Dec. 3, 1940. M. B. WOOD 2,224,111

FUSIBLE PROTECTIVE DEVICE

Filed July 14, 1938

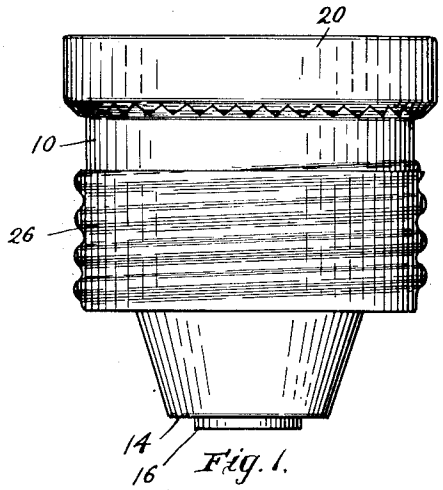


Fig. 1.

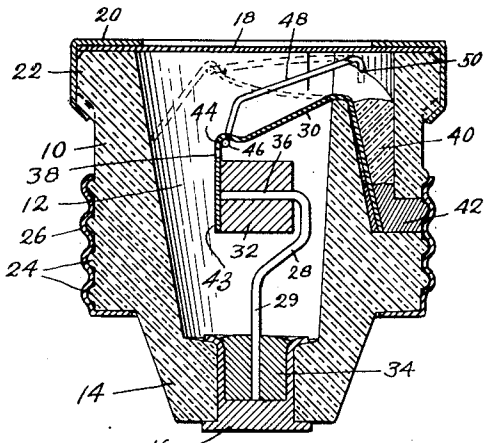


Fig. 3

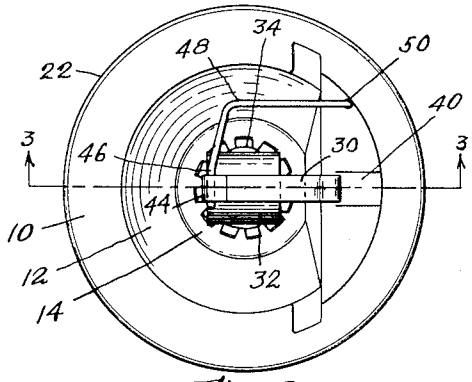


Fig. 2.

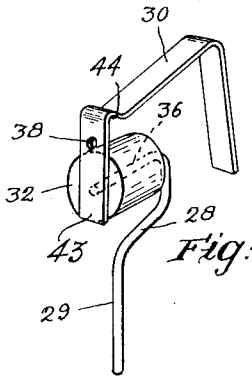


Fig. 4.

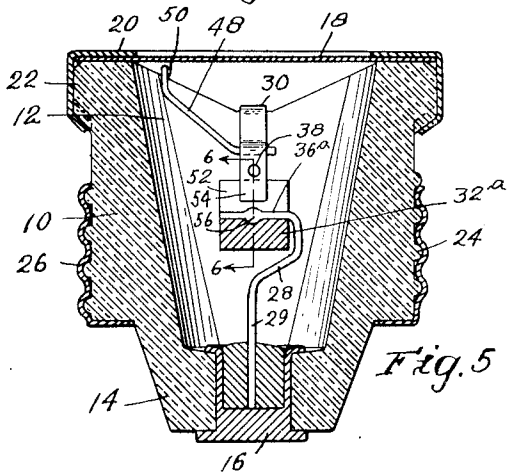


Fig. 5

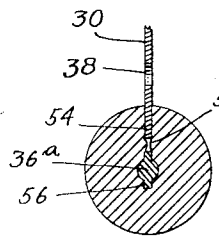


Fig. 6.

Inventor:
Morris B. Wood
by
T. T. Drummond
Atty

Patented Dec. 3, 1940

2,224,111

UNITED STATES PATENT OFFICE

2,224,111

FUSIBLE PROTECTIVE DEVICE

Morris B. Wood, Newbury, Mass., assignor to The Chase-Shawmut Company, Newburyport, Mass., a corporation of Massachusetts

Application July 14, 1938, Serial No. 219,224

24 Claims. (Cl. 200—123)

This invention relates to thermal cut-outs or fusible protective devices characterized by employing a low melting temperature mass of metal, and means for melting the mass to effect the release of a movable circuit interrupting member and the consequent interruption of the circuit.

The primary object of the present invention is the provision of a simple reliable device of the type set forth that is capable of being radially and economically manufactured in quantities and under conditions that provide for substantially identical performance of devices intended to have the same ratings.

Fig. 1 is a side elevation of a fusible protective device embodying the present invention.

Fig. 2 is a plan view of Fig. 1 with the end cap removed.

Fig. 3 is an enlarged section taken along line 3—3 of Fig. 2.

Fig. 4 is a perspective view of the circuit conducting elements of the device of Fig. 3.

Fig. 5 is a sectional view similar to but at right angles to Fig. 3 illustrating a modified form of the current conducting elements.

Fig. 6 is a sectional detail taken along line 6—6 of Fig. 5.

The fusible protective device embodying the present invention and chosen for purposes of illustration is of the plug fuse type and includes a cylindrical body 10 of insulating material, as porcelain, having an internal chamber 12 open at the top and closed by the bottom wall 14 through which a tubular center contact member 16 of a more or less common type is extended. The open upper end of the chamber is closed by a transparent closure disc 18, usually mica, retained in place by a metal end cap 20 the side wall of which is crimped over the outstanding flange 22 of the plug body. The plug body is provided with external screw threads 24 on which an internally and externally screw-threaded metal terminal shell 26 is threaded.

The construction of the plug body and the terminals is not herein of particular importance, except as noted in the claims, as the invention resides more specifically in the current conducting elements disposed within the plug body.

The current conducting elements include a supporting rod 28, a movable conductor 30, and a mass 32 of low melting temperature metal. The supporting rod 28 comprises a length of wire or ribbon preferably sufficiently stiff to be self-supporting and to support the parts attached thereto in the position illustrated. The lower part or shank 29 of the wire or rod is straight and is retained within the inner tubular end of the center contact 16 by a mass of high melting point solder 34. The upper end of the rod has a horizontally reflexed end portion 36 providing a hook on which the readily fusible metal mass 32 is disposed. The metal mass 32 preferably is cylindrical and has a central bore into which the hook 36 is pressed but is otherwise free, that is to say, it is not retained in any retaining cup or the like supporting means.

The conductor 30 is flexible and preferably is a copper strip forming a heater for the fusible mass and also a fuse link and is provided with a most readily fusible portion by a perforation 38 or the equivalent. The outer end of the fuse link is located in a vertical channel in the side wall of the plug body filled with cement 40 and electrically and mechanically connected to the screw shell 26 by a mass of high melting temperature solder 42. The fuse link extends crosswise of the plug chamber 12 and downwardly and its inner end 43 is bent substantially vertically downward and is abutted against the end of the fusible mass 32 and is attached to the mass by applying a hot iron to the link thereby melting the metal in the end face of the fusible mass and causing it to be bonded to the link.

The fusible link above the perforation 38 is provided with a transverse channel 44 in its under face in which the horizontal end 46 of a wire spring 48 is located, the other end of the spring being located in a socket 50 formed in the upper end of the plug body. The spring is arranged to exert an upward tension on the link and to move the link in a circuit opening direction into some position as illustrated by the dotted lines Fig. 3 remote from the fusible mass when the bond between the link and the fusible mass is sufficiently loosened, thereby interrupting the circuit through the device. When the link itself fuses at the perforations 38 by reason of an abnormally high current the spring 48 moves the link into the same position thereby enlarging the circuit interrupting gap.

The fusible metal 32 is sufficiently big in diameter and long to absorb a substantial amount of heat so that the device can be traversed by a moderate overload for a substantial period of time before the heat developed in the link and accumulated in the fusible mass raises the temperature sufficiently high to loosen the bond between the link and the mass and effect the interruption of the circuit. When, however, the device is traversed by a heavy overload on short circuit current the fuse link is adapted to blow

and interrupt the circuit before the fusible metal can fuse and effect the opening of the circuit.

The fusible link **30** constitutes the heater for the fusible mass and the mass ordinarily fuses on the end face thereof at the junction between the mass and the fuse link. The rod **28** constitutes a thermal resistor to prevent undesirable loss of heat from the fusible mass to the center contact as conditions governing the loss of heat from the center contact in different sockets in which the device might be screwed is out of the control of the manufacturer of the interrupting device.

The rod **28** can be made of any suitable material that will provide a desirable temperature difference between its ends. A steel alloy wire is very satisfactory not only because it has considerable thermal resistance but also because it is stiff. A copper wire also can be used. The length and cross section of the rod will, of course, be adjusted to provide the desired thermal drop for the metal employed. The hook formation of the wire is desirable in that it permits a relatively long length of wire to be used so that the thermal drop between its ends is substantial and small manufacturing variations, such as variations in the height of solder **34** on the rod **28**, do not materially influence the calibration of the device. The hook formation together with the inclination of the fuse link keeps the fusible mass on the wire regardless of the position of the device when it is installed in a socket although the fusible mass becomes soldered to the end of the hook in the act of fusing the mass to the fuse link.

In the modification illustrated in Figs. 5 and 6, the fuse link and the supporting rod instead of being fused to the fusible mass is crimped thereto or is compressed thereon. In this instance the mass **32***a* has a slot **52** in which the end part **36***a* of the support and the end part **54** of the fusible link are located after which the fusible mass is pressed into firm mechanical holding pressure with the link and hook. The hook can have a flattened part **56** the more securely to retain the fusible mass thereon. The end of the link can be similarly arranged although this is not essential.

In operation on low overloads the fusible mass fuses at its region of contact with the link so that the spring can pull the link end out of the mass and upwardly into a circuit interrupted position in the manner heretofore explained.

I claim:

1. In a fusible protective device, a conductive element comprising a rigid thermally-resistive conductor anchored at one end, a free readily fusible pre-formed mass on and enclosing and supported directly by the other end of said conductor, a flexible heating conductor attached to said readily-fusible mass and releasable therefrom upon the fusing of said mass, and means responsive to the fusing of said mass to flex said flexible heating conductor away from said mass.

2. In a fusible protective device, a fusible mass, a stationary support constituting a thermal resistor carrying said mass at one end, a mass-heating conductor bonded to said mass, and means for separating said mass and heating conductor upon release of the bond therebetween.

3. In a fusible circuit interrupter, a rigid supporting hook, a pre-formed fusible mass supported by said hook, a conductor releasably attached to said fusible mass, and means responsive to the release of said attachment due to the fusing of said mass to remove said conductor therefrom.

4. In a fusible conductor, a fusible mass, a supporting rod having one end embedded in and thereby directly supporting said fusible mass, a heating conductor attached to said fusible mass and releasable therefrom upon the fusing of said mass, and means responsive to the fusing of said mass for separating said conductor and said fusible mass.

5. In a fusible circuit interrupter, a body containing a chamber, a rigid support extended longitudinally of said chamber and having a part extended transversely thereof, a fusible mass on said transverse part and supported directly thereby, a heating conductor adherent to said fusible mass and releasable therefrom upon the fusing of said mass, and means for separating said conductor and mass upon the fusing of said mass.

6. In a fusible circuit interrupter, a body containing a chamber, a rigid support extended longitudinally of said chamber having an end part extended transversely of said chamber, a tubular fusible mass threaded on said transverse part, a heating conductor adherent to said tubular fusible mass and releasable therefrom upon the fusing thereof, and means responsive to the fusing of said mass for separating said conductor and fusible mass and interrupting the circuit through the interrupter.

7. In a fusible circuit interrupter, a body containing a chamber, a support extended longitudinally of said chamber having an end part extended transversely of said chamber, a tubular fusible mass on said transverse end part and supported directly thereby, a conductor fused to an end face of said tubular mass, and means responsive to the fusing of said mass for separating said conductor and mass.

8. In a fusible circuit interrupter, a supporting rod, a tubular fusible mass on the end of said rod having one end face substantially flush with the end of said rod, a conductor on said end face, said mass being fused to said conductor and to the end of said rod, and means for separating said conductor and mass upon the fusing of the latter.

9. In a fusible circuit interrupter, a rigid supporting rod anchored at one end and having a hook at its other end, a fusible mass threaded on said hook, a heating conductor attached to said mass and releasable therefrom upon the fusing thereof, and means responsive to the fusing of said mass for separating said mass and said conductor.

10. In a fusible protective device, a conductor having a hook end, a fusible mass supported by said hook end, a second conductor adherent to said mass, and separate spring means exerting separating tension between said conductors and fusible mass.

11. In a fusible circuit interrupter, a body containing a chamber, a contact member on the end of said body, a supporting rod having one end part fixed to and supported rigidly by said contact member and extended longitudinally of said chamber and having a reflexed free end part disposed crosswise of said chamber, a fusible mass supported by said reflexed end part, a conductor attached to said fusible mass and releasable therefrom upon the fusing thereof, and means connected to said body and to said conductor responsive to the fusing of said mass for separating said conductor and mass.

12. In a fusible circuit interrupter, a body containing a chamber, a contact member on the end of said body, a supporting rod having one

end part fixed to said contact member and extended longitudinally of said chamber and having a reflexed free end part disposed crosswise of said chamber, a tubular fusible mass on said free end, a conductor fixed to the end face of said fusible mass, and means responsive to the fusing of said mass for separating said mass and conductor.

13. In a fusible circuit interrupter, a supporting rod, a rigid anchorage for one end of said rod, a pre-formed fusible mass on and enclosing and engaging the other end of said rod, a conductor attached to said fusible mass and releasable therefrom upon the fusing thereof, and separate conductor tensioning means.

14. In a fusible circuit interrupter, a chambered enclosing body having center and annular contacts, a supporting rod carried by and extended upwardly in said chamber above said center contact, said rod having a hook at its free end which is disposed crosswise of said chamber, a pre-formed fusible mass on and surrounding said hook, a conductor attached to said fusible mass and releasable therefrom upon the fusing thereof, and means responsive to the fusing of said mass for separating said mass and conductor.

15. In a fusible circuit interrupter, a chambered enclosing body having center and annular contacts, a supporting rod carried by and extended upwardly in said chamber above said center contact, said rod having a hook at its free end which is disposed crosswise of said chamber, a pre-formed fusible mass on and surrounding said hook, a conductor fused to said fusible mass, and conductor-tensioning means responsive to the fusing of said mass for separating said conductor and mass.

16. In a fusible circuit interrupter, a support, a conductor, a fusible mass carried by said support and crimped about said conductor, and conductor tensioning means independent of the conductor operative to interrupt the circuit through the interrupter in response to the fusing of said mass.

17. In a fusible circuit interrupter, a support, a fusible mass crimped about said support, a fusible conductor attached to said fusible mass and releasable therefrom upon the fusing thereof, and means responsive to the fusing of said mass for separating said conductor and mass.

18. In a fusible circuit interrupter, a support, a conductor, a fusible mass crimped about and onto said support and conductor, and means for separating said conductor and mass in response to the fusing of the latter.

19. In a fusible circuit interrupter, a body containing a chamber, a support having a fusible mass located in said chamber and having a face spaced from a side of said chamber, a conductor fused to that face of said fusible mass, and spring means disposed above said mass for moving said conductor away from said fusible mass in the space between said mass and wall of said chamber and crosswise of said chamber in response to the fusing of said mass.

20. In a fusible circuit interrupter, a supporting member having rigid anchoring means for one end and free at the other end and composed of a thermal resistance material, a fusible metal mass on and supported by the free end of said supporting member, and a heating conductor attached to said fusible mass and releasable therefrom upon the heating of said conductor and the fusing of said mass, and means for separating said heating conductor and mass upon the fusing of the latter.

21. In a fusible circuit interrupter, a relatively thermally insulated fusible mass, a heating conductor attached to said fusible mass and releasable therefrom upon the fusing of said mass, and means responsive to the fusing of said mass for separating said mass and heating conductor.

22. In a fusible circuit interrupter, a fusible mass, supporting means therefor characterized by opposing conduction of heat therethrough from said mass, a heating conductor attached to said fusible mass and releasable therefrom upon the fusing of the latter, and means responsive to the fusing of said mass for separating said mass and heating conductor.

23. In a fusible protective device, terminals, a fusible mass, a thermally resistive electrically conducting support for said mass and one terminal, a heating conductor connected to said other terminal and attached to said fusible mass and releasable therefrom upon the fusing of said mass, and means for separating said heating conductor and mass upon the fusing of the latter.

24. In a fusible circuit interrupter, a fusible mass, a terminal, a support carrying said mass at one end and connected at its other end to said terminal and composed of thermally resistive material and being relatively long between said mass and terminal to oppose conduction of heat from said mass to said terminal, a second terminal, a heating conductor connected to said second terminal and attached to said fusible mass and releasable therefrom upon the fusing of the latter, and means responsive to the fusing of said mass for separating said mass and heating conductor.

MORRIS B. WOOD.