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DETONATOR

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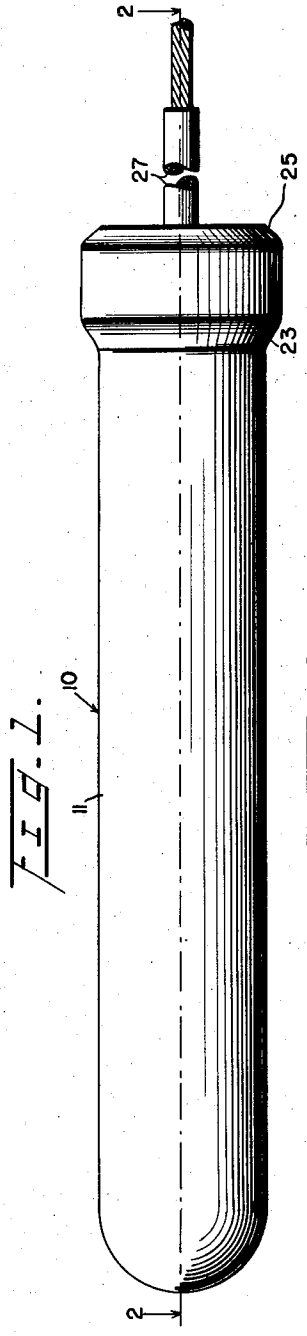


FIG. 1.

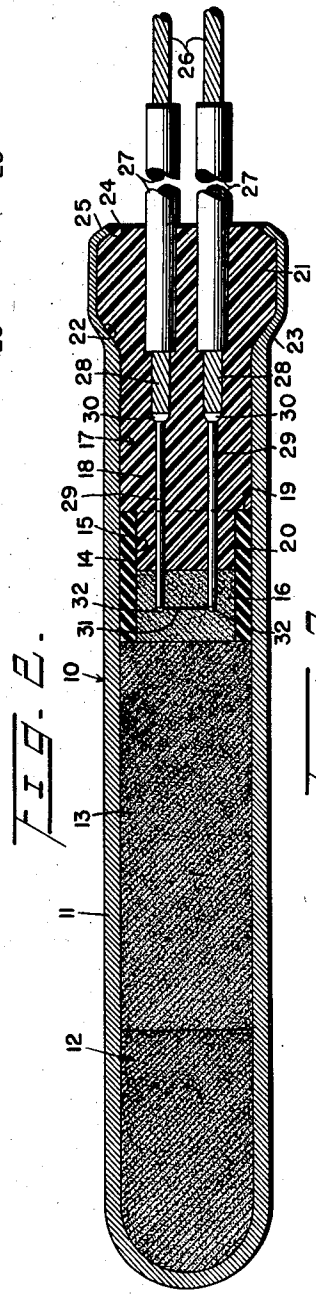


FIG. 2.

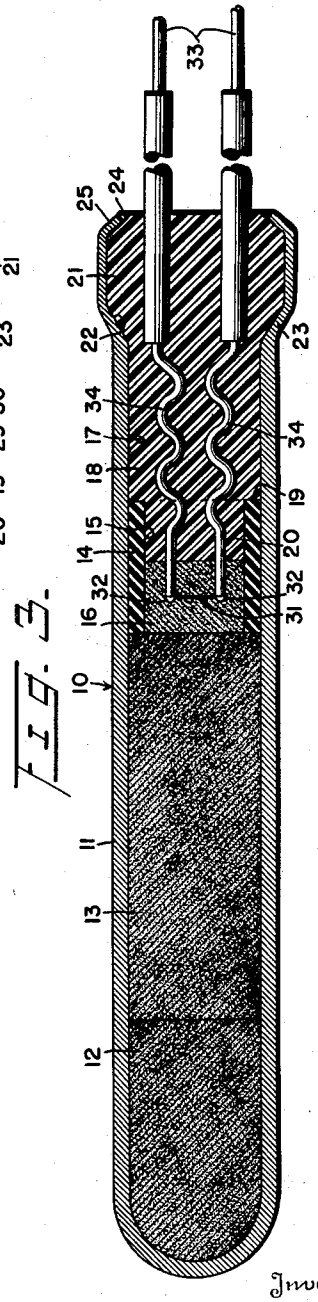


FIG. 3.

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DETONATOR

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This invention relates to an electroresponsive detonator and is particularly adapted for use in an underwater ordnance weapon such, for example, as a mine adapted to be planted from an aircraft at a high altitude, depth charge, torpedo and the like.

The present invention provides a low energy electrically fired detonator so constructed as to withstand severe impact shock without damage or injury thereto.

The present invention also provides a new and improved electroresponsive detonator in which the explosive charges are hermetically sealed therein in such a manner as to prevent deterioration thereof over a long period of time.

One of the objects of the invention is the provision of a new and improved electroresponsive detonator for use in ordnance weapons in which means are provided for firing the explosive charges arranged therein in response to a low energy electrical impulse applied to the firing means thereof.

Another object of the invention is the provision of a new and improved electroresponsive detonator in which the internal components thereof are encased within a metal housing in such a manner as to prevent relative movement thereof regardless of the amount of shock received thereby.

A further object of the invention is the provision of a new and improved electroresponsive detonator which is relatively percussion insensitive thereby preventing premature firing thereof during handling and transportation.

A still further object of the invention is the provision of a new and improved electroresponsive detonator which is economical to manufacture, reliable in operation, and which possess all the qualities of ruggedness, safety and durability during handling and transportation.

Still other objects, novel features and advantages of the invention will become apparent from the following specification, taken in connection with the accompanying drawings, wherein:

Fig. 1 is an elevational view of the electroresponsive detonator of the present invention;

Fig. 2 is a central longitudinal sectional view of the detonator taken on line 2—2 of Fig. 1; and

Fig. 3 is a central longitudinal sectional view of an alternative form of the detonator.

Referring to the drawing in detail for a more complete understanding of the invention wherein like reference characters designate like parts throughout the several views, the electroresponsive detonator disclosed thereon is generally indicated by the reference character **10**, and comprises a casing **11** composed of any suitable material

suitable for the purpose such, for example, as copper, brass or the like.

An explosive charge **12** of any well known type such, for example, as the type known to those skilled in the arts as "PETN" is pressed into one end of the casing **11**, and a primer charge **13** of "DDNP chlorate" is also pressed into the casing **11** in abutting relation with respect to the explosive charge **12**.

Arranged within the casing **11** in abutting relation with respect to the charge **13** is an annular collar **14** composed of fiber or any other materials suitable for the purpose. The collar **14** is provided with a centrally disposed bore **15** having a flash charge **16** of any suitable type arranged therein adapted to initiate firing of the explosive and primer charges **12** and **13** when the flash charge **16** is fired by an electrical impulse, as is well known to those skilled in the art to which the invention pertains.

A plug generally indicated by the reference numeral **17** and composed of any plastic material suitable for the purpose is secured within the casing **11**, as will be hereinafter more fully described. The plug **17** comprises a body portion **18** having a shoulder **19** formed thereon adapted to have abutting engagement with one end of the collar **14** while the other end of the collar is in abutting relation with respect to the primer charge **13** thereby to maintain the collar in fixed position within the casing. The plug **17** is also provided with a reduced nipple **20** formed thereon which extends a predetermined distance into the bore **15** in the collar **14** and is of such length as to engage the flash charge **16** thereby maintaining the flash charge in abutting engagement with respect to the primer charge **13**. The other end of the plug **17** is provided with an enlarged head **21** formed thereon adapted to coact with complementary means on the casing **11** in such a manner as to prevent relative movement of the plug and casing with respect to each other when the deonator has been completely assembled. It is to be noted that the plug **17** comprises first, second and third cylindrical portions of progressively decreasing diameter, the first portion being head **21** and the third portion nipple **20**. The complementary means for maintaining the plug **17** and casing **11** in fixed relation with respect to each other comprises an inclined conic frustum shoulder **22** formed on the inner portion of the head **21** of the plug **17** adapted to have abutting engagement with a complementary conic frustum portion **23** formed on the casing. There is also formed on the outer end of the head **21** an inclined conic frustum shoulder **24** having abutting engagement with a flange **25** formed on the outer end portion of the casing in any suitable manner but preferably by crimping, as clearly shown on Fig. 2. It will be understood, however, that the plug **17** is inserted into the casing **11** before the crimping operation takes place.

When the assembly of the detonator is complete, Fig. 2, it will be apparent, after a careful study thereof, that the interior components of the detonator are also maintained in a fixed postion within the casing due to the abutting relation therebetween and the manner in which the plug **17** is secured within the casing in the aforesaid abutting relation with the interior components. Therefore the interior components of the detonator are fixed and will not move even under conditions of severe shock.

The detonator of the present invention is thus particularly adapted to withstand the severe shock of impact of an aircraft planted mine against the surface of the water when the mine is launched from a high altitude.

It will be further understood, however, that during assembly of the detonator, the plug **17** may be coated with a waterproof compound of any type suitable for the purpose before the plug is inserted into the casing **11**. After a sufficient quantity of waterproofing compound has been applied to the plug, the plug is then pressed into the casing and the open flanged end thereof is crimped about the head **21** of the plug **17** as heretofore described, whereby by reason of the conical surfaces provided, a moisture-proof seal is obtained between the casing and plug, thus hermetically sealing the aforesaid explosive charges within the casing and preventing deterioration thereof due to atmospheric conditions.

A pair of lead-in wires **26** are molded into the plug **17** in spaced relation with respect to each other, a portion of each lead-in wire **26** extending a predetermined distance into the plug. A sleeve **27** composed of any insulating material suitable for the purpose such, for example, as felted asbestos and cotton braid is secured to each lead-in wire and molded within the plug, as best shown on Fig. 2. Each end portion **28** of the lead-in wires **26** extends a predetermined distance beyond each of the sleeves **27** and has respectively secured thereto terminals **29** as by solder or the like **30**. A portion of the terminals **29** is molded in the body **18** of the plug and extends a predetermined distance beyond the reduced portion **20** thereof and into the flash charge **16**, the purpose of which will more clearly appear as the description proceeds.

The inner end portions of the terminals **29** are connected together by a bridge wire **31** composed of any material suitable for the purpose such, for example, as the type of wire known in the trade as "Nichrome." It will be understood, however, that the ends of the bridge wire **31** are secured to the respective ends of the terminals **29** in any suitable manner, preferably by soldering the parts together as indicated by the reference character **32**, thereby providing means for firing the flash charge **16** in response to an electrical impulse received thereby from any suitable source of power, not shown, such, for example, as a battery, as is well known to those skilled in the art to which the invention pertains.

It will be understood, however, after a study of Fig. 2 of the drawings, that the internal components of the detonator are assembled in the casing **11** in such a manner as to prevent any movement thereof with respect to each other during handling and transportation thereby to prevent premature firing of the aforesaid explosive charges therein or damage to the components of the detonator in response to a severe shock received thereby. It will be further understood that the aforesaid explosive charges **12**, **13** and **16** are hermetically sealed within the casing **11**, as heretofore described, thereby to prevent deterioration thereof due to atmospheric conditions, thus providing a detonator of exceptionally long life either in storage or within an ordnance weapon, as the case may be.

On Fig. 3 of the drawings an alternative form of the detonator is shown in which the construction thereof is generally similar with respect to the form shown on Figs. 1 and 2 except that the firing means of Fig. 3 are somewhat modified. In this form of the device the plug **17** is formed with first, second and third cylindrical portions similar to the showing in Fig. 2 and the firing means comprise a pair of lead-in wires **33** molded into the plug **17** in spaced relation with respect to each other, but each of the lead-in wires **33** has a plurality of corrugated portions **34** formed thereon which are molded into the aforesaid second and third portions of the plug **17**, thus permanently securing the lead-in wires within the plug and preventing accidental withdrawal of the lead-in wires **33** from the plug. The inner ends of the lead-in wires **33** extend beyond the reduced nipple **20** on the plug and have secured thereto the bridge wire **31** in the same manner as heretofore shown and described.

It will be understood, however, that in the form shown on Fig. 3 the explosive charges **12**, **13**, and **16** are hermetically sealed within the casing **11** and the component parts of the detonator are maintained in fixed position with respect to each other as heretofore shown and described.

While the invention has been described with particularity in reference to two examples which produce satisfactory results, it will be apparent to those skilled in the art to which the invention pertains, after understanding the invention, that the invention in its broader aspect could be carried out by other instrumentalities, and it is understood that the terms used in the claims are words of description and not of limitation except as necessitated by the prior art.

The invention herein described and claimed may be manufactured and used by or for the Government of the United States of America for governmental purposes without payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electroresponsive detonator of the character disclosed comprising a preformed casing having an elongated cylindrical body portion, a cylindrical head portion of greater diameter than said body portion and a frustro conic portion intermediate said head and body portions, an explosive charge arranged within said body portion, a collar arranged within the body portion in sealing engagement therewith and with said explosive charge, a flash charge arranged within said collar for firing the explosive charge, a preformed plug pressed into said casing and comprising a first, second, third cylindrical portion of progressively decreasing diameter and a complementary frustro conic portion intermediate said first and second portions in sealing engagement with said head portion, body portion, collar, and frustro conic portion of the casing respectively, flange means on said head portion overlapping said first cylindrical portion of the plug for maintaining said first, second and third cylindrical portions and the complementary frustroconic portion thereof in sealing engagement with said head portion, body portion, collar and frustro conic portion of the casing respectively, a pair of lead-in wires extending through the plug and molded therein, a plurality of corrugated portions on said lead-in wires molded in said second and third portions of the plug for maintaining said wires fixed to the plug, a pair of straight portions on one end of said lead-in wires and molded into said third portion of said plug and said flash charge, a bridge wire secured to said lead-in wires and embedded in said flash charge for firing the charge in response to an electrical impulse applied thereto, and a pair of straight portions on the other end of said lead-in wires and molded in said first, second and frustro conic portions of the plug and extending outwardly therefrom for establishing an external electrical connection to said bridge wire.

2. An electroresponsive detonator of the character disclosed comprising a preformed casing having an elongated cylindrical body portion and a cylindrical head portion of greater diameter formed thereon, an explosive charge arranged within said body portion, a collar arranged within said body portion in sealing engagement therewith and with said explosive charge, a flash charge arranged within said collar for firing the explosive charge, a preformed molded plug pressed into said casing and comprising a first, second and third cylindrical portion of progressively decreasing diameter in sealing engagement with said head portion, body portion and collar respectively, a flange formed on said head portion overlapping said first cylindrical portion of the plug for maintaining said first, second and third cylindrical portions thereof in sealing engagement with the head portion, body portion and collar respectively, a pair of lead-in wires extending through the plug and molded therein, a plurality of cor-

rugated portions on said lead-in wires molded in said second and third portions of the plug for maintaining said wires fixed to the plug, a pair of straight portions on one end of said lead-in wires and molded into said third portion of the plug and said flash charge, a bridge wire secured to said lead-in wires and embedded in said flash charge for firing the charge in response to an electrical impulse applied thereto, a pair of straight portions on the other end of said lead-in wires and molded in said second portion of the plug and extending therebeyond for establishing an external electrical connection to said bridge wire, and a pair of flexible sleeves secured on said last named straight portions and molded in said first portion of the plug.

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