig. 2 may, in some instances, be equipped with three-poles for controlling such electric energy translating devices, as three-phase motors and similar devices. The terminal bolts 37 and 38, and 39 and 41 for the resistors 32 and 33 may be connected in circuit with the poles of the interrupter, in order that the various phases of the motors may be protected from overload. Thus, if a current of a predetermined value has traversed the circuit interrupter for a predetermined length of time, the bimetallic strips 27 and 28 will have been heated by the resistors 32 and 33, to a temperature of such a value that the contact member 16 will have been actuated out of engagement with the contact member 13, thereby effecting deenergization of the relay 57, and the actuation of the circuit interrupter to an open-circuit position.

In Fig. 3 of the drawings, a single-pole circuit interrupter of the type illustrated in Fig. 2 is illustrated for protecting a motor 65 from overloads. The motor may be energized from electric-energy supply conductors 66 and 67 and the energization thereof controlled by switch contacts 68 and 69 that corresponds to the contacts or terminals 51 and 52, of Fig. 2. The contacts 68 and 69 may be actuated to a circuit-closing position by the coil 57, that is provided with a starting switch 71 and a stopping switch 72. When the starting switch 71 is actuated to a circuit-closing position, the coil 57 is energized from the supply conductors 66 and 67, and upon the closing of the contacts 68 and 69, the interlock or contact member 16 is caused to engage the stationary contact 13, thus establishing a permanent energizing circuit for the coil 57.

The current which traverses the motor 65 flows through a resistor 73 that corresponds with either one of the resistors 32 and 33 and causes a bimetallic strip 74 similar to the strips 27 and 28, of Fig. 1, to be heated in accordance with the value of current traversing the motor. If the value of current traversing the motor has exceeded a predetermined value and has traversed the motor for a predetermined length of time, the bimetallic strip 74 will have actuated the push-rod 44 upwardly to effect disengagement of the contact member 16 from the contact member 13. The coil 57 being thus deenergized, the circuit interrupter, constituted by the contacts 68 and 69, is caused to be actuated to an open-circuit position to effect deenergization of the motor 65. As the circuit interrupter is opened, the hook portion 62 of the interlock 61 is moved upwardly and is effective to hold the contact member 16 disengaged from the cooperating contact member 13, as long as the interrupter remains open. Thus, the bimetal strips 27 and 28 may return to their initial positions, with the push rod 44 in its lowermost position, without permitting a reclosing of the energizing circuit through the coil 57, and a consequent reclosing of the interrupter. When the motor has been deenergized for such a length of time that the bimetallic strip 74 will have been cooled to

its normal position, the circuit controlled by the contacts 13 and 16 may again be established by closing the starting switch 71 which, as shown in Fig. 3, is connected in shunt-circuit relation to the contact members 13 and 16. But so long as the bimetallic strip is deflected to such a position that the interlock 16 is in an open circuit position, the interlock is not permitted to close even though the starting switch 71 is closed.

The relay illustrated in Fig. 1 may be calibrated in terms of percent full load, as indicated by a scale 75 on the base 11. If it is desired that the relay shall effect deenergization of the motor 65 at 100% full load, the bell-crank lever 12 is positioned, as shown in Fig. 1 of the drawings, and for other values the lever is positioned in accordance with scale calibration.

If it is necessary that the thermostatic actuating device 26 be protected from atmospheric conditions, a cover 77 may be provided for enclosing the relay structure mounted on the base 11.

Various modifications may be made in the device embodying my invention without departing from the spirit and the scope thereof. 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 control means for a contactor having a main switch, a magnet coil controlling said main switch and an auxiliary switch in the circuit of the magnet coil, said control means including thermally-actuable means for effecting opening of the auxiliary switch and thereby of the main switch, and mechanical means operatively associated with the main switch for holding open the auxiliary switch as long as the main switch is open.

2. A control means for a contactor having a main switch, a magnet coil for closing said switch and an auxiliary switch for controlling the circuit of the magnet coil, said control means including means responsive to a current of a predetermined value traversing said main switch for effecting opening of the auxiliary switch and thereby of the main switch, and mechanical means on the main switch and actuated thereby for holding open the auxiliary switch as long as the main switch is open.

3. A control means for a contactor having a main switch, a magnet coil for closing said switch and an auxiliary switch for controlling the circuit of the magnet coil, said control means including means responsive to a current of a predetermined value traversing said main switch for effecting opening of the auxiliary switch and thereby the main switch, and means on said main switch operatively engaging the auxiliary switch when the main switch is open for preventing reenergization of the magnet coil by the auxiliary switch upon deenergization of the current-responsive means.

4. A control means for a contactor having a main switch, a magnet coil for effecting closing of the main switch, and an auxiliary switch spring-biased to its closed position for controlling the energization of the magnet coil, said control means including thermally-actuable means energized in accordance with an electric current traversing the main switch for causing opening of the main switch, and a finger on said main switch operatively engaging the auxiliary switch when the main switch is open for preventing reenergization of the magnet coil upon deenergization of the thermally-actuable means.

5. A control means for a contactor having a main switch, a magnet coil for effecting closing of the main switch, and an auxiliary switch spring-biased to its closed position for controlling the energization of the magnet coil, said control means including a thermal means responsive to a current of a predetermined value traversing the main switch for opening the auxiliary switch to effect opening of the main switch, and a finger on the main switch out of operative engagement with the auxiliary switch when the main switch is closed for holding the auxiliary switch open as long as the main switch is open.

In testimony whereof, I have hereunto subscribed my name this 3rd day of August, 1927.

HAROLD E. WHITE.