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W. M. BRADSHAW

THERMAL RELAY

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Fig. 1.

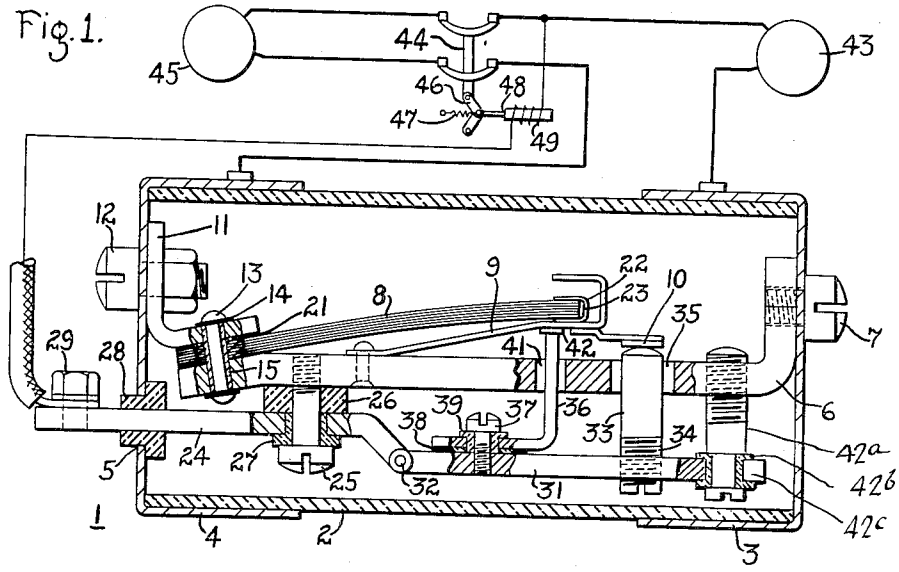
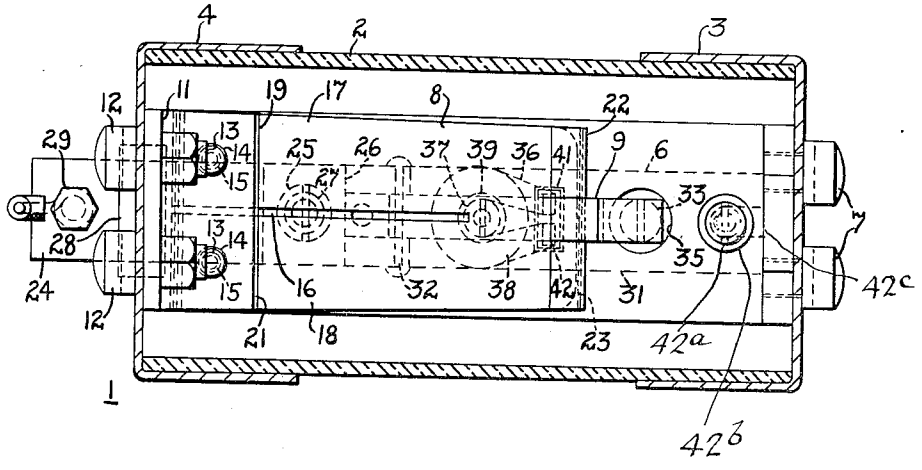


Fig. 2.



WITNESSES:

R. J. Butler.

Abt. Pendleton

INVENTOR

William M. Bradshaw.

BY

Wesley G. Carr

ATTORNEY

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UNITED STATES PATENT OFFICE.

WILLIAM M. BRADSHAW, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

THERMAL RELAY.

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My invention relates to electrical protective devices and more particularly to thermal relays.

One object of my invention is to provide a thermal relay that shall have such a time interval in the operation thereof as to afford protection to electrical apparatus against continued overloads.

Another object of my invention is to provide a thermal relay, of the cartridge type and of the above indicated character, that shall have means whereby its contact members are quickly actuated in both the opening and closing operations under predetermined conditions.

Another object of my invention is to provide a thermal relay, of the above indicated character, in which a unitary adjusting device controls both the contact member and the magnetic member.

A further object of my invention is to provide a thermal relay, of the above indicated character, that shall be compact in form, relatively inexpensive to construct, and reliable and effective in its operation.

In the preferred form, my invention comprises an enclosed cylindrical casing with connecting ferrules at the ends thereof. A base member that is operatively connected between the ferrules supports a bimetallic member and a contact member. The contact member is so mounted that the free end of the bimetallic member, at certain points on its path of travel, engages the contact member, causing it to engage or disengage a second contact member. This second contact member, together with a permanent magnet is mounted on a member pivotally connected to the base member, but electrically insulated therefrom.

In the engaged position of the contact members, the ends of the permanent magnet are in engagement with an armature that is mounted on the movable contact member, and an adjusting screw is provided to move the free end of the pivotally mounted member toward or away from the base member, thereby simultaneously adjusting the contact member and the permanent magnet. With this arrangement, operation of the bimetallic member effects quick actuation of the movable contact member.

In the accompanying drawings:

Figure 1 is a side view, partially in elevation and partially in section, of the thermal relay embodying my invention, together with a diagrammatic view of the electrical circuits illustrating the application of my invention to the protection of electrical apparatus.

Figure 2 is a view, partially in plan and partially in section, of the thermal relay shown in Fig. 1.

Referring to Figures 1 and 2 of the drawing, a relay 1, embodying my invention, comprises a cylindrical casing 2 which is provided with a ferrule 3 at one end, and, at the other end, with a ferrule 4 having an opening 5 therein. A base member 6 is rigidly secured to the ferrule 3 by screws 7 and it supports a bimetallic member 8 and a resilient member 9 that is normally biased away from the base member 6 and supports a contact member 10. A brace member 11 gives rigidity to the structure by being secured firmly to the ferrule 4 by bolts 12, and to the bimetallic member 8 and the base member 6 by rivets 13. The rivets 13 are electrically insulated from the brace member 11, the bimetallic member 8, and the base member 6 by means of insulating washers 14 and insulating bushings 15.

A longitudinal slot 16 divides the bimetallic member 8 into two parts 17 and 18. The part 17 is electrically insulated from the base member 6 by means of an insulating member 19, but is in electrical engagement with the brace member 11, while the part 18 is in electrical engagement with the base member 6, but is insulated from the brace member 11 by means of an insulating member 21. The free end of the bimetallic member 8 is held together by means of a clamp member 22, having an insulating lining 23.

A bracket member 24 is mounted on the base member 6 by a screw 25, but is electrically insulated therefrom by means of an insulating member 26. The screw 25 is electrically insulated from the bracket member 24 by means of a flanged insulating bushing 27. The bracket member 24 extends through the opening 5 in the ferrule 4, but is electrically insulated from the ferrule by means of an insulating bushing 28. The outer end of the bracket member 24 carries a terminal screw 29. A member 31 is pivotally connected to the bracket member 24

by means of a hinge pin 32, and supports an adjustable contact member 33 and a permanent magnet 36.

The contact member 33 is so threaded, as at 34, as to be adjustable with respect to the pivotally mounted member 31, and extends through an opening 35 in the base member 6. The permanent magnet 36 is secured to the pivotally mounted member 31 by a screw 37, but is electrically insulated therefrom by means of an insulating member 38. The screw 37 is electrically insulated from the magnet 36, by means of a flanged insulating bushing 39. The pole pieces of the magnet 36 extend through an opening 41 in the base member 6 and engage an armature member 42 that is rigidly secured to the resilient member 9. The member 31 and the members carried thereby, may be adjusted relatively to the member 6 by a screw 42*a* that has screw threaded engagement with the member 6 and is electrically insulated from the member 31 by a collar 42*b*, which collar is mounted on a reduced end portion of the member 42*a* and is located in a notch 42*c* in the member 31.

Referring to the diagrammatic view of the electrical circuit shown in Figure 1, a source of electrical energy 43 is connected in circuit with the thermal relay 1, a circuit breaker 44, and electrical apparatus 45 that is to be protected. The circuit breaker 44 has a toggle mechanism 46 to which is connected an actuating spring 47 and an armature member 48 of an electromagnet 49. One terminal of the coil of the electromagnet 49 is connected to the source of energy 43 and the other terminal is connected to the terminal screw 29 on the bracket member 24 of the relay.

The thermal relay is shown in the drawings in its circuit-closing condition, the contact members 10 and 33 being in engagement. Under this condition, an electric circuit is completed comprising the source of energy 43, ferrule 3, base member 6, contact members 10 and 33, resilient member 9, pivotally mounted member 31, bracket member 24, terminal screw 29, and the coil of the electromagnet 49.

With the coil of the electromagnet 49 thus energized, the circuit breaker 44 is held in its closed position, as shown, permitting current to traverse the main circuit extending from the source of energy 43, through the ferrule 3, the base member 6, bimetallic member 8 from the part 18 to the part 17 thereof, the brace member 11, ferrule 4, and circuit breaker 44 to the electrical apparatus 45.

When current traverses the bimetallic member 8, its temperature is increased to thereby cause its free end to move away from the base member 6. If the current exceeds a predetermined value, the bimetallic member 8 will, after a predetermined interval of time, attain such temperature that its free end will move far enough to engage a U-shape portion on the resilient member 9 to thus cause the contact member 10 to disengage the contact member 33.

When the bimetallic member 8 engages the U-shape portion of the member 9, the armature 42 is forced out of engagement with the magnet 36, and the resiliency of the member 9 will cause it to be actuated with a snap action, interrupting the electrical circuit of the electromagnet 49 very quickly. When the coil of the electromagnet 49 is de-energized, the spring 47 actuates the circuit breaker toggle mechanism 46 to open the circuit breaker 44, thus interrupting the circuit of the apparatus 45 to be protected.

When no current traverses the main circuit the temperature of the apparatus 45 falls, as does also that of the bimetallic member 8. When the temperature of the bimetallic member 8 has fallen to such degree that this member has substantially returned to its ineffective position, the armature member 42 secured to the contact member 9 is forced into close proximity to the pole pieces of the magnet 36. When a certain proximity is attained, the magnetic force is sufficient to overcome the resiliency of the member 9 and the armature member 42 rapidly engages the pole pieces of the magnet 36, thereby bringing the contact member 10 rapidly into engagement with the contact member 33, and reclosing the electric circuit through the operating coil of the electromagnet 49. This coil then actuates the armature member 48 to close the circuit breaker 44, thereby restoring the electric circuit extending through the apparatus 45 to its normal, or closed, condition.

The thermal relay embodying my invention is adapted to be constructed as a cartridge-type relay and in this form it may be installed in standard cartridge-fuse clips. The mechanism of the relay is a unit and may be secured to the ferrules of the cartridge-type casing by easily removable end screws, thus providing ease of inspection and adjustment.

My invention is not limited to the applications illustrated nor to the structure of the relay as described above, as various modifications may be made therein, and it may be adapted to protect various devices without departing from the spirit and scope of the invention, as set forth in the appended claims.

I claim as my invention:

1. A thermal relay for electrical apparatus comprising a bimetallic member freely movable through a definite path, a relatively movable contact member, and magnetic means co-operating with the contact member to cause the bimetallic member to actu-

ate the contact member with a snap action when it reaches substantially either end of its path of free movement, corresponding to a predetermined temperature of the bimetallic member.

2. A thermal relay for electrical apparatus comprising a bimetallic member freely movable through a definite path, relatively movable contact members for controlling an electric circuit under predetermined conditions, and magnetic means whereby one contact member is rendered positively inoperative while the bimetallic member is traveling through its path of free movement.

3. A thermal relay of the cartridge-fuse type, comprising a tubular casing of electric-insulating material, metal ferrules at the ends of said casing, a bimetallic member in said casing electrically connected to the metal ferrules and having one end freely movable through a definite path, a fixed contact member, a contact member movable by said bimetallic member at the ends of its free movement, and means operatively associated with said contact members for effecting engagement and disengagement of said contact members by said bimetallic member with a snap action.

4. A thermal relay of the cartridge-fuse type comprising a tubular casing of electric-insulating material, metal ferrules at the respective ends thereof, a base member having one end secured to one of said ferrules, a bimetallic member supported by the other end of said base member having its ends electrically connected respectively to said base member and to the second ferrule, the free end of said bimetallic member being freely movable through a definite path, a fixed and a movable contact member operatively supported by said base member, and means operatively supported by said base member for effecting disengagement of said contact members by said bimetallic member with a snap action.

5. A thermal relay of the cartridge-fuse type comprising a tubular casing of electric-insulating material, metallic ferrules at the ends of said casing, a base member supported by and in electrical connection with one of said ferrules, a bimetallic member supported by said base member and in electrical connection with said base member and the other ferrule, a spring member for yieldingly limiting the free movement of one end of the bimetallic member, contact members adapted to be engaged and disengaged by movement of said spring member, and magnetic means associated with said contact members for so controlling the same that said engagement and disengagement is effected with a snap action.

6. A thermal relay of the cartridge-fuse type comprising a tubular casing of electric-insulating material, metallic ferrules at the ends of said casing, a base member supported by and in electrical connection with one of said ferrules, a bimetallic member supported by said base member and in electrical connection with said base member and the other ferrule, a spring member for yieldingly limiting the free movement of one end of the bimetallic member, a movable contact member carried by said spring member, a second contact member, a magnetic member which holds the two contact members in engagement under predetermined conditions, and a means for operatively supporting said second contact member and said magnetic member and for permitting of their simultaneous adjustment relatively to the movable contact member.

In testimony whereof, I have hereunto subscribed my name this 29th day of October, 1923.

WILLIAM M. BRADSHAW.