Nov. 27, 1928. 1,693,404

M. J. SANDIN

THERMAL CUT-OUT

Filed Jan. 23, 1923

Fig. 1.

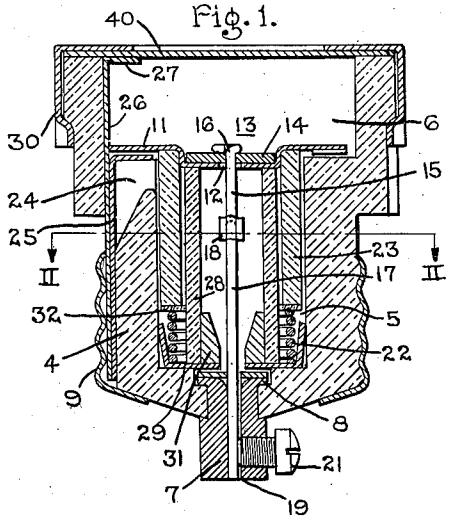


Fig. 2.

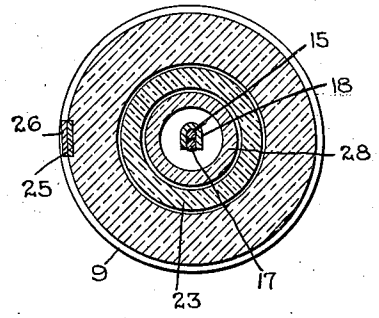
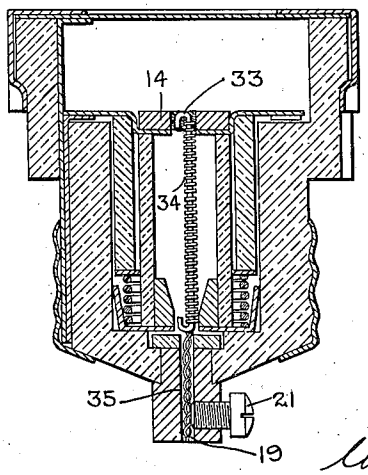


Fig. 3.



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UNITED STATES PATENT OFFICE.

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THERMAL CUT-OUT.

Application filed January 23, 1923. Serial No. 614,381.

My invention relates to thermal cutouts and particularly to cutouts of the screw-plug type for interrupting circuits under overload and short-circuit conditions.

In my co-pending application Serial No. 614,379, filed January 23, 1923, I have disclosed a cutout of the plug type wherein an insulating receptacle is provided with a threaded terminal that is adapted to be inserted in a standard fuse screw socket or receptacle. A thermal-responsive cutout refill connects the terminals of the cutout and is adapted to cause interruption of the circuit under overload and short-circuit conditions. The cutout described in the above copending application is adapted for operation in circuits having a capacity approximately above five amperes, depending upon the size of the heating conductor of the thermal-responsive refill.

It is an object of my invention to provide a thermal cutout similar in general characteristics to the device shown in the above copending application, but which is adapted for use in circuits operating on smaller currents such as from a fraction of an ampere to five amperes or the minimum range of the cutout device referred to above.

It has been found that the heat-conducting characteristics of a device constructed in accordance with the disclosure in the above copending application are such that, in order to cause sufficient heating to interrupt the circuit under small current conditions, such, for instance, as a current of one ampere, the cross-sectional area of the heating conductor required would be so small that the refill would be impractical for commercial purposes.

Another object of my invention is to provide a thermal-responsive cutout having such heating characteristics that a heating conductor of practicable dimensions may be employed which will cause the interruption of the circuit on relatively low-current conditions.

Another object of my invention is to provide a thermal-responsive cutout device, having the above characteristics, wherein the refill is of simple and rugged construction suitable for commercial use and wherein the refill is of such character that it may be used in a cutout casing such as may be used for refills having greater capacity.

These and other objects, that will be made apparent throughout the further description of my invention, are attained by means of the apparatus hereinafter described, and illustrated in the accompanying drawings, wherein:

Figure 1 is a vertical section through a cutout embodying my invention;

Fig. 2 is a transverse section through the cutout device taken on the line II—II of Fig. 1, and

Fig. 3 is a vertical section through a cutout device, showing a modified form of thermal-responsive refill.

Referring to the drawings, the cutout device includes an insulating casing or tubular receptacle 4 closed at one end and having bores 5 and 6 extending longitudinally thereof, the latter being of greater diameter than the former. A tubular terminal member 7 is mounted in the closed end of the receptacle or casing 4 and is retained therein by a flange 8 that is spun into contact with the inner surface of the end wall of the casing.

A threaded terminal 9 is mounted on the outer surface of the casing 4 which is adapted to fit within a standard threaded socket or receptacle (not shown). A terminal disc 11 is mounted within the bore 6 of the casing and is provided with a perforation 12 through which the heating conductor of a thermal-responsive refill 13 is inserted, the refill serving to connect the terminal 11 with the tubular terminal 7. The refill comprises a contact disc 14 to which a heating conductor 15 made of high-resistance metal is attached by means of an enlarged head 16 on the conductor 15, which is secured to the contact disc 14 by means of solder or by any preferred means.

A heating conductor 17, similar to the conductor 15, is releasably connected to the free end of the conductor 15 by a readily fusible metal that is soldered to the adjacent ends of the conductors and a metal container 18 that is of U-shape, as indicated in Fig. 2, and which serves to support the solder during the assembly operation of the parts constituting the refill. The heating conductor 17 is adapted to extend into a bore 19 in the terminal 7, as indicated in Fig. 1, and is clamped therein by means of a set screw 21.

The terminal disc 11 is normally biased toward the open end of the casing and away from the terminal 7 by means of a helical spring 22 that is disposed between the closed end of the casing and the inner end of an insulating barrier tube 23 that fits within the

bore 5 of the casing and prevents the escape of arc gases, incident to the separation of the heating conductors, through the opening 24 in the casing through which a flexible conductor 25, that connects the terminal 9 to the conductor disc 11, extends. An extension 26, having an inwardly-directed flange 27, serves to limit the outward movement of the disc 11.

The helical spring 22 is protected from arc gases by means of an inner insulating tube 28 that is mounted on a spring-supporting disc 29 and which is retained in central position by a sleeve 31 that is attached to the disc 29. An insulating washer 32, that fits within the bore 5 and surrounds the barrier tube 28, serves to seal the joint between the barriers 28 and 23 and protect the spring 22 from arc gases, regardless of the relative operative positions of the barrier tubes.

The construction of the casing and the terminal disc 11 and the barriers just described is similar to the construction shown in the above copending application, the only difference being in the form of refill. The open end of the casing is closed by a detachable cap 30 having a transparent mica window 40 through which it renders the refill visible.

In operation, the current flows through the heating conductors 15 and 17. The soldered joint connecting the heating conductors is isolated from the terminal disc 11 and from the terminal tube 7 and, consequently, the joint is located at the hottest point in the heating conductor constituted by the conductors 15 and 17 and will be substantially unaffected by the heat-radiating characteristics of the terminal disc 11. For this reason, a relatively thick heating conductor may be employed that will cause fusion of the soldered joint under relatively low-current conditions, in fact, the circuit may be interrupted by a device constructed as herein described when subjected to currents of less than one ampere.

If a heating conductor constituting a thermal-responsive refill were soldered directly to the contact disc 14, as in the manner disclosed in my copending application, the cross-sectional area thereof would of necessity be so small, in order to produce sufficient heat to overcome the heat-conducting effect of the terminal disc, that the wire would be impractical and would be of insufficient strength to meet the requirements of shipping and handling in commercial use. By providing a heating conductor on both sides of the soldered joint, the cooling effects of heat conduction on the soldered joint are reduced to a minimum and, consequently, less energy is required to cause the interruption of a circuit and, therefore, the refill operates with greater efficiency.

In Fig. 3, I have shown a cutout mechanism similar to that illustrated in Fig. 1, except that a modified form of refill is shown, wherein a relatively rigid supporting wire 33 is soldered to the contact disc 14 and serves to support a relatively fine heating wire 34 that is wound about the supporting wire 33.

Under low-current conditions, the wire 34, which is of relatively great length and insulated from the supporting wire, causes rapid heating of the supporting wire 33 and subsequent fusion of the binding metal or solder joint which joins the wire to the disc 14. By reason of the supporting wire, a fine heating conductor may be employed and, as indicated, the end of the heating wire is doubled or twisted to constitute a terminal portion 35 that is adapted to be inserted within the bore 19 of the terminal tube 7 where it is retained by a set screw 21.

The refill illustrated in Fig. 3 is also suitable for interrupting circuits operating under relatively low-current conditions. When the disc 14 is separated from the supporting wire 33, the spring 22 moves the terminal disc 11 away from the supporting wire and causes interruption of the circuit.

While I have illustrated and described but two embodiments of my invention it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims

I claim as my invention:

1. A cutout for electric circuits comprising a pair of relatively movable terminal members, biasing means tending to move said members apart, a casing for enclosing the terminal members and a composite renewable thermal-responsive element for conductively connecting the members and for releasably opposing said biasing means comprising a pair of heating conductors connected respectively to the terminal members and having their free ends releasably soldered to one another by a metal fusible at a relatively low temperature.

2. In a cutout for electric circuits, the combination with a pair of relatively movable terminal members one of which is adapted to be biased for separating movement, of a composite renewable thermal-responsive element comprising a pair of heating conductors connected respectively to the terminals and having their free ends releasably connected by a fusible link soldered to the conductors.

3. A thermal-responsive refill for a circuit cutout comprising a pair of heating conductors joined by a link consisting of a metal supporting member containing fusible metal that is soldered to the supporting member and to the conductors.

4. A thermal-responsive refill for a circuit cutout comprising a pair of heating conductors having overlapped ends joined by a link consisting of a metal supporting mem-

ber containing fusible metal that is soldered to the supporting member and to the conductors.

5. A thermal-responsive refill for a circuit cutout comprising a pair of heating conductors joined by a link consisting of a metal supporting member of U-shape surrounding the adjacent ends of the conductors and containing fusible metal that is soldered to the conductors and to the supporting member.

In testimony whereof, I have hereunto subscribed my name this 9th day of January, 1923.

MAURITS J. SANDIN.