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(54) **FUSE WITH AT LEAST ONE MELTING MEMBER**

SICHERUNG MIT MINDESTENS EINEM SCHMELZELEMENT

FUSIBLE DOTÉ D'AU MOINS UN ÉLÉMENT DE FUSION

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EP 2 912 675 B1

Description

[0001] The invention refers to a fuse, which comprises at least one melting member and which is allowed to be deactivated when required, although the electric current there-through has not overcome each pre-determined nominal value, by which a forced interruption of each electric circuit is achieved, into which such fuse is integrated.

[0002] In accordance with the International Patent Classification, such invention belongs to protective elements, which are furnished with a melting member and suitable for protection of electric circuits against overloading. Moreover, such invention can also belong to electricity, namely to basic electric components which are suitable for overvoltage protection and in which a varistor having a positive temperature characteristics is applied.

[0003] The purpose of the invention is to create a fuse with at least one melting member, which could without essentially increasing the number of consisting parts or complexity of manufacturing thereof and therefore in an economical manner enable forced interruption of each electric circuit, into which the fuse is integrated, even in the case, when the electric current in said circuit would not exceed a pre-determined nominal value, at which the melting member would normally have to be interrupted.

[0004] Fuses with melting member, which are well-known to those skilled in the art, usually comprise a body, which is made of an electric insulating material like e.g. ceramics and is furnished with a passage, through which a melting member is inserted, which consists of an electric conductive material and is electrically connected with contact terminals, which are located on the external surface of said body. Said melting member is surrounded with appropriate arc extinguishing material, usually with silica or the like. Dimensions of said melting member are adjusted to conducting electric current below a pre-determine value, and is melted as soon as an excess current occurs, by which the electric circuit throughout said fuse is interrupted.

[0005] However, those skilled in the art are also aware that in certain circumstances such fuse is unable to assure a perfectly reliable protection of the electric circuit. In particular in direct high-voltage electric circuits, in which the value of a direct voltage is e.g. approx. 1.500 V (DC), and the value of the electric current is e.g. approx. 100 A, irregularities like formation of arc in switches or welding of contact terminals or the like may be expected despite to the fact that the value of the electric current is still maintained below a pre-determined nominal value, since in such cases the electric circuit cannot be interrupted just by means of the fuse. Such circumstances usually occur in large electricity accumulating batteries, in photovoltaic plants or the like. Also in electric vehicles, e.g. by crash or various defects, the electric circuit has to be promptly interrupted for precautionary reasons. As known, in such context many sensors are integrated with-

in a vehicle for the purposes of detecting various physical categories, like e.g. accelerations, by which then triggering of airbags or disconnecting of certain appliances is achieved. Thanks to such approaches, a fuse with a melting member has been proposed in DE 203 15 849 U, which is combined with a pyrotechnic triggering assembly, which is activated in certain conditions in order to interrupt the melting member by means of explosion regardless to that the current has not yet reached a pre-determined nominal value. However, integration of such assembly leads to enormous increasing of components and moreover requires a completely technology of manufacturing, and is of these reason also extremely cost consuming. Moreover, application of such fuse in a vehicle, where by crash various volatile fluids or gases may be present, could by triggering said pyrotechnic assembly lead to quite unpredictable consequences.

[0006] A fuse with a melting member, which is disclosed in EP 1 577 906 A2, is integrated into a primary electric circuit and is arranged in a heat-conductive relationship with a temperature depending resistor, through which a secondary electric circuit is established, in which two contact terminals are arranged apart from each other in the area of the fuse, which are electrically interconnected via appropriate melting member, the resistance of which is increasing by increasing proportionally with increasing of the temperature. As soon as the temperature is sufficiently high, the resistance is increased practically up to that level, where the resistor is not conductive anymore, which should normally lead to melting thereof and interruption of the circuit. Such fuse should therefore protect the circuit against overloading. The secondary circuit merely serves for forced interruption of the primary circuit in the case, when the current in the first circuit does not exceed the nominal value, and the melting member is not interrupted due to excess current. In such case, by generating appropriate impulse, said secondary circuit is activated, in which the temperature-depending resistor is exposed to the current, in which the heat is generated, which is thanks to said heat-conductive relationship transferred to the melting member, which starts melting. Also in this case numerous components are required for the purposes of functioning of said forced interruption. Since said melting member is in a heat-conductive relationship with said temperature-depending resistor, upon interruption of the primary circuit due to excess current it is generally possible that via said element, which is in contact with the melting member, a by-pass circuit is established at least for certain time period, through which an electric circuit is still established despite to interruption of the melting member as such.

[0007] The present invention generally refers to a fuse with at least one melting member which is suitable for interrupting each electric circuit extending there-through and which comprises a body consisting of electric insulating material and surrounding each disposable melting member, which is adjusted to each nominal value of the electric current (I) and electrically connected to electric

contact terminals, which are located on the external surface of said body of the fuse and via which said fuse is electrically connectable into each disposable primary electric circuit, which is then by means of said fuse protected against excess current, said fuse, said fuse further comprises a resistor, said resistor is located adjacent to said melting member and in a thermal-conductive relationship with said melting member, and wherein said resistor is electrically connected into a secondary electric circuit, which includes at least one switch, which can be activated in need and independently on situation within the primary electric circuit. Such a fuse is known from JP2000-315451 and WO99/60595. In accordance with the present invention, the resistor is a voltage dependent resistor, i.e. a varistor, the electric resistance of the voltage dependent resistor is inversely proportional to voltage to which it is exposed. The invention further provides that said melting member and said resistor are located within said body of the fuse and are surrounded with a filler suitable for extinguishing of electric arc, in particular with silica.

[0008] The invention moreover provides that said secondary electric circuit, into which said resistor is included, also comprises a switch, which is a remote-controlled switch.

[0009] The invention still further provides that in addition to said electric contact terminals which are electrically connected with said melting member for the purposes of connecting the fuse into each disposable primary electric circuit, at least two further electric contact terminals are arranged on said body, in particular on the external surface thereof, which are intended for connecting said fuse into a secondary electric circuit.

[0010] A fuse according to the invention may also comprise more than one melting member, wherein however each of disposable melting members is arranged in heat-conductive relationship with said resistor.

[0011] The invention also refers to an electric circuit, which includes an electric voltage source and at least one load, and moreover comprises at least one fuse according to anyone of claims. In this, said electric voltage source is preferably a direct voltage source.

[0012] The invention will be described on the basis of an embodiment, which is presented in the attached drawings, wherein

- Fig. 1 is a schematically shown melting member of the fuse combined with a varistor;
- Fig. 2 is a realistic scheme of the melting member according to Fig. 1;
- Fig. 3 is a schematically presented embodiment of a standardized CH-type fuse;
- Fig. 4 is a schematically presented embodiment of a standardized NV-type fuse;
- Fig. 5 is an electric circuit with integrated fuse according to the invention.

[0013] A fuse 1 is foreseen according to the invention,

which is furnished with at least one melting member (Figs. 1 and 2) and is capable to interrupt an electric circuit, into which it is integrated. A standardized CH-type fuse 1 with a single melting member 2, is presented in Fig. 3, while the NV-type fuse also with a single melting member is shown in Fig. 4.

[0014] The fuse 1 comprising a body 10 consisting of electric insulating material and surrounding each disposable melting member 2 which is adjusted to each nominal value of the electric current I within each disposable circuit C' and which is electrically connected with each disposable electric contact terminals 11, 12, which are located on said body 10, in the shown embodiments on the external surface thereof, and via which the fuse 1 is connectable to each primary electric circuit C' , which is then by means of said fuse 1 protected against excess current.

[0015] In accordance with the invention, said fuse 1 also comprises a voltage dependent resistor 3, namely a varistor having a such characteristics that its resistance is inversely proportional to electric voltage to which it is exposed. Said resistor 3 is located adjacent to said single melting member 2, and is therefore arranged in a heat-conductive relationship with said melting member 2. Simultaneously, said resistor 3 is electrically connected into a secondary electric circuit C'' , which is moreover furnished with at least one switch 4, which is optionally a remote-controlled one and can be in the need activated quite independently from each conditions in the primary electric circuit C' , so that the current I' occurs therein, which triggers heating of said varistor 3. Prior to activation of said switch 4, said secondary circuit C'' is interrupted, and the resistance of said varistor 3 is extremely high, so that the varistor 3 located adjacent to said melting member 2 does not have any impact to the situation within the primary circuit C' . When the excess current occurs within the primary circuit C' , at least a portion of said melting member 2 is melted, and the fuse 1 is therefore functioning exactly on the same manner like any other known fuse of such type.

[0016] Whenever the value of Electric current I in the primary circuit C' is below a nominal value, but the primary circuit C' would have to be promptly interrupted of any reason, then the secondary circuit is established and connected to the voltage source by means of activating said switch 4, upon which the current I' starts energizing the resistor 3 and the resistance of said resistor 3 starts decreasing, by which the resistor 3 is then heated quickly and intensively. The heat, which is generated within said resistor 3, is then transferred to the melting member 2, upon which at least a portion thereof is melted, by which in emergency a forced interruption of said primary circuit C' can be achieved, although the excess current has not occurred therein at all.

[0017] Moreover, the invention provides that the melting member 2 and the resistor 3 are both located within the body 10 of said fuse 1 and surrounded with a filler which is suitable for reducing effects of electric arc i.e.

for extinguishing thereof, in particular with silica.

[0018] Corresponding to earlier explanations, in addition to said electric contact terminals 11, 12 which are electrically connected with the melting member 2 for the purposes of connecting the fuse 1 into a primary circuit C', at least two additional electric contact terminals 13', 13'' are located on the external surface 10 of the fuse 1 (Figs. 3 and 4), which are electrically connected with said resistor 3 and are intended for connection of the fuse 1 into the secondary electric circuit C''.

[0019] Whenever the fuse 1 is used for protecting an electric circuit with high nominal current value, then at least two melting members 2 ought to be used. In such cases, each disposable melting member 2 must be arranged in the previously mentioned heat-conductive relationship with the resistor 3.

[0020] The invention also refers to an electric circuit, which includes at least a voltage source 5, in particular a direct voltage source, at least one load 6, and also at least one fuse 1 characterized by previously disclosed features.

Claims

1. Fuse (1) with at least one melting member (2) which is suitable for interrupting each electric circuit extending there-through and which comprises a body (10) consisting of electric insulating material and surrounding each disposable melting member (2), which is adjusted to each nominal value of the electric current (I) and electrically connected to electric contact terminals (11, 12), which are located on the external surface of said body (10) of the fuse (1) and via which said fuse (1) is electrically connectable into each disposable primary electric circuit (C'), which is then by means of said fuse (1) protected against excess current, said fuse (1), said fuse (1) further comprises a resistor (3), said resistor (3) is located adjacent to said melting member (2) and in a thermal-conductive relationship with said melting member (2), and wherein said resistor (3) is electrically connected into a secondary electric circuit (C''), which includes at least one switch, (4), which can be activated in need and independently on situation within the primary electric circuit (C'), **characterized in that** said resistor is a voltage dependent resistor, i.e. a varistor (3), the electric resistance of the voltage dependent resistor is inversely proportional to voltage to which it is exposed.
2. Fuse according to Claim 1, **characterized in that** said melting member (2) and said resistor (3) are located within said body (10) of the fuse (1) and are surrounded with a filter suitable for extinguishing of electric arc, in particular with silica.
3. Fuse according to Claim 1 or 2, **characterized in**

that said secondary electric circuit (C''), into which said resistor (3) is included, also comprises a switch (4), which is a remote-controlled switch.

4. Fuse according to anyone of the preceding Claims, **characterized in that** in addition to said electric contact terminals (11, 12) which are electrically connected with said melting member (2) for the purposes of connecting the fuse (1) into each disposable primary electric circuit (C'), at least two further electric contact terminals (13', 13'') are arranged on said body (10), in particular on the external surface thereof, which are intended for connecting said fuse (1) into a secondary electric circuit (C'').
5. Fuse according to anyone of the preceding Claims, **characterized in that** it comprises more than one melting member (2), wherein each of disposable melting members (2) is arranged in heat-conductive relationship with said resistor (3).
6. Electric circuit, which includes an electric voltage source (5) and at least one load (6), further **comprising** at least one fuse (1) according to anyone of Claims 1 - 5.
7. Electric circuit according to Claim 6, **characterized in that** said electric voltage source (5) is a direct voltage source.

Patentansprüche

1. Sicherung (1) mit mindestens einem Schmelzeinsatz (2), die dafür geeignet ist, jeden elektrischen Stromkreis zu unterbrechen, der dort hindurch verläuft, und die einen Körper (10) umfasst, der aus einem elektrisch isolierenden Material besteht und jeden Wegwerf-Schmelzeinsatz (2) umgibt, der auf jeden Nennwert des elektrischen Stroms (I) eingestellt wird und elektrisch mit elektrischen Kontaktanschlüssen (11, 12) verbunden ist, die sich auf der Außenfläche des Körpers (10) der Sicherung (1) befinden und über die die Sicherung (1) elektrisch mit jedem wegwerfbaren Primärstromkreis (C') verbunden werden kann, der dann mittels der Sicherung (1) vor Überstrom geschützt ist, wobei die Sicherung (1) des Weiteren einen Widerstand (3) umfasst, wobei der Widerstand (3) neben dem Schmelzeinsatz (2) angeordnet ist und in einer wärmeleitfähigen Beziehung mit dem Schmelzeinsatz (2) steht, und wobei der Widerstand (3) elektrisch mit einem Sekundärstromkreis (C'') verbunden ist, der mindestens einen Schalter (4) umfasst, der bei Bedarf und situationsunabhängig innerhalb des Primärstromkreises (C') aktiviert werden kann, **dadurch gekennzeichnet, dass** der Widerstand ein spannungsabhängiger Widerstand, das heißt ein Varistor (3), ist, wobei sich

der elektrische Widerstandswert des spannungsabhängigen Widerstands umgekehrt proportional zu der an ihn angelegten Spannung verhält.

2. Sicherung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Schmelzeinsatz (2) und der Widerstand (3) innerhalb des Körpers (10) der Sicherung (1) angeordnet sind und von einem Füllmaterial umgeben sind, das geeignet ist, einen elektrischen Lichtbogen zu löschen, insbesondere Kieselsäure. 10
3. Sicherung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Sekundärstromkreis (C''), in dem der Widerstand (3) enthalten ist, außerdem einen Schalter (4) umfasst, der ein ferngesteuerter Schalter ist. 15
4. Sicherung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** zusätzlich zu den elektrischen Kontaktanschlüssen (11, 12), die elektrisch mit dem Schmelzeinsatz (2) verbunden sind, um die Sicherung (1) mit jedem wegwerfbaren Primärstromkreis (C') zu verbinden, mindestens zwei weitere elektrische Kontaktanschlüsse (13', 13'') an dem Körper (10), insbesondere an dessen Außenfläche, angeordnet sind, die dafür vorgesehen sind, die Sicherung (1) mit einem Sekundärstromkreis (C'') zu verbinden. 20
5. Sicherung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie mehr als einen Schmelzeinsatz (2) umfasst, wobei jeder der Wegwerf-Schmelzeinsätze (2) in wärmeleitfähiger Beziehung mit dem Widerstand (3) angeordnet ist. 25
6. Stromkreis, der eine elektrische Spannungsquelle (5) und mindestens eine Last (6) enthält, und des Weiteren mindestens eine Sicherung (1) nach einem der Ansprüche 1-5 umfasst. 30
7. Stromkreis nach Anspruch 6, **dadurch gekennzeichnet, dass** die elektrische Spannungsquelle (5) eine Gleichspannungsquelle ist. 35

Revendications

1. Fusible (1) avec au moins un élément de fusion (2) qui est approprié pour interrompre chaque circuit électrique s'étendant en son sein et qui comprend un corps (10) constitué d'un matériau isolant électrique et entourant chaque élément de fusion jetable (2), qui est ajusté à chaque valeur nominale du courant électrique (1) et électriquement connecté à des bornes de contact électrique (11, 12), lesquelles sont situées sur la surface externe dudit corps (10) du fusible (1) et par l'intermédiaire desquelles ledit fusible (1) est électriquement connectable dans cha-

que circuit électrique primaire jetable (C'), qui est ensuite au moyen dudit fusible (1) protégé contre du courant en excès, ledit fusible (1) comprenant en outre une résistance (3), ladite résistance (3) étant située de manière adjacente audit élément de fusion (2) et dans une relation thermoconductrice avec ledit élément de fusion (2), et dans lequel ladite résistance (3) est électriquement connectée dans un circuit électrique secondaire (C''), qui inclut au moins un commutateur (4), qui peut être activé au besoin et indépendamment de la situation au sein du circuit électrique primaire (C'), **caractérisé en ce que** ladite résistance est une résistance dépendante de la tension, c'est-à-dire une varistance (3), la résistance électrique de la résistance dépendante de la tension est inversement proportionnelle à la tension à laquelle elle est exposée,

2. Fusible selon la revendication 1, **caractérisé en ce que** ledit élément de fusion (2) et ladite résistance (3) sont situés au sein dudit corps (10) du fusible (1) et sont entourés d'une charge appropriée pour l'extinction de l'arc électrique, en particulier de silice. 40
3. Fusible selon la revendication 1 ou la revendication 2, **caractérisé en ce que** ledit circuit électrique secondaire (C''), dans lequel ladite résistance (3) est incluse, comprend également un commutateur (4), qui est un commutateur commandé à distance. 45
4. Fusible selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'en plus** desdites bornes de contact électrique (11, 12) qui sont électriquement connectées audit élément de fusion (2) aux fins de connecter le fusible (1) dans chaque circuit électrique primaire jetable (C') au moins deux autres bornes de contact électrique (13', 13'') sont disposées sur ledit corps (10), en particulier sur la surface externe de celui-ci, lesquelles sont destinées à connecter ledit fusible (1) dans un circuit électrique secondaire (C''). 50
5. Fusible selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend plus d'un élément de fusion (2), dans lequel chacun des éléments de fusion jetables (2) est disposé dans une relation de conduction de chaleur avec ladite résistance (3). 55
6. Circuit électrique, qui inclut une source de tension électrique (5) et au moins une charge (6), comprenant en outre au moins un fusible (1) selon l'une quelconque des revendications 1 à 5.
7. Circuit électrique selon la revendication 6, **caractérisé en ce que** ladite source de tension électrique (5) est une source de tension directe.

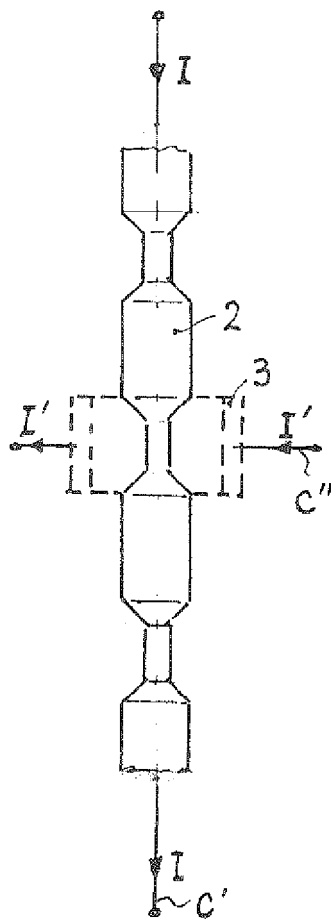


Fig. 1

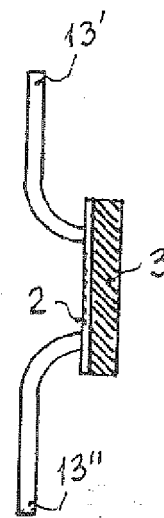


Fig. 2

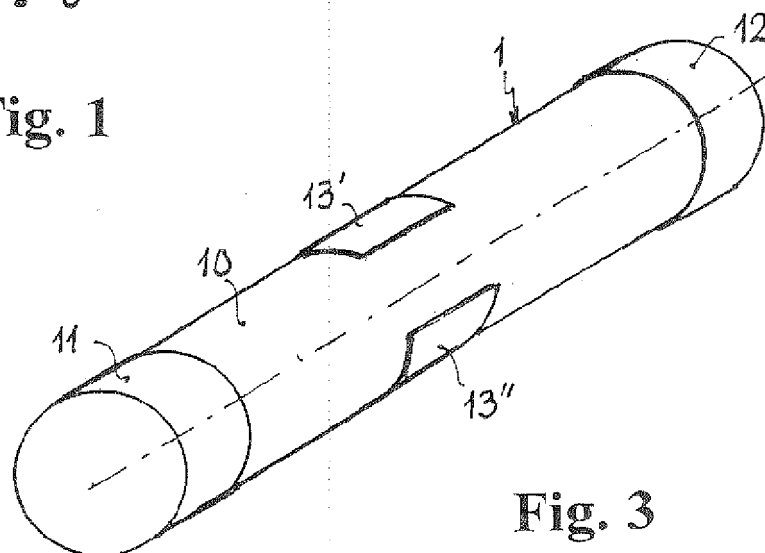


Fig. 3

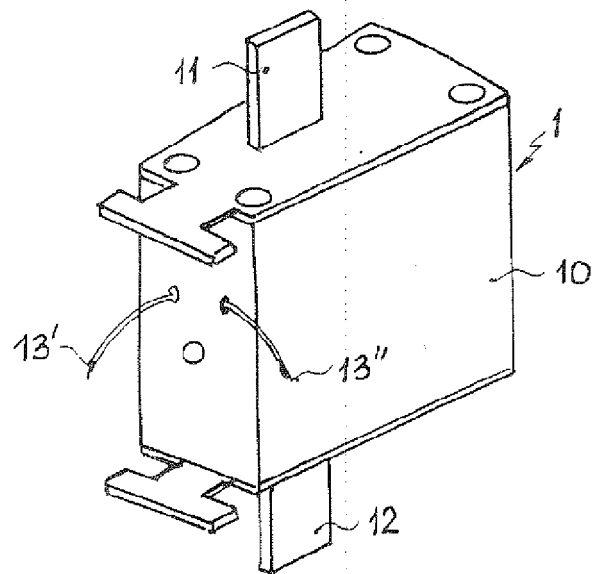


Fig. 4

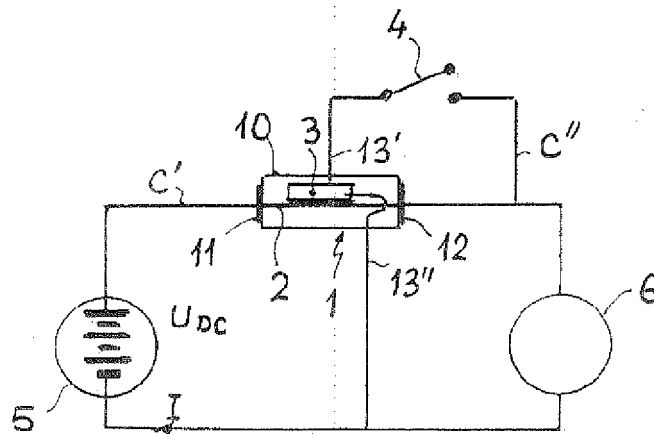


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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