Dec. 12, 1933. E. D. ANGELL 1,939,194

CIRCUIT BREAKER

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Fig. 1.

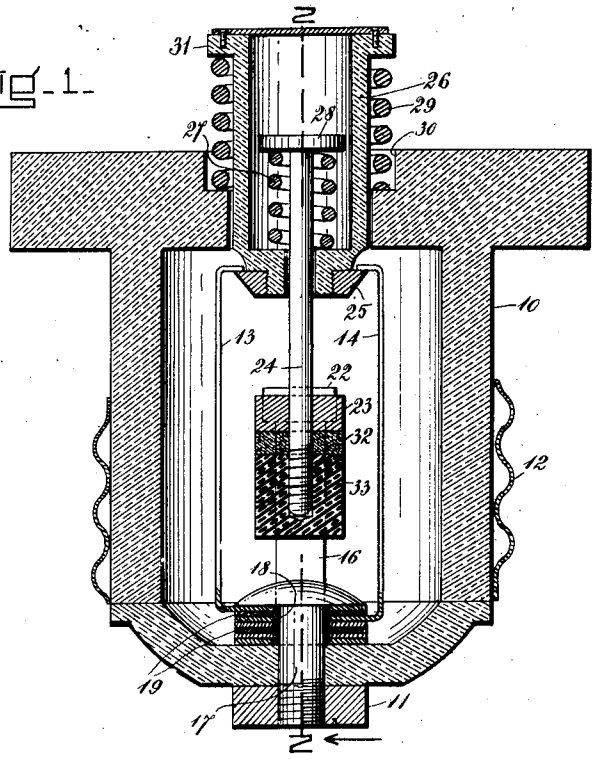
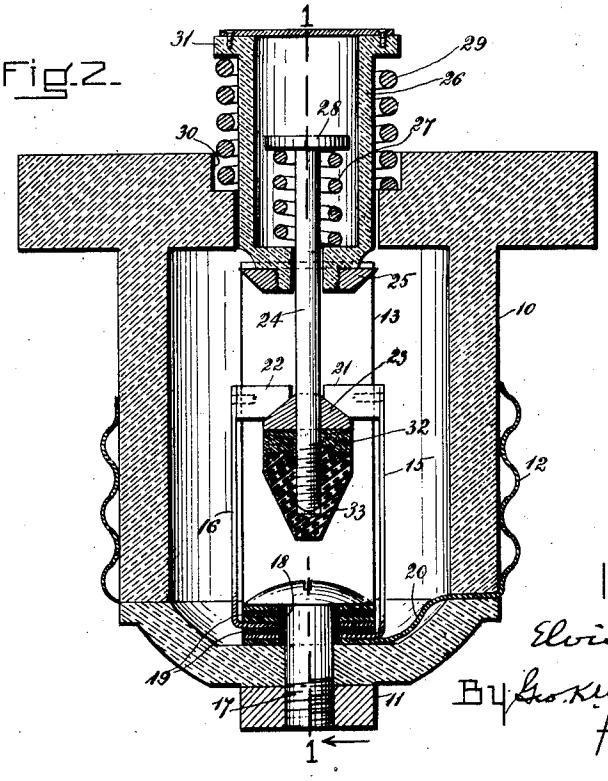


Fig. 2.



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CIRCUIT BREAKER

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8 Claims. (Cl. 200—116)

This invention relates to circuit breakers and more especially to circuit breakers of the fuse-plug type that may be used either to protect, or as a substitute for, fuses, although it will be understood that my invention is capable of general application to open circuit when overload occurs.

The object of my invention is to improve and simplify the construction and augment the efficiency of thermally-actuated circuit breakers in the manner hereinafter more fully set forth.

In the drawing which accompanies and forms a part of this specification—

Figure 1 is a central section of a circuit breaker embodying my invention taken on the line 1—1 of Fig. 2; and

Fig. 2 is a central section taken on the line 2—2 of Fig. 1.

In the particular drawing selected for more fully disclosing the principle underlying my invention and which is to be considered as illustrative merely and not as restrictive, 10 is a hollow plug of insulating material provided with external contacts, shown in the present instance as the end contact 11 and the threaded shell 12, whereby the plug may be screwed into the usual socket to connect the same to the circuit to be protected.

Enclosed within the shell are a pair of substantially parallel, oppositely-disposed conducting strips 13, 14 and a pair of substantially parallel strips 15, 16 of any suitable thermostatic material, the latter being arranged at right angles to the former and each consisting of a plurality of materials having different degrees of expansion under the same temperature.

In the present instance said strips are supported as follows: The end portion of each strip is bent at right angles to the vertical portion and perforated to receive the bolt 17, the upper portion of which is provided with an insulating sleeve 18. Insulating washers 19 are interposed between the perforated bent portion of said strips in such manner as to insulate strip 13 from strip 14 and to insulate the thermostatic strip 15 from the thermostatic strip 16. The strip 14 is in electrical contact with the thermostat strip 16 and the thermostat strip 15 is in electrical contact with a washer 20 which in turn is connected electrically to the threaded shell 12.

Contact members 21, 22 are connected to the upper ends of the thermostatic strips 15, 16, respectively, and engage a circuit-closing member 23, shown in the present instance as rigidly secured to the rod 24. Preferably each contact member has a bevelled face and the circuit-closing member has a surface bevelled reversely to the faces of said contact members. The upper ends of the strips 13, 14 are in engagement with the circuit-closing member 25 rigidly connected with the hollow push-plug 26. As shown in the present instance, the upper end portions of said strips 13, 14 are bent at right angles and engage the upper surface of the circuit-closing member 25.

By means of the spring 27 interposed between the head 28 of the rod 24 and the bottom of the hollow push-plug 26, the circuit-closing member 23 is maintained normally in electrical contact with the contact members 21, 22, and the spring 29 disposed in the socket 30 formed in the upper face of the plug and taking against the flange 31 of the hollow push-plug serves to maintain the circuit-closing member 25 normally in electrical contact with the end portions 26 of the conducting strips 13, 14.

It will thus be seen that normally the manually-operable switch comprising the conducting strips 13, 14, the thermally-controlled switch comprising the thermostatic elements 15, 16 and the external contacts of the plug are in series, and when the plug is screwed into a socket connected in the usual manner to a circuit, the latter will be closed through the circuit breaker as follows, viz, from the end contact 11 to the strip 13, thence to the circuit-closing member 25, strip 14, thermostatic strip 16, contact member 22, circuit-closing member 23, contact member 21, thermostatic strip 15, conductor 20 and thence to the other terminal of the circuit through the shell 12.

Immediately below the circuit-closing member 23 a body of non-arcing material 32, such as carbon, is attached to the rod 24 and below said carbon body a tapered plug 33 of insulating material is secured to said rod. In the present instance the non-arcing member is shown as a washer held in position by the insulating plug which may be threaded to said rod.

The operation is as follows: On overload the thermostatic strips become heated and bend outwardly permitting the spring 27 to raise the rod 24 and thereby draw the circuit-closing member out of co-operative position with respect to the contact members 21, 22, the insulating plug 23 now intervening between said contact members, with the result that as soon as the thermostatic strips become cooled and swing toward each other, they will rest against said insulating plug,

thereby maintaining the circuit open until the device is re-set.

I prefer to bevel the lower surfaces of the contact members 21, 22 and to give the upper face of the circuit closer 23 a corresponding bevel in the reverse direction to minimize the friction that would otherwise exist and make the circuit breaker more sensitive and reliable. The washer of carbon or other non-arcing material, although not essential, is highly desirable to minimize arcing when the circuit closer 23 is drawn out of electrical contact with the members 21, 22.

To re-set the circuit breaker the hollow push-plug is depressed, whereupon the manually-operable switch comprised of the strips 13, 14 and circuit closer 25 is opened and then the circuit-closer 23 is brought into electrical contact with the members 21, 22, the rod 24 being forced downwardly by the engagement of the head 28 thereof with the closure (preferably transparent) of the hollow push-plug 26 and, finally, as the hollow push-plug is released, the retrograde movement thereof effected by the spring 29 will close the manually-operable switch. If the overload or short-circuit difficulty has not been rectified, the thermostatic elements immediately will become heated again and the thermally-controlled switch, of which they form a part, will open the circuit. It will thus be seen that it will be impossible to maintain the circuit in closed condition by holding the push-rod 31 down.

When the thermally-controlled switch is open the contact members 21, 22 will be in engagement with the tapered end of the plug 33 and such taper, although not essential is desirable to minimize the friction that would otherwise exist between said contact members and insulating plug upon the downward movement of the rod 24.

Having thus disclosed an illustrative embodiment of my invention, without however limiting myself thereto, what I claim and desire to secure by Letters Patent is:

1. A circuit breaker comprising in combination a pair of oppositely-disposed thermostatic elements, means arranged for electrically connecting said elements in an electric circuit, contact members connected, respectively, to said thermostatic elements, each said contact member having a bevelled face, a movable circuit-closing member having a surface bevelled reversely to the bevelled faces of said contact members, resilient means holding said contact members and circuit-closing member in circuit-closing position with the bevelled surface of said circuit-closing member in electrical contact with the bevelled faces of said contact members, an insulating member connected for movement with said circuit-closing member and disposed to intervene between said contact members when said circuit-closing member is moved by said resilient means out of circuit-closing position and manually-actuated means for restoring said circuit-closing member to circuit-closing position.

2. A circuit breaker comprising in combination a housing having external contacts and enclosing a thermally-controlled switch said switch comprising bimetallic strips, each consisting of a plurality of materials having different degrees of expansion under the same temperature, a manually-operable switch means maintaining said manually-operable switch normally closed irrespective of the condition of said thermally-controlled switch, means electrically connecting said contacts and said switches, resilient means maintaining said thermally-controlled switch normally closed and a push-plug construction extending into said housing and disposed in a manner successively to open said manually-operable switch and close said thermally-controlled switch on inward movement, and on retrograde movement to close said manually-operable switch.

3. A circuit breaker comprising in combination a housing having external contacts and enclosing a thermally-controlled switch, a manually operable switch and means electrically connecting said contacts and switches, a hollow push-plug extending into said housing and carrying one member of said manually-operable switch, resilient means co-operating with said push-plug for maintaining said manually-operable switch closed, a rod carrying one member of said thermally-controlled switch, the outer end of said rod being disposed within said hollow push-plug, and resilient means co-operating with said rod for maintaining said thermally-controlled switch closed, said rod and hollow push-plug being disposed in a manner successively to open said manually-operable switch and close said thermally-controlled switch when moved together into said housing.

4. A circuit breaker comprising in combination a housing having external contacts and enclosing a thermally-controlled switch, said switch comprising a pair of oppositely-disposed thermostatic elements and each of said elements comprising a bimetallic strip formed of a plurality of materials having different degrees of expansion under the same temperature, contact members connected, respectively, to said thermostatic elements, a push-rod extending into said housing, a circuit-closing member carried by said push-rod and disposed for co-operation with said contact members, and an insulating member also carried by said push-rod and arranged to intervene between said contact members when said circuit-closing member is in circuit-opening position, the outer end of said insulating member being tapered to permit the passage thereof between said contact members on the inward movement of said push-rod.

5. A circuit breaker comprising in combination a housing having external contacts and enclosing a thermally-closed switch and a manually-operated switch electrically connected with said thermally-controlled switch and said contacts, said thermally-controlled switch comprising two oppositely-disposed substantially-parallel strips of thermostatic material and said manually-operated switch comprising two oppositely-disposed substantially-parallel strips of conducting material arranged in a plane substantially at right angles to the plane of said strips of thermostatic material, a circuit-closing member disposed to co-operate with said strips of thermostatic material, a circuit-closing member disposed to co-operate with said strips of conducting material, means for moving the last-mentioned circuit-closing member out of contact with said strips of conducting material, and means controlled by said means for moving the first-mentioned circuit-closing member into co-operation with said strips of thermostatic material.

6. A circuit breaker comprising in combination a manually-operable switch, a thermally-controlled switch, said thermally-controlled switch comprising bimetallic strips, each consisting of a plurality of materials having different degrees of expansion under the same temperature, means connecting said switches electrically, means

maintaining said manually-operable switch normally closed irrespective of the condition of said thermally-controlled switch, manually-actuated means for opening said manually-operable switch, and means controlled by said manually-actuated means for closing said thermally-controlled switch.

7. A circuit breaker comprising in combination a manually-operable switch, a thermally-controlled switch, said thermally-controlled switch comprising bimetallic strips each consisting of a plurality of materials having different degrees of expansion under the same temperature, means connecting said switches electrically, means maintaining said manually-operable switch normally closed irrespective of the condition of said thermally-controlled switch, manually-actuated means for controlling the opening of said manually-operable switch, and means controlled by said manually-actuated means for closing said thermally-controlled switch.

8. A circuit breaker comprising in combination a pair of oppositely-disposed thermostatic elements, means arranged for connecting said elements in an electric circuit, contact members connected, respectively, to said thermostatic elements, a movable circuit-closing member, resilient means holding said contact members and circuit-closing member in circuit-closing position, and manually-actuated means for restoring said circuit-closing member to circuit-closing position.

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