June 16, 1942. E. H. TAYLOR 2,286,518

FUSIBLE PROTECTIVE DEVICE

Filed Feb. 13, 1940

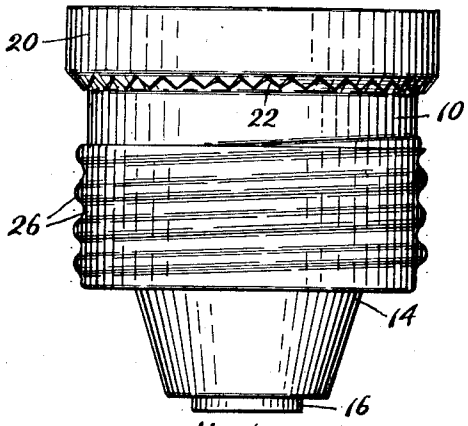


Fig. 1.

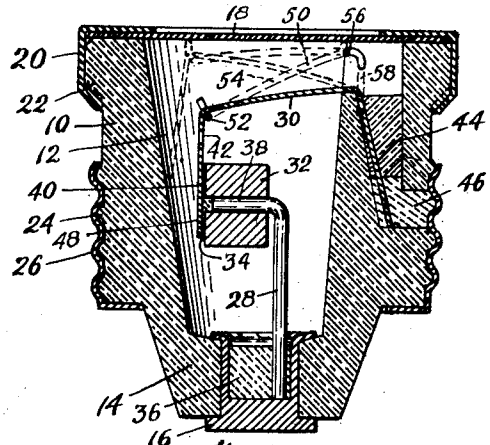


Fig. 3.

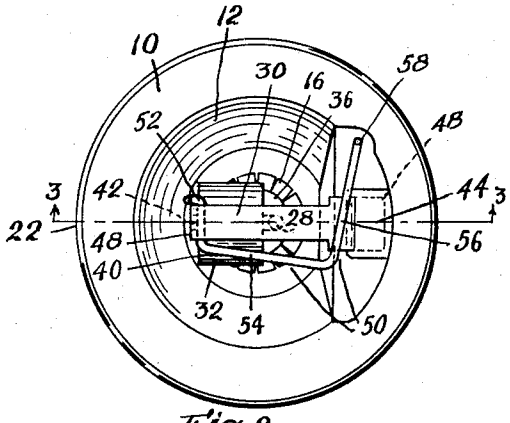


Fig. 2.

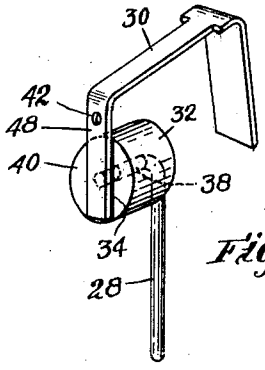


Fig. 4.

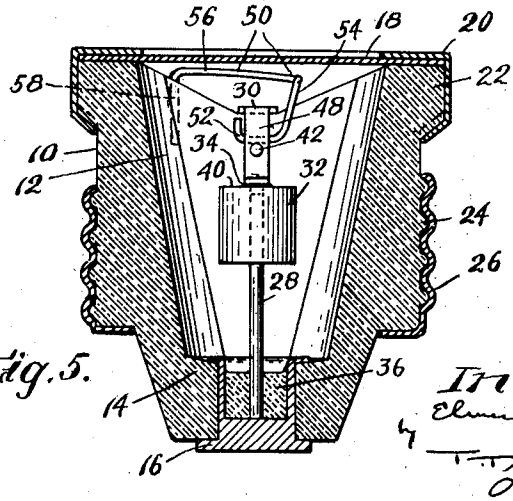


Fig. 5.

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UNITED STATES PATENT OFFICE

2,286,518

FUSIBLE PROTECTIVE DEVICE

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Application February 13, 1940, Serial No. 318,697

7 Claims. (Cl. 200—123)

This invention relates to thermal cut-outs or fusible protective devices, characterized by the use of a low melting temperature metal for releasably connecting together the current conducting elements of the device, said current conducting elements including means for melting the metal to effect the release of one of the conducting elements from the others to interrupt the circuit.

One of the objects of the present invention is to provide a simple effective device of the type above set forth which is capable of being readily and economically manufactured in quantities and under conditions which provide for substantially identical performance of devices intended to have the same ratings.

Another object of the invention is to provide an improved thermal cut-out or fusible protective device wherein a fusible conductor is electrically and mechanically connected to a heat absorbing block of electrical conducting material by a readily fusible mass in such a manner that the time lag characteristics of these devices will have substantially identical ratings.

A further object of the invention is the provision of a fusible protective device of the type above set forth wherein but a small amount of readily fusible material is required and wherein the desired time lag of operation is provided by a suitable heat absorbent block carrying the fusible material and interposed between the heating conductor and the movable conductor.

A still further object of the invention is generally to improve the construction and operation of thermal cut-outs or fusible protective devices.

With the above and other objects and features in view, the invention will now be described with reference to the accompanying drawing in which:

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

Fig. 2 is a plan view of the construction shown in Fig. 1 with the end cap removed;

Fig. 3 is a view in section taken along the line 3—3 of Fig. 2;

Fig. 4 is a perspective view of the circuit conducting elements of the device illustrated in Fig. 3; and

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

The fusible protective device embodying the present invention, chosen for purposes of illustration, is of the plug fuse type and includes a cylindrical body 10 of insulating material, such as porcelain, having an internal chamber 12 open at the top and closed by a bottom wall 14 through which a tubular center contact member 16 of a more or less common type is extended. The upper end of the chamber is closed by a transparent closure disc 18, usually formed of mica, and which is retained in place by a metal end cap 20 the side wall of which is crimped over an outwardly projecting flange 22 of the plug body 10.

The plug body is also 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 of particular importance herein except as set forth in the claims since 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, a mass 32 of heat absorbing metal, and a mass 34 of low melting temperature metal for connecting together the mass 32 of heat absorbent metal and one end of the flexible or movable conductor 30. The supporting rod 28 is formed of a length of wire or ribbon which preferably is sufficiently stiff to be self-supporting and to support the parts attached thereto in the position illustrated. The supporting rod 28 is formed of relatively high resistance material which is adapted to become sufficiently heated when traversed by currents of sufficient magnitude to effect the operation of the device. The lower part of the supporting rod 28 is straight and is retained within the inner tubular end of the center contact 16 by a mass of high melting temperature solder 36. The upper end of the rod has a horizontally bent end portion 38 which forms a hook on which the mass of heat absorbent metal 32 is secured. The mass 32 of heat absorbent material preferably is formed of copper and is cylindrical and has a central bore in which the horizontally bent portion or hook 38 of the rod 28 is secured. The heat absorbent mass 32 and the portion 38 of the rod 28 may be secured together in any suitable manner to provide a good mechanical and electrical connection between the rod 28 and the mass 32. Preferably, these parts are secured together by means of low melting temperature solder, such as the mass 32, and when the low melting temperature solder is applied to the face 40 of the block 32 some of the low temperature solder passes into the opening or bore, and upon

hardening mechanically secures the bent end portion 38 within the bore in the block 32. The block and conductor 28 can, however, be otherwise fixed together as by the block being a pressure fit on the conductor.

The conductor 30 is flexible and preferably is a copper strip which operates also as a fuse link and is provided with a most readily fusible portion by a perforation 42 or the equivalent. The fusible link or conductor 30 is so constructed that it has a relatively low resistance and, consequently, has a minimum heating effect. The outer end of the fuse link is located in a vertical channel in the side wall of the plug body which is filled with cement 44 and electrically and mechanically connected to the screw shell 26 by a mass of high melting temperature solder 46. The fuse link extends crosswise of the plug chamber 12 and downwardly and at its inner end part 48 is bent substantially vertically downwardly and is abutted against the end 49 of the heat absorbent copper block 32 which is coated with the mass of low melting temperature solder 34. The end 48 is attached to the mass by applying a hot iron to the link which thereby melts the metal and causes it to be bonded to the link. With this arrangement there is but a film of solder between the fuse link and the lag block 32.

The perforation 42 of the fusible link 30 is located preferably in the vertical section 48 of the link. A wire spring member 50 underlies the fuse link 30 at the opening or perforation 42 and operates to tension the entire fuse link 30. The spring 50 is provided with a hooked end portion 52 which underlies the link 30, an upwardly inclined portion 54, a substantially horizontal portion 56, and a downwardly extending portion 58 which enters into a hole formed in the upper end of the plug body. The spring 50 is arranged to exert an upward tension on the link and to move the link in a circuit opening direction into a position such as illustrated by dotted lines in Fig. 3 so that the lower end of the link is remote from the heat absorbent block 32 when the bond between the block and the lower end of the link is sufficiently loosened, thereby interrupting the circuit through the device. When the link itself fuses at the perforation 42 in response to an abnormally high current, the spring 50 will move the substantially horizontal portion of the link into substantially the same position, thereby enlarging the circuit interrupting gap.

The mass 32, which is preferably formed of copper, is sufficiently great in diameter and of such length that a substantial amount of heat will be absorbed so that the device can be traversed by a moderate overload for a substantial period of time before the heat developed in the resistance rod 28 and accumulated in the heat absorbing mass 32 raises the temperature sufficiently to fuse or melt the layer or coating of low temperature melting solder 34 on the face of the block 32 sufficiently high to permit the spring 50 to move the lower end of the fuse link 30 out of electrical engagement with the block 32 to interrupt the current. When, however, the device is traversed by a heavy overload, approximating a short-circuit current in value, the fuse link is adapted to blow and interrupt the circuit before the fusible metal 34 can fuse and effect the opening of the circuit.

The supporting rod 28 constitutes the heater for the device. It is to be noted that the substantially straight vertical portion of the heater or resistance rod 28 becomes heated to a relatively high temperature when traversed by moderate overload currents which are continued for a relatively long period of time. The bent end 38 does not develop any substantial amount of heat since the greater portion of this bent portion 38 is shunted by the block 32. The bent portion 38, however, does conduct the heat developed or generated in the substantially vertical portion of the rod 28. Thus the temperature of the block 32 is increased mainly by conduction through the portion 38 of the rod 28, although it is apparent that some heat may be transmitted to the block from the rod 28 by convection and radiation. Thus, heat is transmitted to the block at a point remote from the face 49 which, consequently, does not become heated sufficiently to fuse the soft solder 34 until the temperature of the entire block has been raised to a relatively high degree. Thus, by this particular construction, a maximum amount of time lag on moderate overload currents is assured.

In the modification illustrated in Fig. 5, the supporting rod 28 is straight instead of being bent at its upper end, as illustrated in the other figures. Thus the cylindrical heat absorbing block 32 is vertically disposed or positioned and its upper end face is coated with a low temperature melting solder for releasably securing the bent lower end of the fuse link 32. This construction operates in precisely the same manner as the modification illustrated in Figs. 1 through 4, inclusive, and is particularly adapted for use in interrupting currents of relatively low value.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a fusible protective device, a rigid metal heating conductor of relatively small mass anchored at one end, a relatively large heat absorbent mass electrically and mechanically connected to the other end of said heating conductor and carried by said end, a flexible conductor, a relatively small mass of readily fusible metal electrically connecting one end of said flexible conductor to said heat absorbent mass, and means responsive to the fusing of said readily fusible metal to move said flexible conductor away from said heat absorbent mass, said heat absorbent mass being large as compared with the mass of said readily fusible metal to delay the fusing of the latter.

2. In a fusible protective device, a heating conductor anchored at one end, a heat absorbent mass of relatively infusible metal electrically and mechanically connected to the other end of said heating conductor and supported thereby, a flexible conductor, a relatively readily fusible metal electrically connecting one end of said flexible conductor to said heat absorbent mass at a point remote from said heating conductor, and means responsive to the fusing of said readily fusible metal to move said flexible conductor away from said heat absorbent mass, said heat absorbent mass being large as compared with the mass of said readily fusible metal to delay the fusing of the latter.

3. In a fusible protective device, a rigid conductor comprising a heating element anchored at one end, a heat absorbent mass of electrical conducting material fixed to the other end of said conductor, a flexible conductor arranged to fuse when traversed by currents in excess of a predetermined value, a readily fusible mass electrically connecting one end of said flexible con-

ductor to said heat absorbent mass at a point remote from said heating conductor, and means responsive to the fusing of said readily fusible mass to move said flexible conductor away from said heat absorbent mass.

4. In a fusible protective device, a body having a chamber therein, a rigid support extended longitudinally of said chamber and having a part extending transversely thereof, a mass of heat absorbent material directly supported on said transverse part arranged to be heated by said support, a flexible conductor, a readily fusible mass on the end face of said heat absorbent mass remote from said support for electrically connecting the heat absorbent mass to one end of said flexible conductor, and means for separating said conductor and said heat absorbent mass upon fusing of the readily fusible mass.

5. In a fusible circuit interrupter, a rigid supporting rod anchored at one end and having a hook at its other end, said supporting rod being formed of resistance material, a cylindrical plug formed of infusible electrical conducting material threaded on said hook, a flexible conductor, a mass of readily fusible material for electrically connecting the heat absorbent mass to one end of said flexible conductor and arranged to release said flexible conductor from said mass of heat absorbent material upon the fusing thereof, and means responsive to the fusing of said readily fusible mass for separating said heat absorbent mass and said flexible conductor.

6. In a fusible circuit interrupter having a chamber therein, a contact member on the end of said body, a supporting rod formed of resistance material having one end part fixed to said contact member and extended longitudinally of said chamber and having a bent free end part disposed crosswise of said chamber, a member formed of infusible electrical conducting material threaded on said bent free end and supported thereby, a flexible conductor fixed to an outer face of said heat absorbent mass remote from the supporting rod, a thin section of readily fusible electrical conducting metal interposed between and releasably fixing the conductor to said outer face, and means responsive to the fusing of said readily fusible means for separating said heat absorbent mass and said conductor, the mass of the heat absorbent member being large relative to the mass of the readily fusible metal.

7. In a fusible circuit interrupter having a chamber therein, a rigid heater wire having a hook at one end, an infusible block of heat absorbent metal supported only by said hook, a flexible conductor, a thin layer of low melting temperature solder on the face of said block remote from the heater wire for connecting one end of the flexible conductor to the block, and means responsive to the fusing of the solder for separating the end of the flexible conductor from the block.

ELMER H. TAYLOR.

DISCLAIMER

2,286,518.—*Elmer H. Taylor*, Newburyport, Mass. FUSIBLE PROTECTIVE DEVICE. Patent dated June 16, 1942. Disclaimer filed November 16, 1944, by the assignee, *The Chase-Shawmut Company*.

Hereby enters this disclaimer to claims 1, 2, 3, and 5 of said specification.

[*Official Gazette December 12, 1944.*]

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