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Palmer

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[54] CONNECTING DEVICES

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[56] **References Cited**

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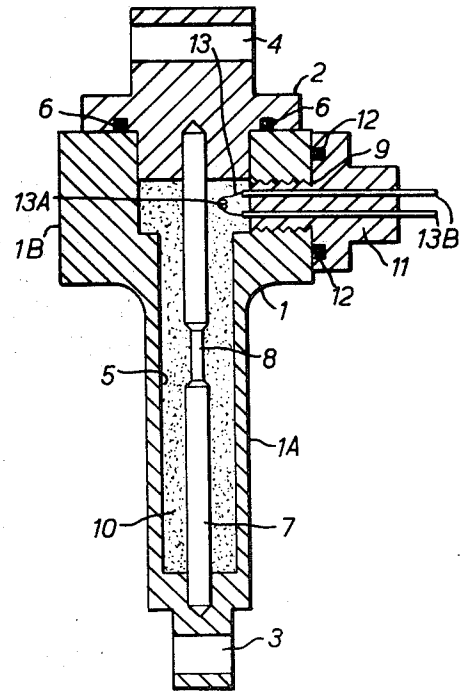
Primary Examiner—Samuel W. Engle

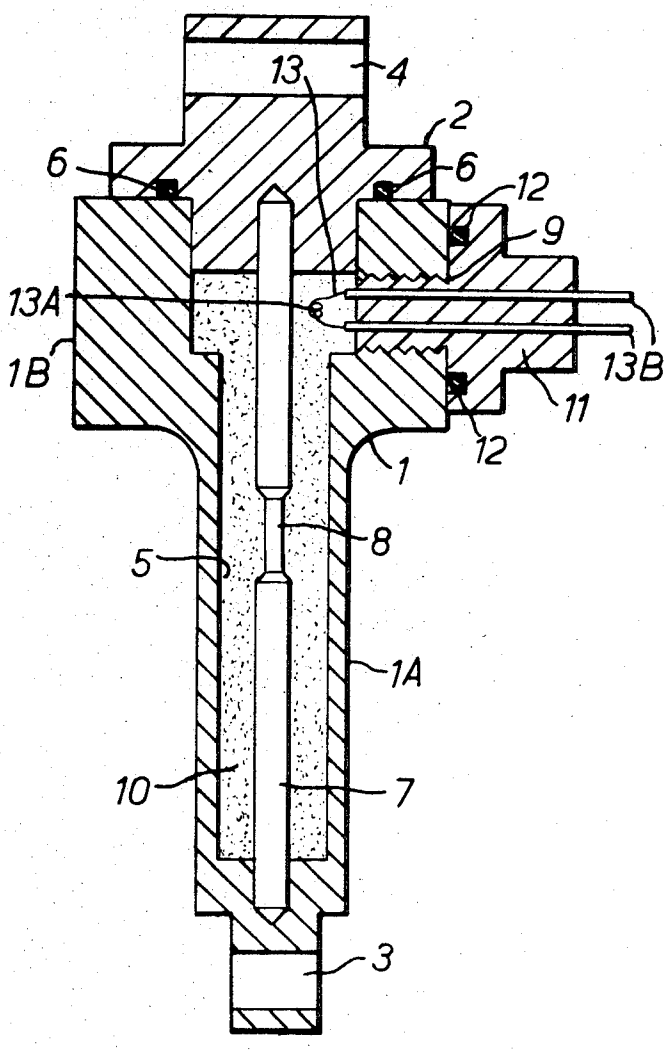
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[57] **ABSTRACT**

Irreversibly severable mechanical and/or electrical linkage useful in submarine oceanographs comprises a connecting member in contact with a thermite mixture which may be ignited so as to destroy the connecting member. Advantageously the connecting member may be of aluminum and the thermite mixture may comprise silicon and red lead.

4 Claims, 1 Drawing Figure




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13B
1B
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CONNECTING DEVICES

This invention relates to connecting devices for providing physical and/or electrical connection between two components which connection may need to be irreversibly severed. Such devices are particularly applicable to submarine oceanographic recording instruments which, having gathered the desired data on the sea bed, are required to release a buoyant capsule containing the recorded information.

Such submarine oceanographic recorders comprise a lower weighted component and an upper buoyant component containing the recording instruments. Hitherto, the components have been connected by a metal linkage surrounded by a detonating chemical, which, when detonated by means of a sonar signal from the surface, severs the metal linkage.

The presence of a detonating material in such equipment represents a safety hazard, particularly during storage. It is this defect which the present invention has been designed to mitigate.

The invention provides a mechanical and/or electrical linkage comprising a connecting member in contact with a thermite mixture, as herein defined, and means for igniting the mixture, the connecting member being such that it is fused or destroyed at the temperature of ignition of the mixture.

The connectiong member is preferably metallic and will normally be so when the linkage is required to provide electrical connection. The preferred material is magnesium or, particularly, aluminum. Where only a mechanical connection is needed it may be possible to employ a connecting member of a resinous material, for example P.V.C.

It is preferred to employ a rod-shaped connecting member having a constriction located at a central point in the thermite mixture where rupture will most readily take place.

The thermite mixture is defined as any mixture of oxidizing and reducing agents capable of being ingited, such compositions are well known in 'thermite' processes and in other applications, such as delayed fused compositions. (See, for example, British Pat. 760,360). Examples of oxidizing agents which may be used in such compositions include red lead, lead dioxide, manganese dioxide, potassium nitrate, potassium permanganate, potassium perchlorate, sodium dichromate and potassium dichromate. Examples of reducing agents which may be used include sulphur, silicon, magnesium, antimony, aluminum, calcium silicide, zirconium, ferrosilicon and titanium. It is desirable that the thermite composition should burn without appreciable evolution of gas which would give rise to the possibility of explosion, either accidentally in storage or during use. For this reason it is preferred to use silicon as a reducing agent and red lead as an oxidizing agent.

The ratios of oxidizing to reducing agent used in the compositions will preferably be approximately those demanded by the stoichiometry of the combustion reaction. In some cases it may be desired to depart somewhat from these proportions in order, for example, to reduce the burning speed of the mixture. The preferred compositions are mixtures of silicon and red lead containing 20 to 40 percent by weight of silicon and 80 to 60 percent by weight of red lead, e.g., compositions comprising substantially 30 percent by weight of silicon and substantially 70 percent by weight of red lead.

The components of the thermite mixture should be as finely pulverized and intermixed as possible. Preferably, the particle size of the mixture is not greater than that capable of passing a 60 BSM size sieve.

The linkage comprises an ignition means set to operate in response to a chosen type of stimulus. The ignition means may be, for example, an electric filament, preferably coated with a small quantity of a readily combustible material such as a styphnate, or a miniature electrical detonator in an appropriate trigger circuit which may be activated by a given signal, for example an electrical, radio, photoelectric, mechanical or acoustic signal.

The linkage of the invention may be employed in a variety of applications, for example as a means of irreversibly disrupting an electric circuit through a metal connecting member and as a so-called 'one-shot' device where the connecting member mechanically restrains the closure of a relay circuit of a safety or alarm mechanism.

The preferred use, as indicated above, is in submarine oceanographic equipment. In this case the container for the thermite mixture will normally be in contact with sea water during use and this will exert a colling effect upon the thermite mixture when ignited. It is therefore advisable to construct the container with a wall thick enough to provide an appreciable degree of thermal insulation.

Where the linkage is used to provide a mechanical connection, the thermite mixture surrounding the connecting member will normally be contained in a casing one end of which is closed by one of the two separable components which are joined by the connecting member. In the case of a submarine oceanograph, it is desirable that the casing should be of some deformable material which will transmit hydrostatic pressure since otherwise the buoyant component may still be held down into the casing by hydrostatic pressure even after the connecting member has ruptured. A suitable material for the casing has been found to by polypropylene of thickness ca. ⅛ inch cms. However, the casing should not be too thin lest on combustion it is destroyed before the connecting member is severed. The nature and dimensions of the novel linkage and the nature of the thermite mixture will determine the minimum permissible thickness of the casing in any given case. Most desirably the thickness and material of the casing are chosen so that after severance of the connecting member and a continued burning of the hermite mixture the casing itself is melted and ruptures, thus equalizing hydrostatic pressure within and without the linkage.

A preferred device of the invention suitable for use with submarine oceanographic will now be described with reference to the accompanying drawing, which is a side elevation in section and to scale.

The apparatus comprises a polypropylene body 1 surrounded by a cap 2 which fits loosely in the top of the container. The central cylindrical section 1A of the body 1 is approximately 1 inch in diameter and ⅛ inch thick and the thicker upper section 1B is also cylindri-

cal and has a diameter of approximately 2⅝ inches. Holes 3 and 4 at the bottom of the body 1 and in the top of the cap 2 respectively provide means of connection to a lower weighted component (not shown) and an upper, instrumented buoyant component (not shown) which make up the oceanograph.

Within the body 1 is a chamber 5 kept watertight by means to the an O-ring seal between the body 1 and the cap 2. The chamber 5 connects with a smaller cylindrical cavity 9 set sideways into the upper thicker section 1B of the body 1 and closed to outside by a plug 11 and O-ring seal 12. The plug 11 is screwed into the cavity 9. Within the chamber 5, with its ends fixed in the cap 2 and the base of the body 1, is centrally located an aluminum tie rod 7 which is substantially cylindrical but with a central construction 8.

The tie rod 7 is surrounded by a thermite mixture 10 consisting of substantially 30 parts by weight of silicon and substantially 70 parts by weight of red lead (triplumbic tetroxide) of particle size such as will pass a 60 mesh BSM sieve.

Set in the thermite mixture 10 is an electrical ignitor 13 comprising an electrical filament 13A and electrical connections 13B thereto. The filament 13A is finely coated with a lower layer of lead styphnate and an upper layer of 5 grains of gunpowder to encourage ignition of the thermite mixture. When the apparatus is in use, the connections 13B are connected to a circuit (not shown) which may be activated by a sonar device. The assembled oceanograph comprising the linkage shown and the weighted and instrumented buoyant components affixed at 3 and 4 respectively rests on the sea bed until activation of the said circuit by a sonar signal. Thereupon a current is caused to flow through the filament of the igniter 13 thus igniting the thermite 10 and fusing and breaking the tie rod 7 at the central construction. The buoyant upper component of the oceanograph is then free to float upwards, bearing with it the cap 2 and the upper fragment of the tie rod 7. The disengagement is not prevented by hydrostatic pressure bearing down on the cap 2 since the polypropylene of the body 1 is sufficiently deformable to transmit hydrostatic pressure to the inside of the chamber 5. Moreover after the rupture of the tie rod 7 the continued burning of the thermite mixture normally fuses and breaks the walls of the body 1 so that hydrostatic pressure above and below cap 2 is equalized.

I claim:

1. A submarine oceanograph comprising at least two separable portions which are positioned apart and joined by a fuseable magnesium or aluminum connecting member, said connecting member being in contact with a thermite-type mixture comprising from 20 percent to 40 percent by weight of silicon and from 80 percent to 60 percent by weight of red lead, means for igniting said thermite-type mixture, a casing surrounding said thermite-type mixture, said casing being composed of a deformable material which will transmit hydrostatic pressure, whereby when said igniting means ignites said thermite-type mixture said thermite-type mixture severs said connecting member and said two separable portions become separated.

2. A submarine oceanograph according to claim 1 wherein said thermite-type mixture comprises substantially 30 percent by weight of silicon and substantially 70 percent by weight of red lead.

3. A submarine oceanograph according to claim 1 wherein said thermite-type mixture has a particle size to be able to pass through a 60 BSM sieve.

4. A submarine oceanograph according to claim 1 wherein said deformable material is polypropylene.

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