

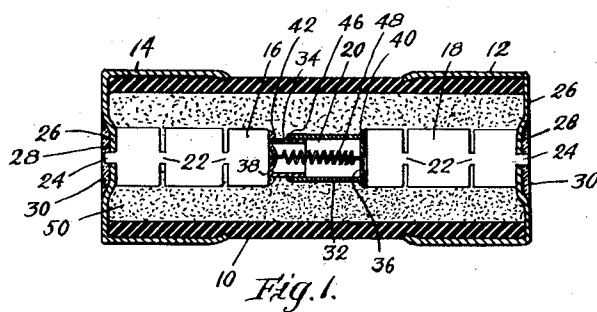
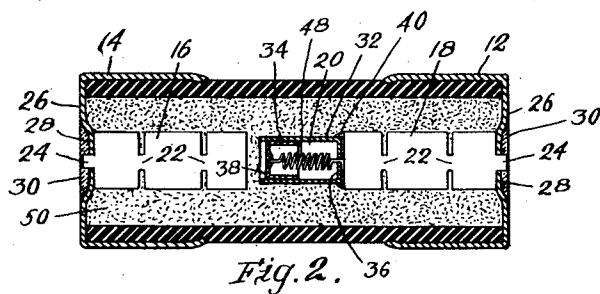
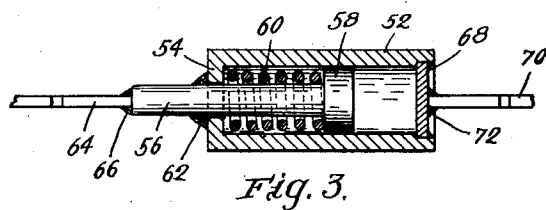
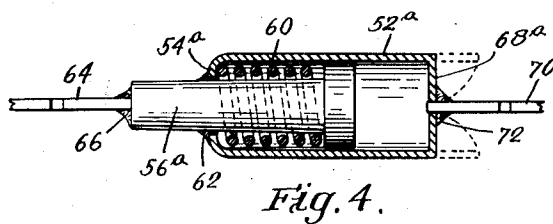
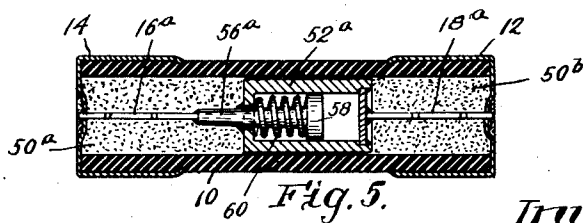
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FUSIBLE ELECTRIC PROTECTIVE DEVICE

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FUSIBLE ELECTRIC PROTECTIVE DEVICE

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This invention relates to fusible protective devices for electric circuits of the type having a readily fusible metal which electrically connects separable elements of a circuit conductor and is adapted to be melted by the electrically generated heating of a part of the conductor to release its hold on the separable elements to effect circuit interruption. The heating conductor, in part, may comprise a fuse adapted to interrupt the circuit more quickly than the fusible metal when traversed by high currents.

The invention relates particularly to a cartridge type of protective device, the elements of which are enclosed within a tubular casing having suitable end terminals.

In a device of the above type it is desirable to employ a spring which serves to effect separation of the cooperating circuit interrupting elements upon the fusing of the fusible metal.

When a thermal cut-out of the above type is used to interrupt circuits traversed by currents of considerable magnitude the circuit interrupting arc may be quite severe especially on currents approximating a short-circuit in value. Hence it is desirable to surround the circuit interrupting elements of the device with some arc quenching powdered or granular material such as is customary to use in non-renewable cartridge fuses. The use of such material about and in contact with the circuit interrupting spring, however, would interfere with the free operation of the spring.

Hence an object of the present invention is the provision of a circuit interrupting device of the type described wherein the spring is enclosed within a casing having collapsible elements normally held against collapse by the low melting temperature fusible metal and permitted to collapse under the action of the spring when the metal fuses, the casing thus shielding the spring from contact with the arc quenching material and permitting free operation of the spring.

A further object of the invention is a protective device of the type above set forth wherein the collapsible casing and its associated parts are made of a material of good heat absorbing property and relatively massive to absorb a substantial amount of heat and thereby delay the fusing of the fusible metal for a suitably long period of time.

Another object of the invention is the provision of a fusible protective device as above described wherein the circuit interrupting electrical conductor includes two fusible links electrically and thermally connected by an interposed

heat absorbing circuit interrupting member united to at least one of said links by a readily fusible metal, both fuse links being adapted to heat by reason of the current traversing them and to raise the temperature of the interposed member following a suitable period of delay determined by the heat absorbing ability of said member to effect the ultimate fusing of the readily fusible metal and secure circuit interruption.

A yet further object is generally to improve the construction and operation of thermally responsive electro-protective devices.

Fig. 1 is a longitudinal section through a cartridge type electric protective device embodying the present invention.

Fig. 2 is a view similar to Fig. 1 but showing the operated position of the parts.

Fig. 3 is a sectional detail through a modified form of heat absorbing spring housing.

Fig. 4 is a sectional detail through a further modified form of spring housing.

Fig. 5 is a longitudinal section through a somewhat modified form of protective device over that of Fig. 1, and illustrating therein the spring housing of Fig. 3.

The cartridge type thermal protective device embodying the present invention includes a tubular insulating casing 10 having end metal caps 12 and 14 thereon which, as herein illustrated, are permanently affixed to the ends of the casing and constitute the circuit terminals of the device. Said end caps are connected within the casing by an electric conductor consisting of the fusible links and heater elements 16 and 18 and the interposed heat absorbing spring casing or housing 20. The fusible links 16 and 18 are or can be identical. Their thermal and electrical characteristics may be different in devices of different current ratings but, in general, each link is provided with one or more fusing necks 22 intermediate its ends of reduced cross-sectional area adapted to fuse to interrupt the circuit when traversed by high overload currents such as those approximating a short-circuit current.

The outer ends of the fuse links are suitably connected to the end caps as by being provided with reduced extensions 24 which extend through the end walls 26 of the end caps and are located in cups or depressions 28 of said end walls and are secured permanently to the caps by high melting temperature solder 30.

The spring casing or housing 20 of Figs. 1 and 2 comprises a cylindrical body 32 and a cylindrical cap 34, both of metal. The body 32 is hollow and is provided with one open end while the

other end is closed by the integral end wall 36. The cap 34 is similarly constructed and has its open end within the open end part of the body 32 and has an end wall 38 opposite its open end which forms a closure for the other end of the cap.

The end wall 36 of the housing is secured to the inner end of the fuse link 18 in a substantially permanent manner by a mass of high melting temperature solder 40. The end wall 38 of the cap 34 is secured to the inner end of the link 16 by a mass of low melting temperature solder or fusible metal 42. The cap and body are also secured releasably together by a mass of low melting temperature solder 46.

A retractile spring 48 is extended between and connected to the ends walls 38 and 36 of the body and cap and exert constant tension thereon in a direction to draw the cap 34 further within the body 32, this movement being normally prevented by the solid fusible metal 42 and 46. A mass 50 of loose particles of arc quenching material of any suitable nature is contained within the enclosing casing 10 and surrounds and is in intimate association with the conducting elements therein.

With the arrangement as above described when the conducting elements within the enclosing casing are traversed by an excess current the conductors 16 and 18 generate heat due to their internal electrical resistance and the heat is imparted to the spring housing 20, thereby elevating the temperature thereof. The spring housing 20 is adapted to have a substantial amount of heat absorbing capacity so that the rate of rise of temperature thereof is suitably slow. When the temperature of the housing 20 reaches a sufficiently elevated point to soften or fuse the readily fusible metal masses 42 and 46 the spring 48 becomes effective to move the cap 34 longitudinally further within the body 32 of the housing, thereby to separate the cap from the end of the fuse link, as is illustrated in Fig. 2. Circuit interruption is thereby effected following a delay dependent upon the heat absorbing capacity of the spring housing.

The filler 50 is effective in rapidly extinguishing the circuit interrupting arc. The filler is isolated from the spring 32 by reason of the enclosing housing and hence the spring is capable of acting promptly and with full effect when the readily fusible metal releases its hold on the fuse link and the housing cap. When the device is traversed by a high overload a fusible neck 22 of a conductor 16 or 18 or a fusing neck of each conductor is fused in a shorter time than is required to fuse the readily fusible metal masses 42, 46, thereby to effect circuit interruption.

Various forms of collapsible spring housings can be employed.

In the modification illustrated in Fig. 3, the housing 52 is cylindrical and tubular and has an integral end wall 54 provided with a passage therethrough in which the rod or plunger 56 is located. Said rod, internally of the housing, has a head 58 between which and the end 54 of the housing is disposed a compression spring 60 that acts both on said end and said head in a direction to move the rod 56 toward the right, Fig. 3. The rod is normally restrained from such movement by a mass of readily fusible low melting temperature metal 62 which is attached both to the rod and to the end 54 of the housing, thereby holding the rod in an outward position with the spring 60 compressed. The end of the rod is se-

cured to a fuse link or heating conductor 64 by a similar mass 66 of low melting temperature metal. The other end of the spring housing 52 is closed by a disc 68 which is secured with the housing and to the inner end of a fusible link 70 by masses 72 of high melting temperature solder. With this arrangement, when the heating elements 64 and 70 impart sufficient heat to the spring housing, the masses 62, 66 of low melting temperature metal fuse or release their holds respectively upon the rod 56 and the heating conductor 64 so that the spring becomes free to expand and to move the rod 56 to the right away from the end of the heating element 64, thereby to effect the interruption of the circuit. All parts of the spring housing, including the spring and the rod 56, are effective to absorb heat and delay the fusing of the fusible metal.

In the modification illustrated in Fig. 4, the housing 52a has its end 54a spun or reflexed inwardly to provide a wall through which the circuit interrupting rod 56a is movable. The other end of the housing is also spun or reflexed inwardly to provide a closure wall 68a to which a heating conductor or fuse link is connected.

The protective device illustrated in Fig. 5 is adapted for relatively small normal current ratings and has essentially the same construction as that illustrated in Fig. 1 except that the spring housing of Fig. 3 is employed therein. With this construction the spring housing is substantially equal in diameter to the internal diameter of the enclosing casing so that the arc extinguishing filler therein is separated into two bodies 50a and 50b which surround the fusible links 16a, 18a and act to extinguish quickly the circuit interrupting arc formed upon the fusing of the links and also the circuit interrupting arc formed upon the separation of the spring urged rod 56a from the end of the link 16a in response to the fusing of the fusible metal. The movement of the rod 56a upon circuit interruption is inwardly of the enclosing housing 52a and hence is not hindered by the presence of the filling material.

I claim:

1. A fusible electrical protective device including an enclosing casing, separable circuit interrupting elements within said casing, means including a fusible mass operable when fused to permit the separation of said elements, a spring within said casing operative to effect the separation of said elements in response to the fusing of said fusible mass, a filler within said casing, and a spring housing embedded in said filler and enclosing said spring and isolating it from said filler.

2. In a fusible electrical protective device, an enclosing casing, a circuit interrupting spring, a spring housing enclosing said spring and located within said casing, said spring housing having relatively moving parts biased for movement by said spring, fusible metal normally holding said housing parts against movement, and means responsive to the fusing of said metal and the release of said parts and the movement of said movable housing part for effecting circuit interruption.

3. A protective device comprising an enclosing casing, a conductor therein having a fusible part, a spring in said casing exerting tension on the fusible part of said conductor to separate the conductor parts upon the fusing of said fusible part, a filler in said casing surrounding said conductor, and a collapsible housing enclosing said spring and isolating it from said filler.

4. A protective device comprising an enclosing casing, a conductor therein having a fusible part, a spring in said casing exerting tension on the fusible part of said conductor to separate the conductor parts upon the fusing of said fusible part, and a heat absorbent housing within said casing enclosing said spring and in heat exchanging relation with said fusible part.

5. In a fusible electrical protective device, an enclosing casing, a spring housing therein having relatively movable parts, a spring within said housing biasing said movable part for movement, a conductor anchored to said movable part by a readily fusible metal releasably holding said part from movement and adapted to fuse and effect release of said part under action of said spring and withdrawal of said movable part from said conductor.

6. In a fusible electrical protective device, an enclosing casing, a conductor within said casing, a spring housing within said casing having a stationary part and a relatively movable part, fusible means releasably holding said housing parts against relative movement and connecting said movable housing part with said conductor, and a spring within said housing acting on said movable part to separate it from said conductor upon the fusing of said fusible means.

7. A fusible electrical protective device as in claim 6, wherein said housing constitutes a heat absorber delaying the fusing of said fusible means.

8. In a fusible electrical protective device, an enclosing casing, a conductor therein, a spring housing therein having a movable plunger projected through one end thereof, fusible means connecting said plunger and housing normally against movement and connecting said plunger and said conductor, and a spring within said housing acting upon said plunger to withdraw it from said conductor in response to the fusing of said fusible means.

9. In a fusible electrical protective device having an enclosing casing, the combination therein of a conductor, a spring housing having a stationary hollow spring enclosing part and a movable part, fusible means connecting said movable part to said conductor, and a spring enclosed within said hollow housing acting on said movable part in a direction to move it toward the stationary part and away from said conductor in response to the fusing of said fusible means.

10. In a fusible electrical protective device having an enclosing casing, the combination therein of a conductor, a spring housing having a stationary hollow spring enclosing part and a movable part, fusible means connecting said movable part to said conductor, and a spring within said hollow housing acting on said movable part in a direction to move it toward the stationary part and away from said conductor in response to the fusing of said fusible means, said conductor constituting a heating means for said fusible means and also constituting a fuse link having a readily fusible section adapted to fuse prior to said fusible means when traversed by a current of predetermined high magnitude.

11. In a fusible electrical protective device, the combination of a conductor, a heat absorbing member having a movable part, fusible means connecting said movable part and conductor, and spring means internally of said heat absorbing

member acting on said movable part in a direction to reduce the length of said heat absorbing member and to separate it from said conductor in response to the fusing of said fusible means, said heat absorbing member having an internal enclosing recess in which said spring is located.

12. In a fusible electrical protective device, the combination of a pair of conductors and an interposed heat absorbing member electrically connecting said conductors and connected with one of said conductors by a readily fusible metal, and spring means enclosed within said heat absorbing member responsive to the fusing of said metal to effect the electrical separation of said heat absorbing member and conductor.

13. A fusible electrical protective device as in claim 12, said conductors having parts adapted to fuse and interrupt the circuit prior to the fusing of said fusible means when traversed by a sufficiently high current, an enclosing casing containing said conductors and heat absorbing member, and an arc quenching filler surrounding said conductors and said fusible metal connection of the heat absorbing member to one of said conductors.

14. In a fusible electrical protective device, the combination of a metal housing, a plunger within said housing, a spring acting between said housing and plunger in a direction to draw said plunger within said housing, and a conductor attached to said plunger by fusible means holding said plunger releasably in advanced position, said fusible means adapted to fuse and permit said spring to separate said plunger from said conductor.

15. In a fusible electrical protective device, the combination of a metal housing, a plunger within said housing, a spring acting between said housing and plunger in a direction to draw said plunger within said housing, and a conductor attached to said plunger by fusible means holding said plunger releasably in advanced position, said fusible means adapted to fuse and permit said spring to separate said plunger from said conductor, said plunger also being releasably connected with said housing by a fusible mass adapted to fuse with said fusible means and release said plunger for movement.

16. In a circuit interrupter, an enclosing casing, a fusible link therein, a spring housing within said casing having a stationary part and a movable part, means including a mass of fusible metal connecting said movable part and said link and normally holding said part against movement, and a spring within said housing acting upon said movable part to withdraw it from said link upon the fusing of said fusible metal.

17. In a circuit interrupter, an enclosing casing, a fusible link therein, a spring housing within said casing having a stationary part and a movable part, one end of said link being connected to a portion of the fixed part of said housing, the said portion of the housing connected to said fuse link acting as a heat absorbing mass to absorb heat from said link upon a partial overload, a mass of fusible material connecting the movable and fixed parts of said housing and normally holding said movable part against movement and a spring within said housing acting upon said movable part to move it to circuit opening position upon fusing of said fusible material.

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