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(54) Fuse.

(57) This invention relates to a fuse of the type having blade contacts. The fuse comprises a housing of an electrically insulating material and a fuse element disposed within the housing. The fuse element comprises two spaced metallic blade terminals having ends projecting beyond the housing and a metallic link strip interconnecting the two blade terminals. The link strip extends virtually freely in a space within the housing and is designed to fuse if current of an intensity exceeding a permissible value is passed through it for a certain time. According to the invention, means are provided for preventing sagging of the link strip upon heating such as would prevent it from operating properly.

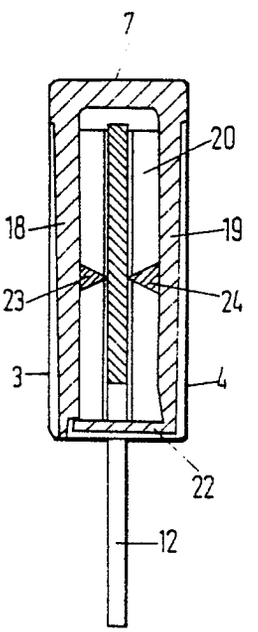

FIG. 2

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Fuse

This invention relates to a blade-type fuse. A prior device of the type to which the present invention relates is known, for example, from U.S. patent 4,344,060, and comprises a housing of an electrically insulating material and a fuse element disposed within said housing, said fuse element comprising two spaced metallic strip or blade terminals having ends projecting beyond the housing, and a metallic link strip interconnecting said two terminals, said link strip being disposed to extend virtually freely in a space within the housing, and being designed to fuse if current of an intensity exceeding a permissible value is passed through it for a certain time. Fuses of this type are frequently being used in the automobile industry.

The prior fuse is, in operation, often used so that the contact blades and the link strip lie in a horizontal plane. Usually, the construction is such that the link strip fuses upon a prolonged passage of current having an intensity slightly in excess of the nominal value determined for the fuse, or upon the passage of a current having a very high intensity (short-circuiting current). In the case of a prolonged slightly excessive current, the temperature of the link strip will increase progressively until the strip melts. The increase in temperature is the result of the dissipation of electric power into the material as a result of the passage of electric current through it.

During normal operation, when the current intensity is below the nominal value, the amount of heat dissipated into the link strip will not be so high that a portion of the strip will fuse or become soft, or becomes excessively longer from thermal expansion. Heat generated in the strip is dissipated into the adjoining strip terminals, the housing, and the panel in which the fuse is mounted. When a current in excess of the nominal current intensity passes through the strip, the amount of heat generated will be so high that insufficient heat can be dissipated via the strip terminals and the housing, so that the temperature will increase to above the fusing temperature. Prior to fusing, the link strip will become softened. For the reliability of the fuse, it is of importance that the softening of the strip prior to fusing and its thermal expansion do not proceed to the extent that the strip begins to sag and will thus touch the wall of the housing. In fact, in that case, there will be extra dissipation of heat, and the fuse will fail to melt. At the current intensities so far conventional, the construction was such that there was hardly if at all any risk of sagging. If higher permissible current intensities are considered, for example, of 30A and higher, however, the construction should be adapted. In particular, in such a case one will often opt for a longer link strip. With a longer link strip, however, the above problem of sagging and touching the wall of the housing may be encountered.

It is an object of the present invention to provide a fuse in which the problems outlined above are prevented. This object is achieved, according to the invention, by a fuse comprising means for preventing sagging of the link strip upon heating such as would prevent it from operating properly. The means provided in accordance with the present invention may be of two kinds. In a first embodiment, the means referred to comprise projections extending into said space from the wall of the housing toward the link strip, said projections supporting the link strip either permanently or upon initial sagging. According to a second possibility, which can be realized together with, or preferably instead of, the first possibility, the means for preventing sagging of the link strip comprise provisions on the link strip proper.

In one suitable embodiment of the fuse according to the present invention, the provisions on the link strip comprise melting point reducing means in combination with means for concentrating the fusing at a pre-determined place. Preferably, the melting point reducing means are tin beads, and the fusing concentrating means are reductions in size of the strip, holes in the strip, or holes in the strip combined with thickened portions around the holes.

In a fuse according to the present invention which has been found to be very satisfactory, a hollow staple of tin is provided in link strip of zinc, and a plug of copper is disposed in the cavity of the hollow staple, which plug is supported by, or closely spaced from, a projection from the wall of the housing.

In another suitable embodiment of the fuse according to the present invention, the link strip is made of copper in two parts interconnected by a tin bead provided by an extrusion-riveting technique.

By a suitable selection of the material of the link strip and the beads, holes, thickenings of the same or of another material to be provided thereon and therein, not only can sagging be prevented, but the fuse can be made slower or less slow. The material for the blade terminals may be the same as the material for the link strip. In that case, terminals and link strip may be made in one integral piece. This is not necessary, however. In the case of separate terminals and link strip, the connection between these members may be effected in a suitable manner by an extrusion-riveting technique.

A suitable material for the blade terminals is tinned brass, in view of its low price. For the link strip, this material is less desirable, in view of its relatively high melting temperature. A material suitable for both types of strips, for example, is zinc coated with a copper layer and/or a tin layer.

The invention is illustrated in and by the following description with reference to the accompanying drawings, in which

Fig. 1 is a perspective view of the housing and the set of blade terminals and link strip of a fuse according to the present invention;

Fig. 2 is a cross-sectional view of a first embodiment of the fuse according to the present invention;

Figs. 3, 4 and 5 are diagrammatic plan views, showing the portion relevant for a good understanding of the present invention of various variants of the fuse according to the invention;

Fig. 6 is a cross-sectional view of an essential part of one embodiment of the fuse according to the present invention;

Figs. 7A and 7B show a detail of a different variant in top plan view and in cross-sectional view, respectively; and

Figs. 8A and 8B similarly show a detail of yet another variant.

Fig. 1 is an exploded view of the fuse according to the present invention. The fuse comprises a housing 1 of suitable plastics material and a fuse element 2 of metal.

As shown also by the cross-sectional view of Fig. 2, housing 1 is of generally rectangular shape, determined by the relatively closely spaced opposed larger sidewalls 3 and 4 which interconnect the smaller sidewalls 5 and 6. The top is defined by top wall 7.

In walls 3 and 4, deeply and less deeply recessed portions are provided. Between the deeply recessed portions, shown, for example, at 8 and 9 in Fig. 1, relatively narrow passages are provided in the interior of the housing, which more or less closely fit the ends 10 and 11 of the respective blade terminals 12 and 13 of fuse element 2. Tab-shaped extremities 14 and 15 of the blade terminals extend to just under apertures 16, 17, respectively, in the top surface 7 of the housing, which apertures link up with the above narrow passages.

The less deeply recessed portions 18 and 19 of walls 3 and 4 leave a space 20 in housing 1, in which, after the introduction of the fuse element 2 into the housing the link strip 21 is disposed to extend virtually freely. Provided at the lower end of the recessed portion 19 of wall 4 is a strip-shaped extension 22 which after the introduction of the fuse element into the housing can be folded to rest against the lower end of the recessed wall portion 18, so that space 20 is closed at the bottom.

The link strip 21 of fuse element 2 is shown in Fig. 1 as being formed integrally with the blade terminals 12 and 13. This, however, is not absolutely necessary. If desired, the link strip, which is the fuse element proper, may be a separate strip connected with the terminals in a suitable manner. Although soldering and welding are possible techniques for connecting a separate link strip, an extrusion-riveting technique is preferred. A separate link strip may be desirable in connection with the choice of the material to be used. A material which is highly suitable for use as a link strip material on the ground of melting characteristics and the like, may be less attractive for the blade terminals on the ground of economic considerations.

In the embodiment of the fuse according to the invention shown in cross-section in Fig. 2, the means for preventing the sagging of link strip 21 in the case of increased generation of heat during operation comprise a pair of projections 23, 24 extending from the respective inner surfaces of the recessed portions 18 and 19 in the direction of link strip 21. Projections 23 and 24, which in the embodiment shown have the shape of cones, may touch link strip 21, or extend just short of this strip. In the first case, during operation, as soon as heat is generated in strip 21, they will already be able to dissipate a small part thereof (in view of the point contact). In the second case, such a dissipation does not take place until after link strip 21 has begun to sag, and the tip of one of the conical projections 23, 24 touches strip 21.

In Figs. 3 et seq., various embodiments of the fuse according to the invention are shown in detail.They are shown diagrammatically only. Thus Figs. 3, 4 and 5 all show a straight link strip between straight blade terminals. It will be clear, however, that both the terminals and the link strip may have any suitable form, in particular that shown in Fig. 1. The link strip and the blade terminals may be formed in one piece or constitute separate parts interconnected in a suitable manner.

In Fig. 3, the link strip 31 is provided between blade terminals 32 and 33 with a pair of holes 34 and 35 punched into it. Provided between holes 34 and 35 is a tin bead 36. In operation, with a suitable selection of position and size of the holes, the temperature of the portion of strip 31 between holes 34 and 35 is kept at a value which will not exceed a pre-determined maximum owing to the presence of the tin between the holes. This maximum will be approximately the melting temperature of tin. Owing to the holes, the heat transmission from the portion between the holes to the portion of the strip 31 between each hole and the adjacent blade terminal is limited. Through all this, in operation, the portion between holes 34 and 35 will have

a virtually constant temperature prior to the possible fusing, which constant temperature will hardly, if at all, be higher than the melting temperature of tin. There is practically no risk of sagging in that configuration.

Fig. 4 shows a variant in which strip 41 linking blade terminals 42 and 43 has two tin beads 44 and 45 spaced some distance apart. Between the tin beads 44 and 45 a hole 46 has been punched in strip 41. Owing to the provision of tin beads 44 and 45, in operation, the temperature of the strip between and around the beads will not exceed a value determined by the melting temperature of the tin. Hole 46 amounts to a reduction in size of strip 41, so that the strip is most likely to fuse at that point. Owing to the limited temperature, there is virtually no risk of sagging.

Fig. 5 shows a variant of the embodiment of Fig. 3. Strip 51 connects blade terminals 52 and 53. A tin bead 56 is provided in the middle of strip 51. On opposite sides of bead 56, reductions 54 and 55 are provided in strip 51, which have a function similar to holes 34 and 35 in Fig. 3.

Fig. 6 illustrates a different solution for the sagging problem. Link strip 61 of zinc is provided at a suitable location, for example in the middle, with a hollow staple 62 of tin. Provided within hollow staple 62 is a plug 63, for example of copper. To prevent plug 63 from falling out when the tin of staple 62 is softened or melts, this plug is kept in position by conical projections 64 and 65 directed inwardly from the inner surface 66, 67 of the wall of the housing of the fuse. In this construction, the hollow staple 62 of tin serves as a melting point reducing means, by virtue of which strip 61 of zinc does not become so hot that it will sag. The copper plug 63 with projections 65 and 64 operate as an additional heat sink and as an additional heat capacity.

Figs. 7A-7B show another variant which is not dissimilar to the embodiment of Fig. 3. The link strip 71 is provided with two spaced holes 72 and 73 with a tin bead 74 provided between them. The difference from the variant of Fig. 3 is that thickenings or collars 75, 76 are provided around the holes, which increases the heat capacity. Such thickenings may alternatively be provided separately without the presence of holes.

Figs. 8A-8B show still another variant. In that variant, the link strip consists of two parts 81 and 82 interconnected by means of a bead of material provided with the help of an extrusion-riveting method. Parts 81 and 82 of the link strip consist, for example, of copper and the bead 83 of tin. This bead has a melting point reducing effect, by virtue of which the fusing temperature cannot become so high as to cause sagging.

In the above description, certain metals are named, because these have been found suitable for the relevant parts of the fuse according to the present invention.Other metals, however, can be used as well.

Claims

1. A blade-type fuse comprising a housing of an electrically insulating material and a fuse element disposed within said housing, said fuse element comprising two spaced metallic strip or blade terminals having ends projecting beyond the housing, and a metallic link strip interconnecting said two blade terminals, said link strip being disposed to extend virtually freely in a space within the housing, and being designed to fuse if current of an intensity exceeding a permissible value is passed through it for a certain time, characterised in that the fuse comprises means for preventing sagging of the link strip upon heating such as would prevent it from operating properly.

2. A fuse as claimed in claim 1, characterized in that the means for preventing sagging of the link strip comprise projections extending into said space from the wall of the housing toward the link strip, said projections supporting the link strip either permanently or upon initial sagging.

3. A fuse as claimed in claim 1 or 2, characterized in that the means for preventing sagging of the link strip comprise provisions on the link strip.

4. A fuse as claimed in claim 3, characterized in that said means comprise melting point reducing means and means for concentrating the fusing at a pre-determined place.

5. A fuse as claimed in claim 4, characterized in that the melting point reducing means are tin beads and the fusing concentrating means are reductions in size of the strip, holes in the strip, or holes in the strip combined with thickened portions around the holes.

6. A fuse as claimed in claim 5, characterized by a link strip of zinc incorporating a hollow staple of tin with a copper plug being disposed in the cavity of said hollow staple, said plug being supported by, or closely spaced from, a projection from the wall of the housing.

7. A fuse as claimed in claim 5, characterised by a link strip of copper made in two parts interconnected by a tin bead provided by an extrusion-riveting technique.

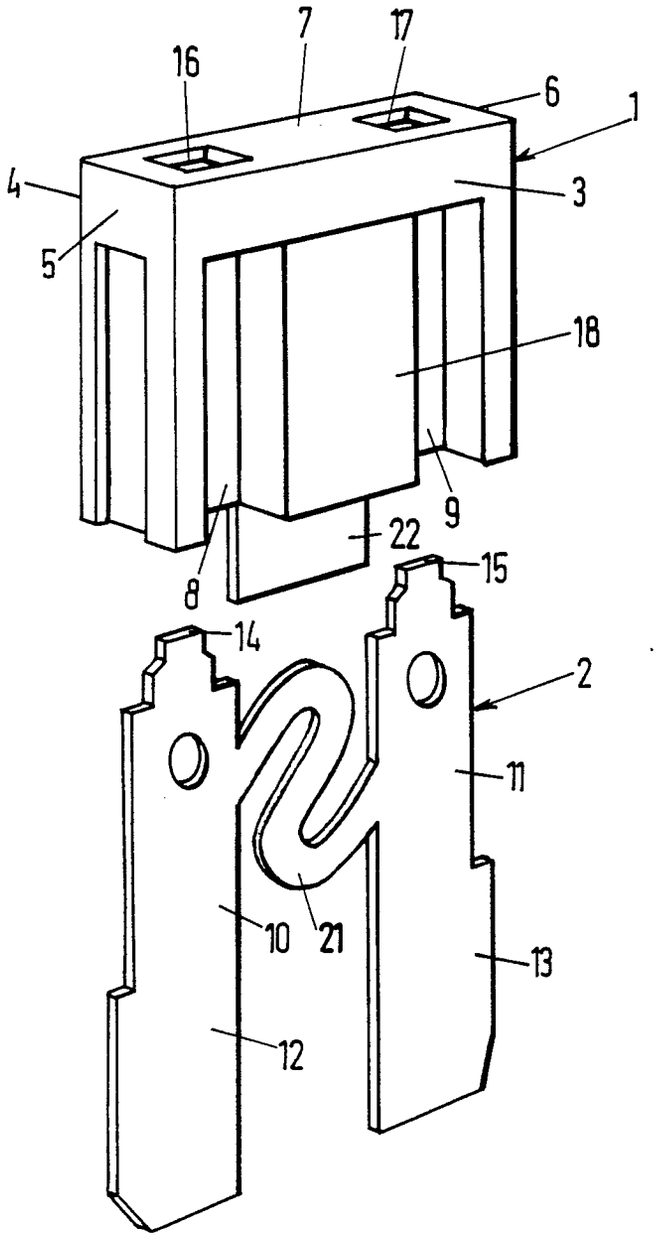

FIG. 1

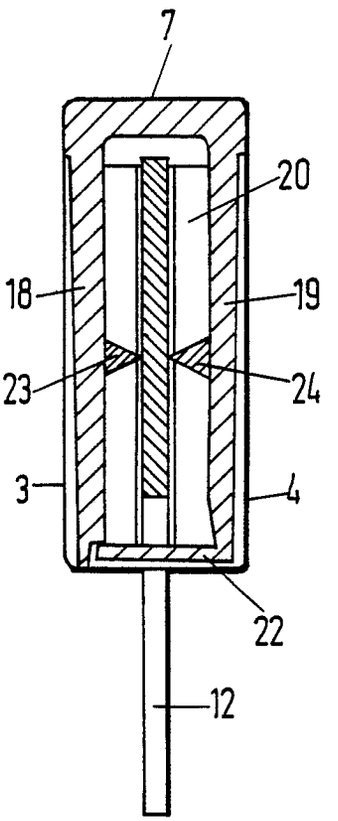

FIG. 2

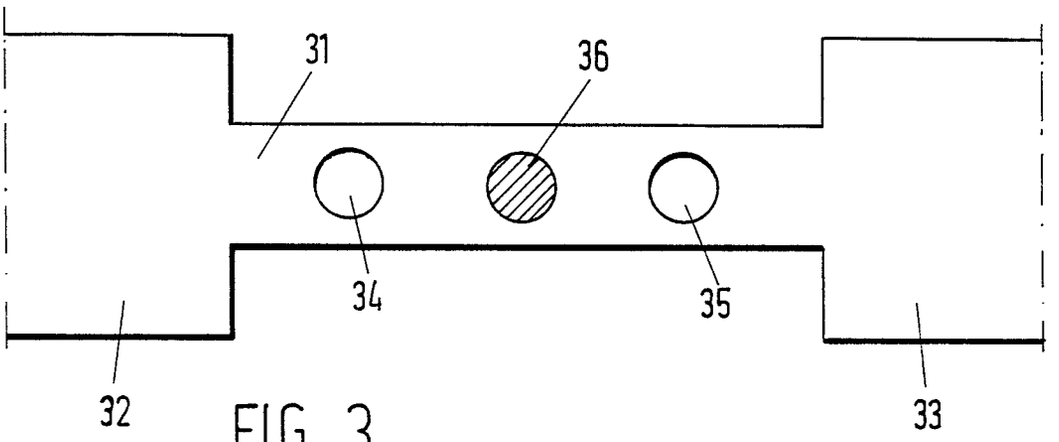

FIG. 3

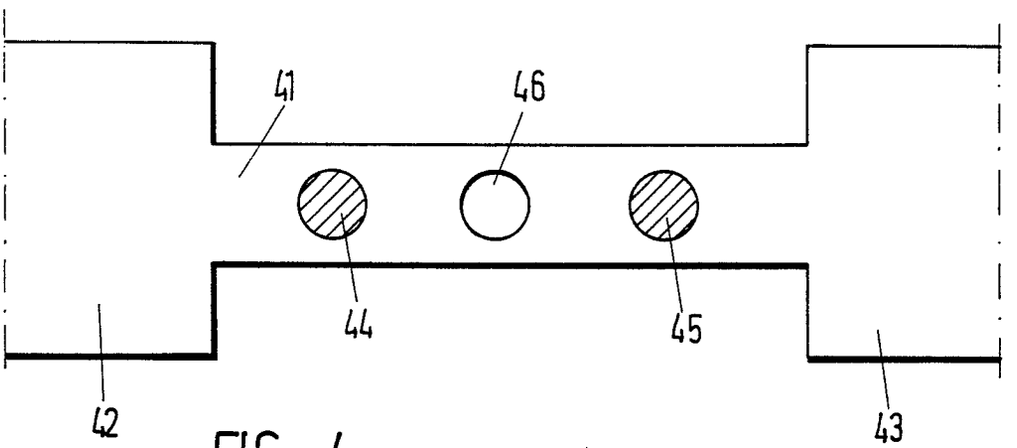

FIG. 4

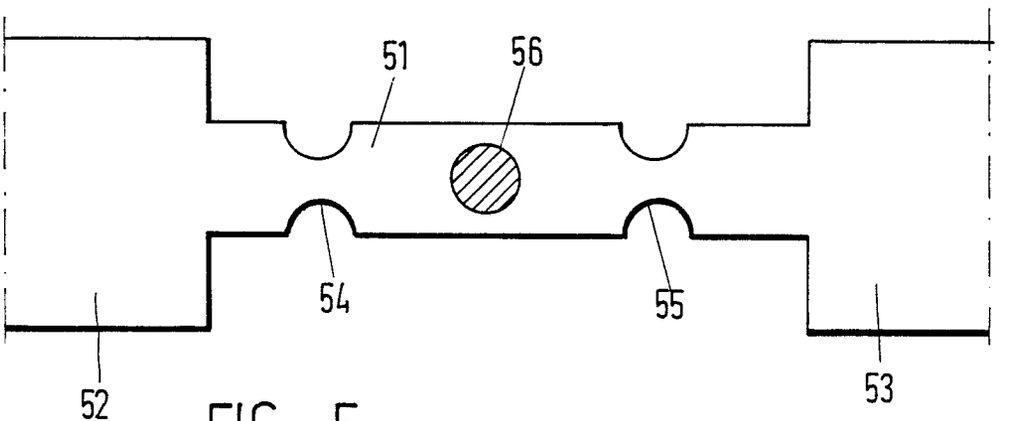

FIG. 5

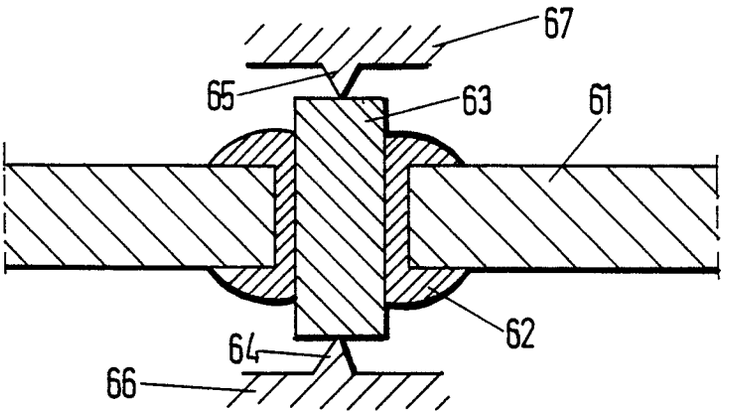

FIG. 6

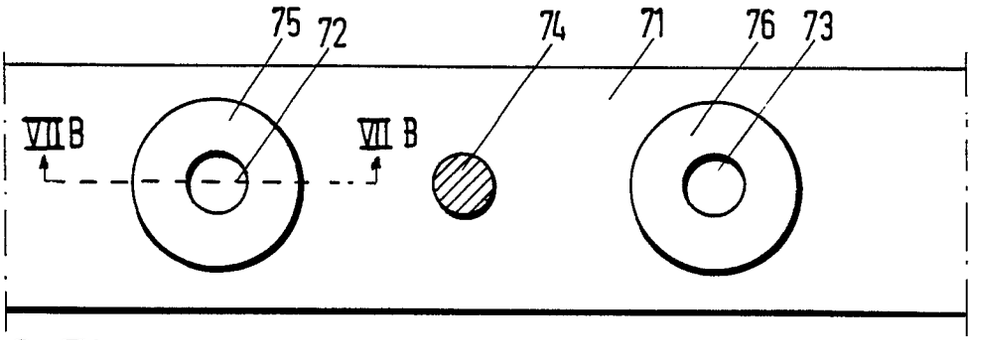

FIG. 7A

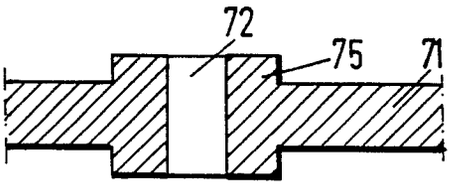

FIG. 7B

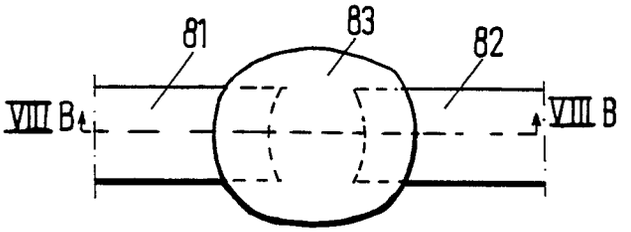

FIG. 8A

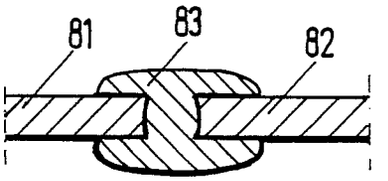

FIG. 8B

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EUROPEAN SEARCH REPORT

Application Number

EP 87 20 1676

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.4)
X	DE-A-2 949 432 (SILLNER) * Page 1, paragraph 1; page 3, paragraph 5; page 9, last paragraph; page 17, last paragraph *	1	H 01 H 85/04
Y,D	US-A-4 344 060 (CIESEMIER) * Figures 1-7; column 4, lines 27-29 *	1,2	
Y	US-A-2 143 031 (RAPP) * Figures 7,13; page 2, column 1, line 75 - column 2, line 14; page 2, column 2, lines 48-52 *	1,2	
Y	GB-A-2 090 081 (BOSLEY) * Figure 1; page 3, lines 110-119,123-126 *	1,3-5,7	
Y	GB-A- 777 057 (PARMITER) * Figures 1-4; page 2, lines 4-16,124-130; page 3, lines 1-4,25-28 *	1,3-5,7	
A	DE-C- 723 352 (GRÜNWALD) * Whole document *	1-7	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 H 85/00
A	GB-A- 439 517 (CRABTREE) * Whole document *	1,3-5,7	
A	DE-U-1 910 594 (SIEMENS)		
A	US-A-2 688 061 (KOZACKA)		
P,L X	US-A-4 635 023 (LITTELFUSE) * Whole document * (This document (assignee LITTELFUSE INC.; filed 22nd May 1985) may throw doubt on the priority claim of the EP PATENT APPLICATION (applicant LITTELFUSE-TRACOR B.V.))	1,3-5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-11-1987	DESMET W.H.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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