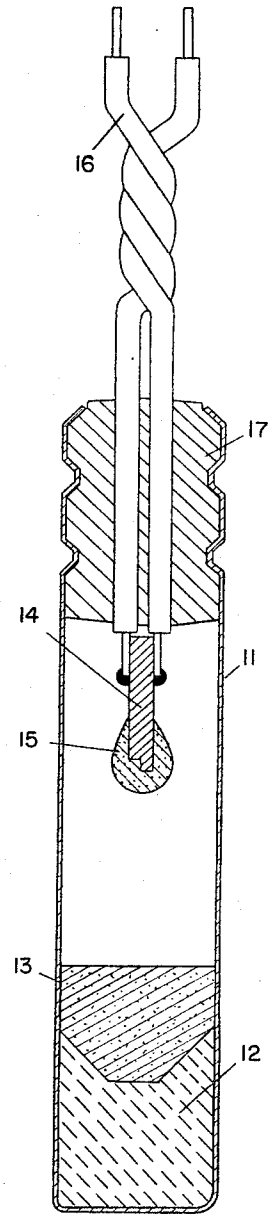
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SEISMIC DETONATOR

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SEISMIC DETONATOR

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This invention relates to a detonator designed for use with explosives for marine seismographic exploration.

In marine seismographic prospecting, charges of explosives comprising an electric detonator, booster and main explosive charge are fired under water, and occasionally a charge accidentally fails to fire or breaks away from the firing line and sinks to the seabed. The detonators presently used can remain under great depths of sea water for a very long time without desensitisation of their fusehead or the detonator explosive charges and there is, therefore, a risk of a "live" detonator from a misfired charge being washed up or dragged from the sea. Exposure of the fusehead and explosive charges of the detonators to water or water-vapour for even very short periods renders the detonator insensitive, but the casing of the present detonator is crimped around a plug of neoprene or other resilient material which completely seals the casing against ingress of water. The casing itself is not normally punctured by sea water corrosion for several weeks.

It is an object of this invention to provide a seismic detonator which, on immersion in water, becomes insensitive within a relatively short period.

In accordance with this invention a seismic detonator comprises a casing having an aperture sealed with a water-destructible sealing plug which on immersion in water resists the ingress of water into the casing for a period sufficient to permit the detonator to be fired but is thereafter affected by the water so that the seal becomes broken.

Whilst the plug may be disposed in any aperture of the casing as, for example, in an aperture in the normally blind end of the detonator casing, it is more convenient for the water-destructible plug to be of resilient material and used in the mouth end of the casing as a replacement for the sealing plug normally disposed around the electrical leading wires of the electric fusehead.

The sealing plug can be of any material whose sealing effect is destroyed by water. It may, for example, be a bound composition which in contact with water breaks up and becomes dispersed. Preferably it is formed from water-soluble material and a material of slow-dissolving characteristics is desirable so as to permit a longer "working" time during which the detonator may be fired. To avoid the possibility of causing misfires by premature water penetration, the water penetration time for current seismic prospecting operations is required to exceed 20 minutes. Water-soluble or water-swellable polymeric materials which initially swell in water before becoming water-permeable are particularly suitable since they provide convenient "working" times.

Conveniently, the material should be capable of being readily moulded in plug form around electric leading wires. We have found that a water-soluble cellulose ether such as, for example, methyl cellulose, plasticised as described in U.K. patent specification No. 703,962 with a mixture of propylene glycol and glycerine, is an especially suitable thermoplastic water-soluble polymeric material. It can be used to form sealing plugs by the standard techniques employed in detonator manufacture and it gives a very water-tight seal around detonator sealing

wires covered with thermoplastic material such as, for example, polyvinyl chloride. On immersion in sea water, the methyl cellulose plug slowly changes from a horn-like material to a soft jelly which eventually allows water or water-vapour to penetrate the interior of the detonator.

In order to further illustrate the invention, a preferred construction of seismic detonator will now be described, by way of example only, with reference to the single figure of the accompanying drawing which shows a longitudinal sectional view of the detonator.

The detonator comprises an elongated cylindrical casing **11** of an aluminum/manganese alloy containing at its blind end a pressed base charge **12** of pentaerythritol tetranitrate covered by a priming charge **13** of a lead azide containing initiating composition. An electric fusehead **14**, comprising a bridgewire heating element embedded in a match-head of lead styphnate containing deflagrating composition **15** and having two polyvinyl chloride covered leading wires **16** attached respectively to the ends of the heating element, is inserted into the mouth end of the casing with the leading wires extending through the opening. A plug **17** consisting of 55 weight percent methyl cellulose composition, commercially available as "Methocel" (R.T.M.) 60 HG 50, 35 weight percent propylene glycol and 10 weight percent glycerine, is formed by injection moulding around the leading wires and the mouth portion of the casing is crimped around the plug by a multi-ring crimp.

One series of these detonators, in which the plug was 5 mm. long and 6.6 mm. diameter, all fired satisfactorily after 1 hour's immersion in sea water but failed to fire after 24 hours' immersion.

What we claim is:

1. A seismic detonator for use when immersed in and in contact with water, said detonator comprising a fusehead, an explosive charge and time delay means operative when said detonator is immersed in water to seal said fusehead and explosive charge against contact with the water during positioning of said detonator in a body of water and subsequently to desensitize said detonator if said detonator has not been fired, said means including a casing surrounding said fusehead and said explosive charge, said casing having an aperture provided with a water-destructible seal which on immersion in water, resists the ingress of water into said casing for a predetermined period of time sufficient to permit said detonator to be fired and is thereafter affected by the water so that said seal becomes broken and permits water to enter said casing whereby said detonator is rendered harmless if it becomes lost in an underwater location without first having been fired.

2. A seismic detonator as in claim **1** wherein said seal is a plug disposed in said aperture.

3. A seismic detonator as in claim **1** wherein said aperture defines a mouth end of said casings, said detonator further including electrical leading wires projecting into said mouth end and wherein said seal is made of resilient material and is disposed in said mouth end around said wires.

4. A seismic detonator as in claim **1** wherein said seal is formed from water-soluble material having slow-dissolving characteristics.

5. A seismic detonator as in claim **1** wherein said seal resists ingress of water into said casing when the latter is immersed in water for a period of time exceeding 20 minutes.

6. A seismic detonator as in claim **1** wherein said seal is formed from water-swellable polymeric material.

7. A seismic detonator as in claim **1** wherein said seal is formed of material capable of being readily molded around electrical leading wires.

8. A seismic detonator as in claim 1 wherein said seal comprises a water-soluble cellulose ether.

9. A seismic detonator as in claim 8 wherein said seal comprises plasticized methyl cellulose.

10. A seismic detonator as in claim 9 wherein said methyl cellulose is plasticized with a mixture comprising propylene glycol and glycerine.

11. A seismic detonator as in claim 10 wherein said seal is formed from material consisting of 55 weight percent methyl cellulose, 35 weight percent propylene glycol and 10 weight percent glycerine.

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