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THERMAL RELAY NORMALLY CLOSED, WITH GUILLOTINE FOR OPENING

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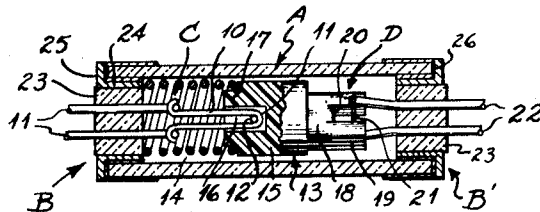


Fig. 1

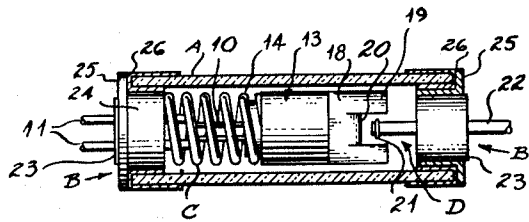


Fig. 2

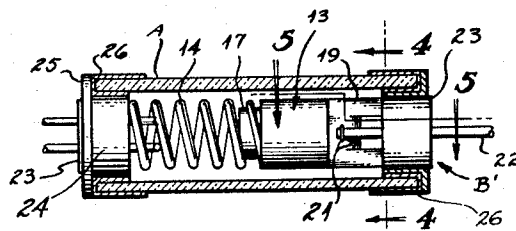


Fig. 3

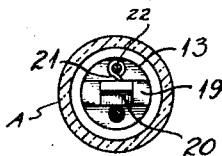


Fig. 4

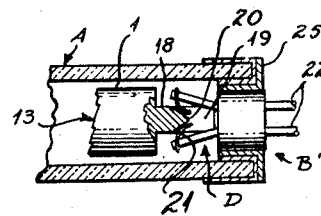


Fig. 5

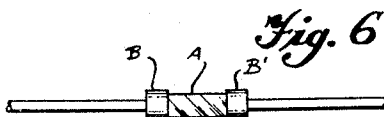


Fig. 6

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THERMAL RELAY NORMALLY CLOSED, WITH GUILLOTINE FOR OPENING

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7 Claims. (Cl. 200—114)

This invention relates to thermal relays of small dimension, adapted to become operative in response to a rise in current above a selected critical value. More specifically, the invention relates to that type of small dimension thermal relay a portion of which has the characteristics of a fuse and is included in a circuit which, when overloaded, will raise the temperature thereof to the critical range; another portion of the relay providing a normally closed connection in a circuit (e.g. bridge circuit) which is separate from the fuse circuit.

It is to be understood that relays of this type have been hitherto proposed, and I do not claim as a broad invention, the concept of a thermal relay embodying a fuse circuit and a separate relay circuit. A general object of the present invention is to provide an improved relay of this type which provides a normally closed connection in a bridge or relay circuit and has a means for mechanically breaking that connection by a plunger which is released when the fuse element of the relay is activated.

A further object is to provide a normally closed thermal relay embodying a guillotine blade on a spring loaded plunger which is normally held in a retracted position by an overload current sensitive fuse element, the guillotine blade being adapted upon release of the plunger to be spring driven against a frangible conductor constituting a connection in the relay circuit, to sever said conductor and to thereafter positively hold the severed fragments of the conductor in separated condition so that they cannot accidentally reestablish contact with one another. A further object is to provide a thermal relay of the type indicated having high temperature, shock, vibration, dielectric and electrical characteristics, all combined in a miniaturized envelope.

A further object is to provide such a relay which can be readily fabricated in mass production, meeting an extremely difficult problem that has not been met with in prior attempts to fabricate such a miniature relay.

A further object is to provide such a thermal relay embodying electrical parts mounted in a glass envelope providing full visibility of the working parts thereof, and having additionally, extremely high hermetically-sealed characteristics.

Other objects and advantages will become apparent in the ensuing specification and appended drawing in which:

Fig. 1 is an axial sectional view, on an enlarged scale, of a thermal relay embodying my invention, showing the guillotine blade and frangible relay conductor in perspective relation to one another;

Fig. 2 is an axial sectional view of the same showing the guillotine blade in side elevation and the frangible conductor in end elevation;

Fig. 3 is an axial sectional view showing the parts in the relation assumed by them when the relay has opened in response to excessive current;

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 3; and

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Fig. 6 is a side view of my improved thermal relay, approximately actual size.

Referring now to the drawings in detail, I have shown therein, as an example of one form in which the invention may be embodied, a normally closed thermal relay embodying generally an envelope structure comprising a cylindrical tubular barrel A of heat resistant (e.g. Pyrex) glass tubing and headers B and B' of composite metal and glass structure closing the respective ends of the envelope; together with operative parts hermetically sealed within this envelope and comprising generally: a fuse unit C at one end of the relay and a normally closed guillotine switch D at the other end of the relay.

Before describing the details of the envelope structure, reference will be made to the novel features of the guillotine switch D as combined with the fuse unit C, with which the envelope structure is combined to provide a hermetically sealed casing.

The fuse unit C embodies an overload current sensitive yoke 10 having spaced arms attached at one end of the yoke to the inner extremities of a pair of conductor terminals 11 projecting through and anchored and sealed in the end cap B; the other end of the yoke 10 embodying a bight 11 which is looped around a pin 12 anchored in a plunger 13, whereby the yoke 10 provides a tension link for holding the plunger 13 in a retracted position against the spring loading of a coil spring 14 which biases the plunger 13 for projection away from the end cap B and toward the other end of the envelope.

The plunger 13 is of dielectric material, preferably a hard, rigid synthetic resin plastic such as phenolic resin or other thermosetting resin of relatively unplasticized thermo-plastic material, i.e. any selected resin having suitable dielectric strength and toughness, either acrylic, urea, vinyl, acetate, or other plastic resin material. It embodies a cylindrical body portion 15 having at one end an axial cavity 16 receiving the bight portion 11 of yoke 10 and a reduced cylindrical neck 17 piloted in the inner end of coil spring 14. Coil spring 14 is engaged under compression between the shoulder defined at the base of neck 17 and the inner face of end cap B against which its outer end is abutted. It is positioned by barrel A in concentric spaced relation to the terminals 11, avoiding any electrical contact therewith. The current of the fuse circuit passes through the terminals 11 and through the yoke 10, whereby an overload of voltage or current will result in the rupture of yoke 10 by melting, thus releasing the plunger 13 for a switch opening action.

Guillotine switch D comprises a guillotine blade 18 formed as an integral part of plunger 13 and projecting from the end thereof remote from the neck 17. Blade 18, at the respective sides thereof, is extended to provide a pair of spaced fingers 19. The web portion of the blade 18, at its outer extremity, is provided with a nose 20 which may be of chisel form as shown best in Fig. 5, for severing a fine conductor wire 21 which constitutes the frangible connector in the relay circuit.

The relay circuit includes a pair of terminals 22 extended through and mounted and sealed in the end cap B', projecting into the interior of the envelope and having the connector 21 anchored to their inner ends and bridging therebetween as shown in Fig. 1. The conductor 21 may be anchored by looping its ends around the respective terminals 22 and soldering or welding the loops to the terminals.

In the retracted position of plunger 13, guillotine nose 20 is spaced away from bridging conductor 21 a distance substantially less than the full travel of plunger 13 which is limited by contact of fingers 19 against the end cap B' as indicated in Fig. 3. Thus at the time the guillotine blade contacts the bridging conductor 21, it will be traveling with sufficient speed to effectively sever the conduc-

tor 21 without any possibility of stretching the wire and leaving it unsevered. As the plunger proceeds to its limit position shown in Fig. 3, the base portion of blade 18 will enter between the fragments of conductor 21 and positively hold them in separated spacing as shown in Fig. 5.

Each of the headers B and B' is of composite construction as shown in the drawing, the terminals 11 and 22 consist in lengths of wire extended through and mounted in the respective headers, and they have respective inner end portions projecting axially into the interior of the envelope A. The inner end portions of terminals 22 are of sufficient length to accommodate the movement of plunger 13 to its limit position wherein frangible conductor 21 has been severed. Conductor 21 is stretched under tension between the terminals 22, to facilitate its rupture by the guillotine blade 20 including a cylindrical plug 23 of high temperature glass (e.g. Pyrex) having a pair of spaced parallel passages through which respective terminals 11 or 22 extend; together with a metallic mounting ring of L-section including a cylindrical collar portion 24 and a radial flange 25 projecting outwardly from the outer end thereof; the collar 24 encircling and being bonded to the cylindrical periphery of plug 23 and being inserted into and bonded to the cylindrical inner wall of a respective end of barrel A; and the flange 25 being bonded to the respective end of barrel A. The terminals 11 are sealed into the plug 23. As the means for bonding the mounting ring 24, 25 to the barrel A and to the plug 23 respectively, I utilize the multiple layer bonding connection disclosed more fully in the applications of Mihai D. Patrichi, Ser. Nos. 615,981 and 616,091 respectively, filed October 15, 1956, for Electrical Resistors and Method of Fusing Metal to Glass Articles respectively. Briefly, such bonding connections (indicated generally by numeral 26) comprise in general coatings of silver paste paint applied and fused to both inner and outer end surfaces of barrel A, coatings of copper electroplated over the fused silver coatings, coatings of silver plated upon the mounting rings 24, 25, and coatings of silver solder sweated into the interstices between the coated mounting rings 24, 25 on the one hand and the coated surfaces of the respective ends of barrel A on the other hand.

In the operation of my improved thermal relay, the terminals 11 are connected into a fuse circuit in which an overload will cause an excessive current to be imposed upon the fuse link 10 and to melt the same so as to release the plunger 13 for spring loaded action; and the terminals 22 are connected into a relay circuit (e.g. bridge circuit) to be protected against the effect of overloading the fuse circuit. In the event the critical current level is reached, the plunger 13 will be released and will be projected by spring 14 against the frangible conductor 21, severing the same and pushing aside the fragments thereof so as to open the relay circuit and positively maintain the same in the open condition.

I claim:

1. In a miniature thermal relay: an envelope comprising a tubular barrel of high temperature glass and a pair of headers closing and sealing the respective ends thereof, each of said headers comprising a central plug of high temperature glass corresponding to that of said barrel in expansion characteristics, and a mounting ring of a metal that is matched to said glass parts in expansion characteristics, interposed between and bonded to the respective glass parts at each end of the envelope; an assembly of fuse parts in one end of said envelope, including a plunger slidably mounted in said barrel, a coil spring engaged under compression between said plunger and an opposed header, a pair of terminals extending through and sealed and insulated in the plug of said opposed header, and a fuse link attached under tension between said terminals and said plunger and normally holding the latter in a retracted position under the

load of said spring; and a normally closed switch in the other end of said envelope, comprising a guillotine blade projecting from the end of said plunger remote from said coil spring, a pair of radially spaced terminals extending through and sealed in the plug of the other header on respective sides of said blade, and a frangible connector wire anchored at the respective ends to the respective inner ends of the last mentioned terminals in opposed spaced relation to the end of said blade and in transverse relation thereto, in a position to be severed by said blade upon projection of said plunger by said coil spring when said fuse link is severed.

2. In a miniature thermal relay: an envelope comprising a tubular barrel of high temperature dielectric material and a pair of headers closing and sealing the respective ends thereof; an assembly of fuse parts in one end of said envelope, including a plunger slidably mounted in said barrel, a coil spring engaged under compression between said plunger and an opposed header, a pair of terminals extending through and sealed and insulated in said opposed header and a fuse link attached under tension between said terminals and said plunger and normally holding the latter in a retracted position under the load of said spring; and a normally closed switch in the other end of said envelope, comprising a guillotine blade projecting from the end of said plunger remote from said coil spring, a pair of radially spaced terminals extending through and sealed and insulated in the other header on respective sides of said blade, and a frangible connector wire anchored at the respective ends to the respective inner ends of the last mentioned terminals in opposed spaced relation to the end of said blade and in transverse relation thereto, in a position to be severed by said blade upon projection of said plunger by said coil spring when said fuse link is severed said blade including a pair of fingers projecting axially beyond the severing end thereof, in spaced embracing relation to said frangible connector, adapted to engage the opposed header to limit the projecting movement of said plunger.

3. A relay as defined in claim 1, wherein said blade includes a pair of fingers projecting axially beyond the severing end thereof, in spaced embracing relation to said frangible connector, adapted to engage the opposed header to limit the projecting movement of said plunger.

4. In a miniature thermal relay: an envelope comprising a tubular barrel of high temperature dielectric material and a pair of headers closing and sealing the respective ends thereof; an assembly of fuse parts in one end of said envelope, including a plunger slidably mounted in said barrel, a coil spring engaged under compression between said plunger and an opposed header, a pair of terminals extending through and sealed in said opposed header and a fuse link attached under tension between said terminals and said plunger and normally holding the latter in a retracted position under the load of said spring; and a normally closed switch in the other end of said envelope, comprising a guillotine blade projecting from the end of said plunger remote from said coil spring, a pair of radially spaced terminals extending through and sealed and insulated in the other header on respective sides of said blade, and a frangible connector wire anchored at the respective ends to the respective inner ends of the last mentioned terminals in opposed spaced relation to the end of said blade and in transverse relation thereto, in a position to be severed by said blade upon projection of said plunger by said coil spring when said fuse link is severed, said blade including a base portion which, in said limit position of projection of said plunger, is interposed between the severed fragments of said frangible connector to positively hold them separated from one another and preventing their re-engaging one another.

5. In a miniature thermal relay: an envelope comprising a tubular barrel of high temperature dielectric material and a pair of headers closing and sealing the respective ends thereof; an assembly of fuse parts in one end of

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said envelope, including a plunger slidably mounted in said barrel, a coil spring engaged under compression between said plunger and an opposed header, a pair of terminals extending through and sealed in said opposed header and a fuse link attached under tension between said terminals and said plunger and normally holding the latter in a retracted position under the load of said spring; and a normally closed switch in the other end of said envelope, comprising a guillotine blade projecting from the end of said plunger remote from said coil spring, a pair of radially spaced terminals extending through and sealed and insulated in the other header on respective sides of said blade, and a frangible connector wire anchored at the respective ends to the respective inner ends of the last mentioned terminals in opposed spaced relation to the end of said blade and in transverse relation thereto, in a position to be severed by said blade upon projection of said plunger by said coil spring when said fuse link is severed, said frangible connector consisting in a fine conductor wire stretched under tension between the ends of the terminals to which it is anchored, whereby to facilitate the severing thereof by said guillotine blade.

6. A relay as defined in claim 2, wherein said blade includes a pair of fingers projecting axially beyond the

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severing end thereof, in spaced embracing relation to said frangible connector, adapted to engage the opposed header to limit the projecting movement of said plunger, wherein said blade includes a base portion which, in said limit position of projection of said plunger, is interposed between the severed fragments of said frangible connector to positively hold them separated from one another and preventing their re-engaging one another.

7. A relay as defined in claim 2, wherein said last mentioned terminals diverge from said other header toward said plunger and wherein said frangible connector consists in a fine conductor wire stretched under tension between the ends of said last mentioned terminals, whereby to facilitate the severing thereof by said guillotine blade.

References Cited in the file of this patent

UNITED STATES PATENTS

710,056	Haskins	Sept. 30, 1902
2,683,201	Miller et al.	July 6, 1954
2,757,259	Cruse	July 31, 1956
2,821,602	Hordechuck	Jan. 28, 1958