(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 121 005**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83201358.5**

(51) Int. Cl.³: **H 01 H 37/76**

(22) Date of filing: **23.09.83**

(30) Priority: **30.03.83 JP 56269/83**

(43) Date of publication of application:
10.10.84 Bulletin 84/41

(84) Designated Contracting States:
CH DE FR GB LI NL

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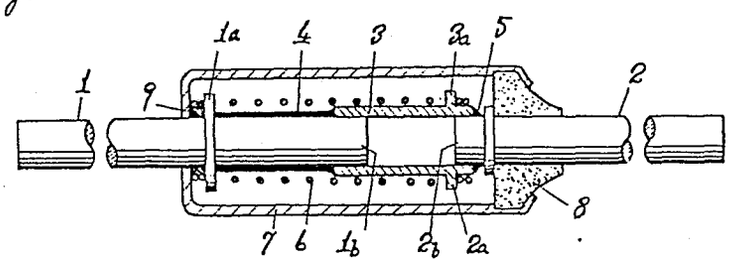
(54) **Thermal fuse.**

(57) A thermal fuse which comprises opposing two lead wires with a required space therebetween, an element bridging the opposing two lead wires and a coil spring set under tension between one of the lead wires and the element. Both end surfaces of the element are welded to each lead wire by fusible alloy and upon fusing of the fusible alloy due to the rise of ambient temperature, the element is moved towards one of the lead wires by the coil spring and a circuit is opened.

Fig. 1



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Thermal Fuse

BACKGROUND OF THE INVENTION

1. Field of the invention

This invention relates to thermal fuses or temperature responsive circuit breakers having high current-carrying capacity and a high fusing temperature.

2. Prior art

Generally, thermal fuses of high fusing temperature type (200°C and higher) are available in two kinds, namely, one uses an organic substance in its temperature sensing region and the other uses an inorganic substance in the same region. The former using an organic substance is kept in a hermetically sealed metallic case so as to avoid erroneous motion caused by decomposition, degradation and decrease of volume of temperature sensing substances due to high temperature. Thermal fuses of this type have disadvantage in that when they are used on cyclical and continuous basis under the condition of ambient temperatures ranging from a normal temperature to 200°C, hermetical sealing becomes lost due to the difference in thermal expansion and thermal shrinking between materials of composing parts. This loss of hermetical sealing often causes erroneous motion of a thermal fuse. The latter using nonferrous metal, for example, in its temperature sensing region raises no problem in weathering-resistance and hermetical sealing but since it uses much fusible alloy in its temperature sensing region, resistivity of the alloy is high and therefore a thermal fuse blows out at a value lower than a predetermined load current value. Thus, it raises a constructional problem. The conventional thermal fuse of high temperature type is 250°C at the highest in fusing temperature.

SUMMARY OF THE INVENTION

In view of the above, the present invention has for its object to provide a thermal fuse having current-carrying capacity of 15 - 20A and voltage of 250V which works accurately at a fusing temperature within the range from 250°C to 300°C. A thermal fuse according to the present invention comprises two lead wires having a head and a flange (or a pin), one having a longer head and the other having a shorter head, opposite each other with a required space therebetween and an element which bridges the opposing two lead wires. Both end surfaces of the element and each lead wire are welded together by fusible alloy at their contact surface and a coil spring under tension is set between the lead wire on one side and the element. With this arrangement, upon fusing of fusible alloy due to the rise of ambient temperature, the element is moved towards one of the two lead wires by the coil spring, with the result that a circuit is opened.

The nature and advantage of the present invention will be understood more clearly from the following description made with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a thermal fuse according to the present invention;

Fig. 2 is an explanatory drawing of the thermal fuse according to the present invention at the time of fusing; and

Fig. 3 is an explanatory drawing showing a different method of setting a coil spring.

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, numeral 1 and numeral 2 denote lead wires opposite each other, with a desired electrically insulative space therebetween. Each lead wire carries a flange (or a pin) 1a, 2a at the outer circumference of the end portion thereof but the length between the flange 1a and an extreme end of the lead wire 1 or the length of a head portion 1b is made longer than the length between the flange 2a and an extreme end of the lead wire 2 or the length of a head portion 2b so that a cylindrical element 3 to be explained later can be put on the head portion 1b. The cylindrical and elec-

trically conductive element 3 bridges the lead wire 1 and the lead wire 2. One end portion of the element 3 is welded to the head portion 1b and the other end portion is welded to the head portion 2b by fusible alloy 4, 5. Fusible alloy 4 and fusible alloy 5 are of the same fusing temperature, but use of fusible alloy 5 is small in quantity because one end of the element 3 is close to the flange 2a and use of fusible alloy 4 is much in quantity because the length between one end of the element 3 and the flange 1a is long.

A coil spring 6 is set between the element 3 and the lead wire 1. One end of the coil spring 6 is hitched to the flange 1a and the other end is hitched to a part of the element 3. Alternatively, it is possible to hitch the coil spring to a projection 3a (or a pin) made at one end portion of the element, as shown in Fig. 1, or to taper the coil spring 6 in conical shape (refer to Fig. 3) and to hitch a tapered end portion 6a to one end of the element 3. In any case, the coil spring 6 should be engaged with and supported by the element 3 and the lead wire 1 in the tensioned state. The tractive power of the coil spring should be such that it does not destroy the deposition power by fusible alloy before fusing.

The above-mentioned element, coil spring and two lead wires are put in a case 7 having an opening in which a lid 8 made of ceramic or heat resisting and insulating material is put. Both the lead wire 2 and the lead wire 1 are passed through the lid 8 and the bottom of the case 7 respectively and are led out of the case 7. In order to retain the hermetical sealing of the case 7, a high temperature sealing material is provided at a hole portion 9 through which the lead wire 1 is passed.

A thermal fuse of high temperature type as mentioned above is used by connecting it to an electric circuit of an electric appliance. If current value larger than a predetermined load current (15 - 20A, for example) is reached and Joule heat generated exceeds the fusing temperature of fusible alloy or the ambient temperature reaches the level of a predetermined fusible alloy fusing temperature, fusible alloy at 4 and fusible alloy at 5 fuse at the same time or fusible alloy 5 at the lead wire 2 in a smaller quantity fuses a little earlier and upon fusing of fusible alloy 4 on the side of the lead wire 1, the element is moved abruptly towards the side of the lead wire 1 by the tractive power of the coil spring 6, as shown in

Fig. 2, and an electric circuit is opened.

According to the present invention, two lead wires, each having a head and a flange, are opposed to each other, an element is bridged between the opposing two lead wires. In welding both end portions of the element to each lead wire by fusible alloy which fuses at a predetermined temperature, use of fusible alloy which is high in specific resistance is limited to the minimum quantity necessary for welding together the element and the lead wire which are low in resistance and therefore a thermal fuse of high load characteristic can be obtained. As the element is bridged in such a fashion that it is biassed to one of the two lead wires by the coil spring under stress, erroneous motion by the coil spring can be prevented.

The figures used in the claims are only meant to explain more clearly the intention of the invention and are not supposed to be any restriction concerning the interpretation of the invention.

What is claimed is.

CLAIM

A thermal fuse comprising opposing two lead wires with a required space therebetween, each having a head and a flange and one lead wire having a longer head than the other lead wire, an element bridging said opposing two lead wires, both end surfaces of said element being welded to each lead wire by fusible alloy and a coil spring set under tension between one of the lead wires and the element, whereby upon fusing of fusible alloy due to the rise of ambient temperature the element is moved towards one of the lead wires by the coil spring and a circuit is opened.

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Fig. 1

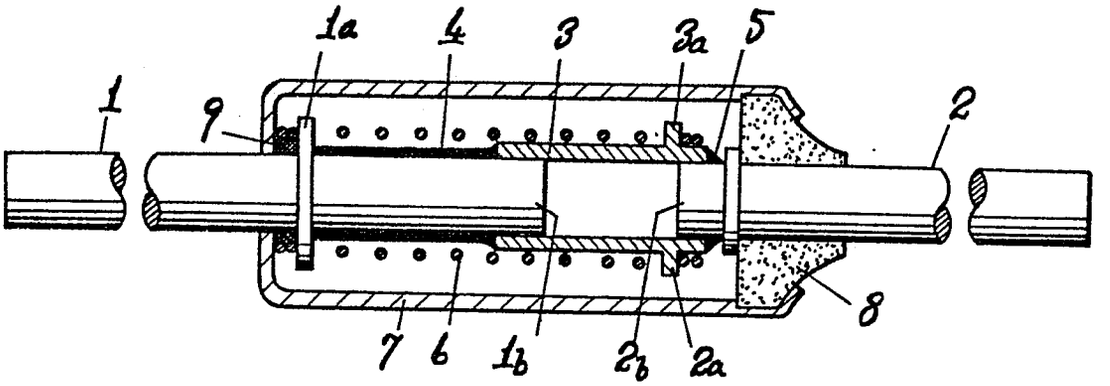


Fig. 2

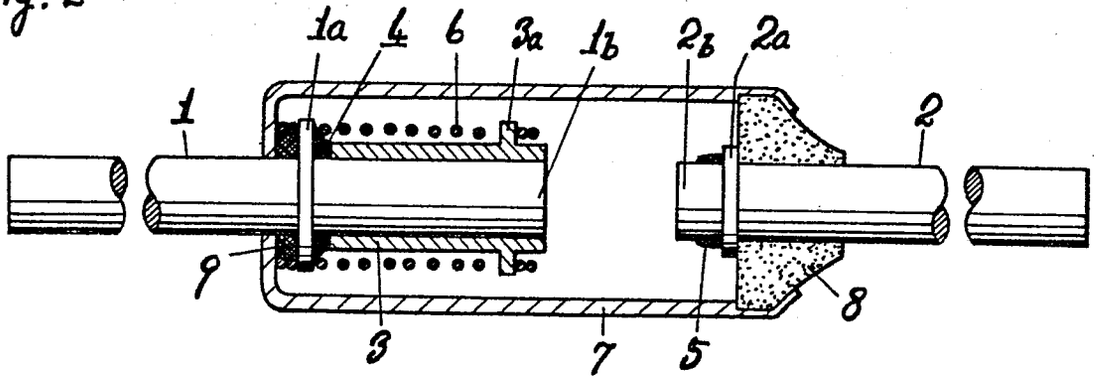
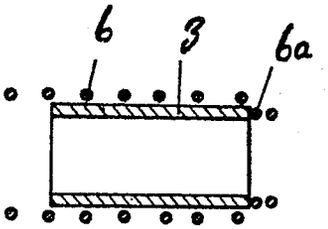


Fig. 3



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EUROPEAN SEARCH REPORT

0121005
Application number

EP 83 20 1358

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	GB-A-1 557 911 (MATSUSHITA) * Page 5, lines 85-104; page 6, line 116 - page 7, line 25 *	1	H 01 H 37/76
A	US-A-4 383 236 (McGRAW-EDISON) * Column 3, line 41 - column 4, line 8 *	1	
A	US-A-4 356 469 (H. DOZIER) * Column 4, lines 7-30 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

H 01 H 37/76

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-06-1984	LIBBERECHT L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
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