United States Patent [19]

Cinquin

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[45] **Mar. 26, 1974**

[54] **FUSE CARTRIDGE**

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[73] Assignee: "**Lucien Ferraz & Cie**", Lyon, France

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[52] **U.S. Cl.** **337/203**, 337/276

[51] **Int. Cl.** **H01h 85/02**

[58] **Field of Search** 337/203, 204, 276, 249, 337/250, 281, 239, 161, 280; 200/150

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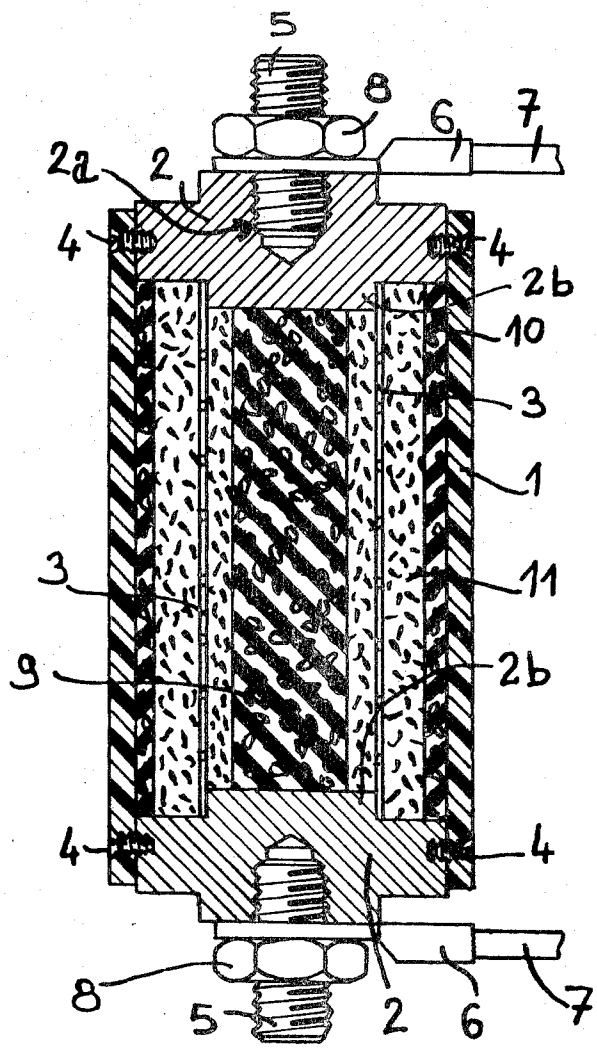
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Primary Examiner—Bernard A. Gilheany
Assistant Examiner—F. E. Bell
Attorney, Agent, or Firm—Alexander & Dowell

[57] **ABSTRACT**

In a fuse cartridge of the kind comprising a tubular body, a pair of heads respectively disposed at the ends of this body to close same and to define therewith a non liquid-tight inner space, and fusible elements which connect the said heads with each other, there is provided within the latter pressure damping means to reduce the pressure peak which is applied to the outer body when the cartridge operates. These means may be in the form of a core and/or a sleeve of a flexible cellular material with closed cells, or of a deformable container filled with a gas under an appropriate pressure, or of calibrated holes which connect the inner space of the cartridge with the outside, the inner ends of such holes being covered by a grid which retains the arc quenching material in which the fusible elements of the cartridge are embedded. Such a cartridge is more particularly adapted for operation within an oil tank.

10 Claims, 2 Drawing Figures



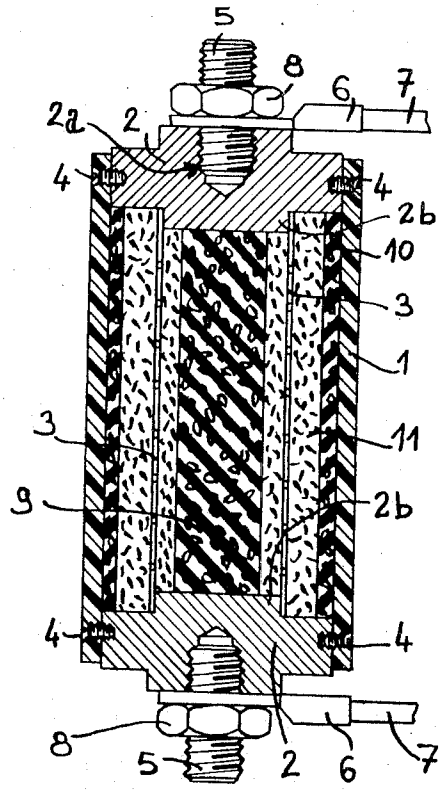
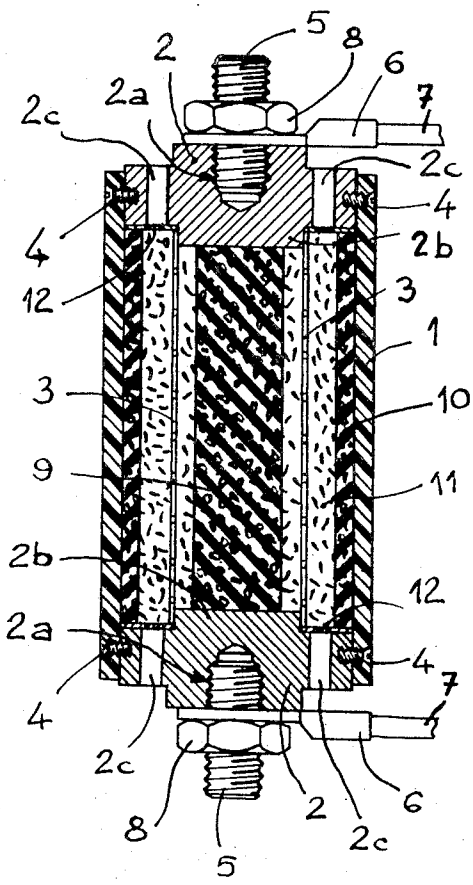

5
8
6
7
2a
2
4
4
2b
10
3
1
3
11
9
2b
4
4
8
5
2
6
7

Fig. 1

Fig. 2


5
2
8
6
7
2a
2c
2c
4
4
2b
12
3
1
3
10
9
11
2b
12
2a
4
4
7
2c
6
8
2
2c
5

FUSE CARTRIDGE

The present invention relates to fuse cartridges and it more particularly concerns those which are intended for being immersed in an insulating oil.

It is known that electric current converters operating with semi-conductor devices are often immersed in an insulating liquid within an appropriate tank. The fuse cartridges adapted to protect such converters should also be disposed within the tank. Since it is relatively difficult and expensive to realize a perfectly oil-tight fuse cartridge it has been proposed to provide such a cartridge with holes through which oil may fill its inner space. But such an arrangement has the disadvantage that when the cartridge "blows", the resulting pressure wave is no more damped by an air cushion as in ordinary cartridges. The cartridge body is therefore submitted to abnormally high pressures and it may burst before the electric arc is quenched by the arc quenching material generally provided within the cartridge.

It is an object of the present invention to provide a fuse cartridge which may operate in a quite satisfactory manner when it is immersed in an insulating oil.

Another object of the invention is to provide a fuse cartridge wherein the inner pressure cannot reach such values that the body of the cartridge may be damaged.

In accordance with the present invention a fuse cartridge comprises within its outer body means for absorbing a fraction of the energy which appears in the form of a pressure wave when the cartridge operates. The said means are preferably formed of a mass of a flexible cellular material with closed cells. In a modified embodiment these means may comprise a deformable gas-tight container filled with a gas under an appropriate pressure.

According to another modification the said means comprise calibrated holes through which the inner space of the cartridge may communicate with the outer liquid mass in which the cartridge is immersed.

In the accompanying drawings:

FIG. 1 is a longitudinal section of a fuse cartridge according to the invention.

FIG. 2 is a longitudinal section of a modified embodiment.

Referring to FIG. 1 the fuse cartridge comprises a tubular insulating outer body **1**, made for instance of a ceramic material or of an appropriate synthetic material re-inforced by glass fibres. Each end of this body **1** is closed by a metallic head **2**, preferably made of copper, the said heads being electrically connected with each other by a number of fusible elements **3** in the conventional manner. In the example illustrated heads **2** are secured in position by radial screws such as **4**. Each head **2** has an outwardly opening screw-threaded blind bore **2***a* which receives a gudgeon **5**. The eyelet **6** provided at the end of the corresponding wire **7** is clamped on this gudgeon **5** by means of a nut **8**. Each head further comprises an inner cylindrical boss **2***b* on the periphery of which the corresponding ends of the fusible elements **3** are soldered.

A central cylindrical mass or core **9** of a flexible cellular material with closed cells, as for instance neoprene, is axially disposed within the cartridge between bosses **2***b*, the fusible elements **3** being arranged around said core and at a distance therefrom. A tubular layer or sleeve **10** made of a similar material is further

provided against the inner side of body **1**. The annular space comprised between the central mass **9** and the sleeve **10** is filled with an appropriate arc quenching material **11** such as quartz sand, in which elements **3** are embedded.

When the fuse cartridge of FIG. **1** is immersed in an insulating oil, since its heads **2** are not mounted in a perfectly liquid-tight manner, it becomes progressively filled with oil, the latter impregnating the arc quenching material **11**. But when the cartridge operates, as for instance under the action of an overload, the pressure wave which appears in its inner space is damped by the cellular material which forms the central mass or core **9** and the peripheral sleeve **10**, each closed cell of this material acting as a minute gas cushion. Bursting of the outer body **1** is thus avoided even under a severe short circuit, and the arc which is formed within the arc quenching material **11** may be effectively quenched by the latter.

In the modification of FIG. **2** each head **2** has a number of perforations **2***c*, each being associated with a grid **12** which prevents the granular arc quenching material **11** from escaping outwardly. The operation remains substantially as above described, but when the cartridge operates a fraction of the gases generated by the inner electric arc may exhaust freely through perforations **2***c* if the latter have been appropriately calibrated with respect to the nominal operating rate of the cartridge. This helps to reduce the peak of the inner pressure wave to which the outer body **1** of the cartridge is submitted.

In a further modification (not illustrated) the pressure wave damping means may be in the form of a deformable container filled with a gas under an appropriate pressure, as for instance of a cylindrical box made of a synthetic material, filled with air at atmospheric pressure and disposed centrally in lieu of the cellular core **9** of FIGS. **1** and **2**. Here again such a deformable container would act as a cushion for damping most of the pressure wave when the cartridge operates.

Although the fuse cartridge according to the invention is primarily designed for operation within an oil tank or the like, it should be understood that it might also be used under normal conditions, i. e. in the atmosphere, more particularly in the embodiment of FIG. **1**, since in such a case the damping action of the cellular material would reduce in a substantial manner the pressure peak during operation and would therefore permit of providing an outer body of reduced thickness, if desired.

I claim:

1. A fuse cartridge comprising:

an outer tubular body having two open ends, an inner side and an outer side;

a pair of terminal heads, each mounted at one end of said outer body to define therewith an inner space, with said body insulating electrically said heads from each other;

fusible elements connecting said heads with each other within said inner space;

a mass of arc quenching material in which said fusible elements are embedded within said inner space;

and at least one cellular mass of a flexible material with closed cells also disposed within said inner space to damp the pressure wave which appears when said cartridge operates, said cellular mass being separated from said fusible elements by at

least a portion of said mass of arc quenching material.

2. In a fuse cartridge as claimed in claim 1, said cellular mass being in the form of a substantially cylindrical core disposed substantially axially of said body, with said mass of arc quenching material and said fusible elements embedded therein being situated around said core.

3. In a fuse cartridge as claimed in claim 1, said cellular mass being in the form of a sleeve applied against the inner side of said outer body, with said mass of arc quenching material and said fusible elements embedded therein, being disposed within said sleeve.

4. In a fuse cartridge as claimed in claim 1, a first cellular mass in the form of a substantially cylindrical core disposed substantially axially of said body, a second cellular mass in the form of a sleeve applied against the inner side of said outer body and defining with said core an annular intermediate space, with said mass of arc quenching material and said fusible elements embedded therein being disposed in said annular intermediate space.

5. In a fuse cartridge as claimed in claim 4, said arc quenching material being granular; said heads having calibrated holes to form a communication between said intermediate annular space and the outside, said holes having an inner end and an outer end; and grids covering the inner ends of said holes to prevent said arc quenching material from escaping therethrough.

6. In a fuse cartridge as claimed in claim 1, said arc quenching material being granular; said heads having calibrated holes to form a communication between said inner space and the outside, with said holes having an inner end and an outer end; and grids covering the inner ends of said holes to prevent said granular arc quenching material from escaping therethrough.

7. A fuse cartridge comprising:

an outer tubular body having two open ends, an inner side and an outer side;

a pair of terminal heads, each mounted at one end of said outer body to define therewith an inner space, with said body insulating electrically said heads from each other;

fusible elements connecting said heads with each other within said inner space;

and at least one pressure contractable means disposed within said inner space to damp the pressure wave which appears when said cartridge operates;

said contractable member being formed of a mass of a flexible cellular material with closed cells; and

said mass being in the form of a sleeve applied against the inner side of said outer body, with said fusible elements being spaced from said sleeve.

8. A fuse cartridge comprising:

an outer tubular body having two open ends, and an inner side and an outer side;

a pair of terminal heads, each mounted at one end of said outer body to define therewith an inner space, with said body insulating electrically said heads from each other;

fusible elements connecting said heads with each other within said inner space;

and at least one pressure contractable means disposed within said inner space to damp the pressure wave which appears when said cartridge operates;

a substantially first pressure contractable member in the form of a cylindrical core made of a flexible cellular material with closed cells, said core being disposed axially of said body between said heads, with said fusible elements being situated around said core while being spaced therefrom; and

a second pressure contractable member in the form of a sleeve also made of a flexible cellular material with closed cells, said sleeve being applied against the inner side of said outer body with said fusible elements being spaced from said sleeve.

9. In a fuse cartridge as claimed in claim 8, a mass of a granular arc quenching material disposed between said core and said sleeve to embed said fusible elements.

10. In a fuse cartridge as claimed in claim 9, calibrated holes provided in said heads to form a communication between said inner space and the outside, said holes having an inner end and an outer end ; and grids covering the inner ends of said holes to prevent said arc quenching material from escaping therethrough.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,800,262 Dated March 26, 1974

Inventor(s) JEAN PIERRE CINQUIN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent (first column)

between lines 6 and 7 insert:

[30] Foreign Application Priority Date

December 30, 1970 - France - No. 70.47712

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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