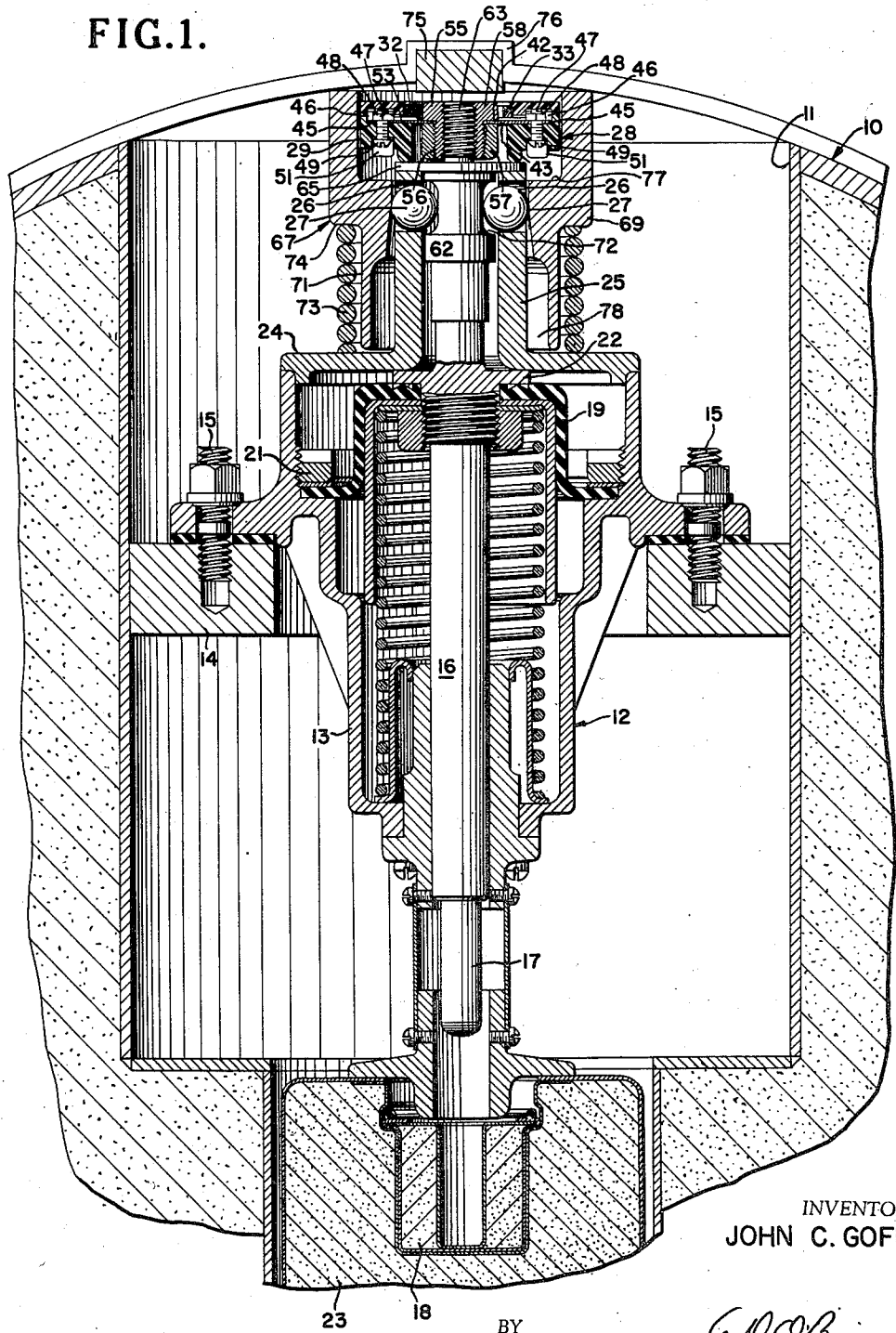
Feb. 12, 1957 J. C. GOFF 2,780,993

ELECTROLYTICALLY CONTROLLED EXTENDER DELAY DEVICE FOR A MINE

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FIG. 1.



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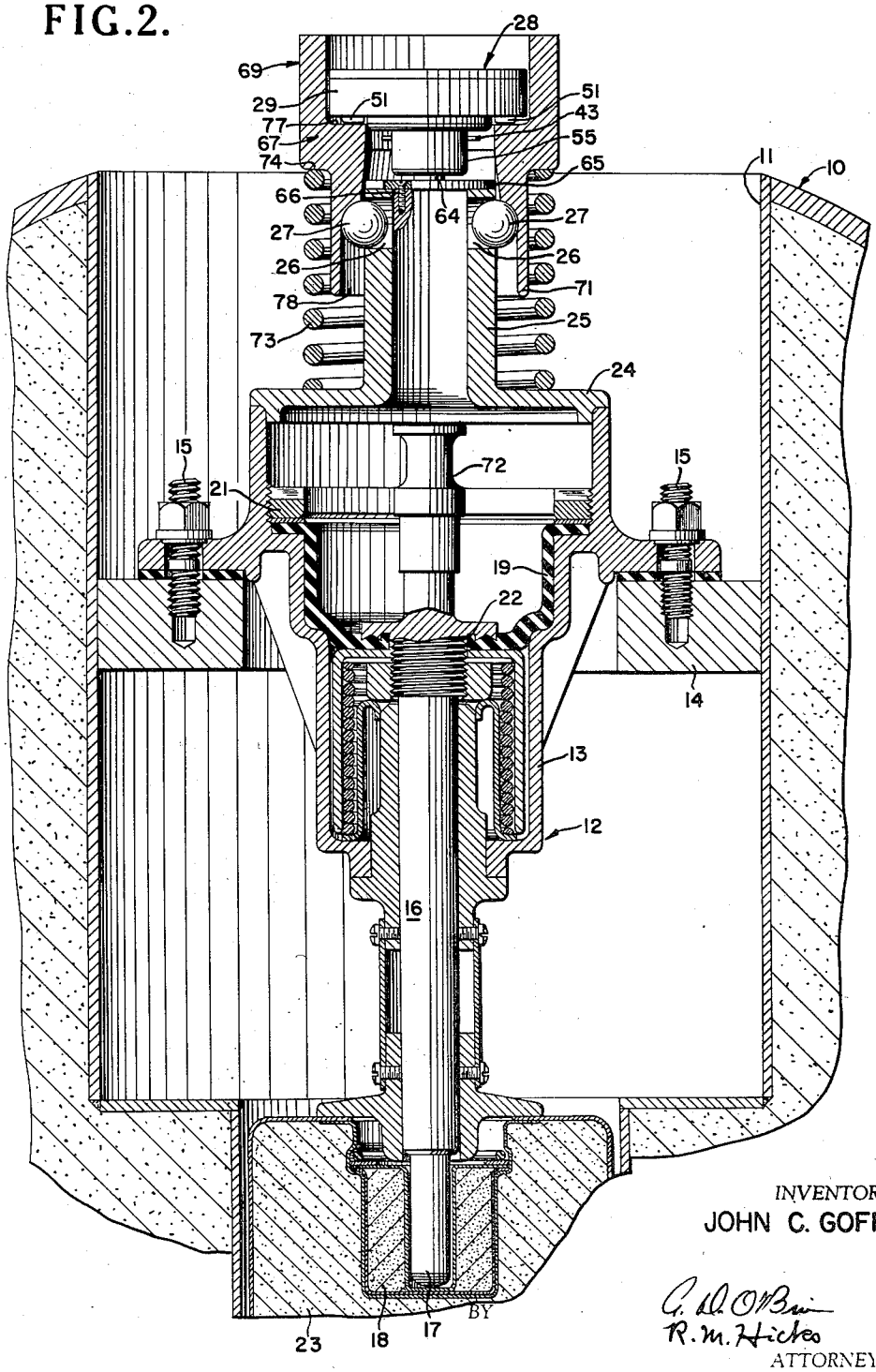
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FIG.2.



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ELECTROLYTICALLY CONTROLLED EXTENDER DELAY DEVICE FOR A MINE

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FIG.3.

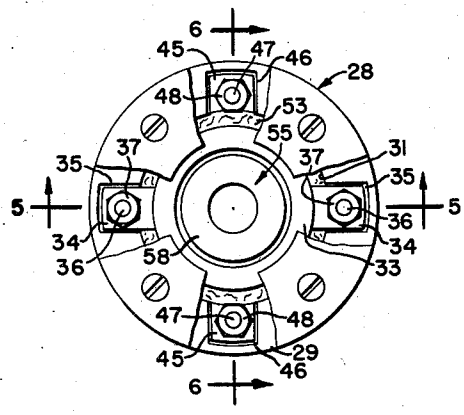


FIG.4.

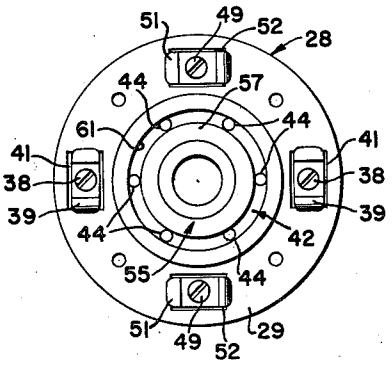


FIG.5.

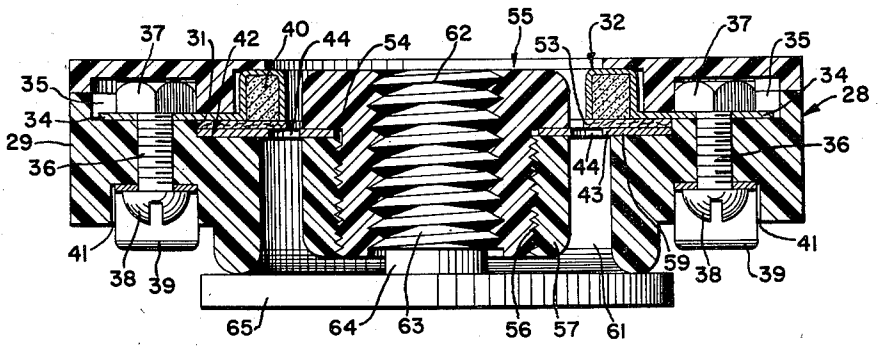
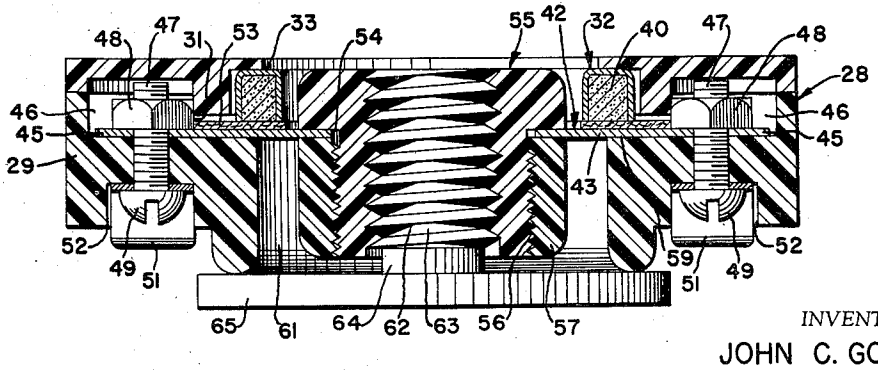


FIG.6.



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2,780,993

ELECTROLYTICALLY CONTROLLED EXTENDER DELAY DEVICE FOR A MINE

John C. Goff, Silver Spring, Md., assignor to the United States of America as represented by the Secretary of the Navy

Application December 24, 1952, Serial No. 327,944

3 Claims. (Cl. 102—16)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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

The present invention relates to an extender mechanism and more particularly to an electrolytically controlled device for releasing the extender of a marine mine for movement from an initial safe position to an armed position in predetermined time delayed relation with respect to the planting of the mine in a body of sea water.

It has been found by actual use that prior art mechanisms such, for example, as the type employing soluble washers have not proven entirely satisfactory for the reason, that occasionally such washers dissolve too rapidly when the mine is planted in the water and thus the extender mechanism is prematurely actuated to an armed position which causes an extremely hazardous condition particularly for the mine laying vessel and the crew thereof during an extensive mine planting operation. Furthermore, clock mechanism heretofore employed for arming marine mines have not proven entirely satisfactory for the reason that often times, due to mechanical defects or corrosion of the essential mechanical components thereof, the clock functions erratically thus causing premature arming of the mine, or upon some occasions, causing complete failure of the clock thereby preventing arming of the mine. In mine planting operations from surface or submarines it is essential to provide means for delaying the arming of the mine for a period of time after the planting thereof sufficient to permit the mine planting craft to travel a safe distance from the mine field and to provide positive means for arming the mine when a predetermined period of time has elapsed. It will be understood, that when a relatively small number of mines are being planted in a narrow channel such, for example, as a river, inlet or bay the period of time required to complete the mine planting operations is relatively short. However, when extensive mine planting operations are being conducted and the mines are planted over a large area, the period of time required to complete such an operation is much longer and may extend over several days or more and thus for safety purposes it is essential that arming of the mines be delayed until such operations are complete and the mine planting craft has traveled a safe distance from the mine field.

In view of the foregoing the present invention contemplates the provision of a new and improved delay arming device for a marine mine wherein means are provided for maintaining the mine in a safe or unarmed condition with the detonator out of firing engagement with the booster charge for a period of time sufficient to permit completion of an extensive mine planting operation, and in which pressure responsive means are adapted to cause positive movement of the detonator into firing engagement with the booster charge when the period of time has elapsed.

An object of the present invention is the provision of

a new and improved electrolytic controlled device suitable for use with a marine mine.

Another object of the invention is to provide delay device for a marine mine wherein means including an electrolytic element maintains the extender in an initial safe or unarmed condition for a predetermined period of time after the mine has been planted in a body of water.

A further object of the invention is to provide a normally locked extender for a marine mine wherein means rendered effective by the sea water releases the extender for movement to an unarmed position by a pressure responsive element when a predetermined period of time has elapsed after the mine has been planted in the water.

A still further object of the invention is to provide a delay device for a marine mine having means rendered effective by electrolytic decomposition for maintaining the detonator extender in an unarmed condition for a predetermined period of time after planting of the mine in a body of water and in which means responsive to the surrounding water and rendered effective as the electrolytic means is decomposed moves the detonator extender to an armed position.

Still another object of the invention is the provision of a new and improved electrolytically controlled delay device for a marine mine adapted to cause arming of the mine a predetermined period of time after the mine has been planted in a body of water.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a fragmentary sectional view of a mine casing illustrating the manner in which the device of the present invention is attached thereto, the device being shown in an initial or unarmed condition;

Fig. 2 is a view similar to Fig. 1 illustrating the device in a released position with the extender in an armed position and the detonator carried thereby in firing engagement with the booster charge;

Fig. 3 is a top plan view of the electrolytic arming cell of Fig. 1;

Fig. 4 is an inverted plan view of the device of Fig. 3;

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 3; and,

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 3.

Referring now to the drawing and more particularly to Fig. 1 thereof the reference character **10** designates a fragmentary portion of a conventional marine mine having a well **11** formed therein. An extender mechanism is indicated by the numeral **12** and comprises a housing **13** disposed within the well **11** and secured to an annular member **14** mounted therein by suitable fastening means **15**. The housing **13** has an extender shaft **16** slidably arranged therein, one end of the extender shaft having an electro-responsive detonator **17** mounted thereon and movable into firing engagement with the primer **18** as the extender shaft is moved by a pressure responsive element **19** sealed to the casing and extender shaft as at **21** and **22** respectively. The primer is encased in a booster charge **23** and is adapted to fire the charge as the primer is fired by the detonator. The housing **13** is provided with a cover plate **24** having a nipple **25** of reduced diameter with respect to the diameter of the housing, formed thereon and extending therefrom. The nipple is provided with a pair of diametrically disposed openings **26** having a pair of locking balls **27** respectively arranged therein for releasably locking the extender shaft thereto.

The electrolytic delay element employed in connection with the aforementioned extender mechanism for delay-

ing the movement thereof to an armed position is generally indicated by the reference character 28 and comprises a casing 29 having a centrally disposed well 31 formed therein. As more clearly shown on Figs. 5 and 6 a silver anode or positive electrode 32 is disposed within the well 31, and comprises an annular inverted cup-shaped member 33. The cup-shaped member 33 is provided with a pair of diametrically disposed terminal members or ears 34 integrally formed thereon and extending outwardly therefrom and disposed within a pair of recesses 35 respectively, the recesses being formed in the casing 29 and bordering on the well 31 in communication therewith. Each ear 34 is secured to the casing 29 by a terminal bolt 36 comprising a nut 37 in engagement with the ears and a head 38 in engagement with a positive contact 39, each contact being arranged within a recess 41 formed in the casing 29. The cup-shaped member 33 is provided with a suitable depolarizer 40 such, for example, as silver chloride fused or pressed therein at a predetermined pressure.

As shown more clearly on Fig. 6 a cathode or negative electrode 42 is arranged within the well 31 and comprises a disc 43 composed of any material suitable for the purpose such, for example, as zinc, steel or the like, the material of which the disc is composed and the thickness thereof being adapted to control the time interval at which the disc will be decomposed by electrolysis when the mine is planted in a body of water. The disc 43 is provided with a plurality of openings or ports 44, Figs. 4 and 5, and a pair of diametrically disposed terminal members or ears 45, Figs. 3 and 6, integrally formed thereon and extending outwardly therefrom and disposed in a pair of decesses 46 respectively, the recesses bordering on the well 31 in communication therewith. Each ear 45 is secured to the casing 29 by a terminal bolt 47 comprising a nut 48 in engagement with the ears 45 and a head 49 in engagement with negative contacts 51—51, each contact being arranged within a recess 52 formed in the casing 29. As more clearly shown on Figs. 5 and 6 a disc 53 composed of any porous insulating material suitable for the purpose such, for example, as filter or blotting paper, is arranged between the anode 32 and the cathode 42, the disc 53 being adapted to provide an insulating barrier between the aforesaid positive and negative electrodes and to provide wick means for supplying the silver chloride with a sufficient but not an excessive amount of sea water when the mine is launched in a body of water. The electrolytic cell hereinabove described, is disclosed and claimed in the application of John C. Goff, Monroe B. Goldberg and Allen J. Sondheimer, Serial No. 324,158, filed December 4, 1952.

The cathode plate or disc 43 is provided with a centrally disposed opening 54 having a nipple 55 arranged therein and threaded as at 56 for threaded engagement with a sleeve 57. By this arrangement the disc 43 is clamped between the head 58 of the nipple 55 and the sleeve 57, the outer portion of the disc being in abutting engagement with the bottom wall 59 defining the recess 31, the recess 31 being in communication with a restricted bore 61 formed in the casing 29 and extending therethrough by way of openings 44 Fig. 5. The nipple 55 is internally threaded as at 62 for threaded engagement with the stub shaft 63 integrally formed on a boss 64 carried by a plate 65 secured to the outer end of the sleeve 25 by screw 66, Fig. 2, and thus by this arrangement the electrolytic time delay cell is secured to the mine casing.

The balls 27 are maintained in locking engagement with the extended shaft 16 by a sleeve slidably arranged on the nipple 25 and generally indicated by the numeral 67. The sleeve comprises an enlarged head 69 having a cylindrical portion 71 formed thereon of reduced diameter with respect to the diameter of the head and normally disposed in engagement with the ball 27 whereupon the balls are maintained in engagement with the annular groove 72 and thus the extender shaft is releasably locked to the mine casing. A spring 73 is disposed about the portion 71 of the sleeve 67 one end being in engagement with the cover 24, the other end thereof being in engagement with a shoulder 74 formed on the sleeve 67 at the junction of the head and reduced portion 71 of the sleeve. By this arrangement the sleeve 67 is urged outward. However, outward movement of the sleeve is prevented by the conventional lock bar 75 releasably locked to the mine casing as at 76 and disposed in abutting engagement with the head 69 of the sleeve 67 Fig. 1.

Upon removal of the bar 75 from the members 76 prior to planting of the mine within the body of water, the spring 73 moves the sleeve 67 an amount sufficient to cause the internal annular shoulder 77 formed thereon to engage contacts 39—39 and 51—51 electrically connected to the anode and cathode respectively. When this occurs an electrical connection is established between the anode and cathode whereupon an electrical current flows therebetween as the sea water saturates disc 53 between the aforesaid electrodes and thus causes electrolytic decomposition of the cathode disc 42, completion of the decomposition occurring in time delayed relation with respect to planting of the mine in the body of water.

As shown more clearly on Fig. 1 the portion 71 of the sleeve 67 has an annular recess 73 formed therein, the recess being normally spaced from the locking ball 27. When the disc 43 is decomposed the sleeve 67 is moved outwardly by spring 73 whereupon the sleeve and casing 29 is ejected from the nipple 25. However, during the outward movement of the sleeve the slots 78 are brought in alignment with the balls 27 and thus as the balls move into the slots the extender shaft 16 is released for movement to an armed position by the diaphragm 19.

It will be understood that when the mine is planted, water enters the extender housing 13 whereupon the diaphragm 19 is actuated in response to the pressure of the water when disc 43 is decomposed. When this occurs the extender shaft secured to the diaphragm is moved sufficiently to move the detonator 17 carried thereby into firing engagement with primer 18 thereby to arm the mine.

If desired, a longer or shorter time delay period may be provided before release of the extender shaft occurs in response to the decomposition of the negative electrode by the use of a negative electrode composed of a metal more or less active in the electro-motive series of metals or by providing negative disc of different thicknesses.

In view of the foregoing, it will be apparent that the invention provides a new and improved arming device for use in a marine mine wherein means are employed for maintaining the detonator extender in an initial safe or unarmed condition for a predetermined time after the mine has been planted in a body of water and in which means rendered effective by electrolytic decomposition releases the extender for movement from an initial safe position to an armed position when the period of time has elapsed.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

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

1. In a marine mine having a releasably locked extender therein adapted to be actuated to an armed position when released, the combination of an electrolytic cell secured to said mine and having an anode and cathode arranged therein, said anode and cathode being rendered effective by the sea water to decompose said cathode by electrolysis when a predetermined period of time has elapsed after the mine has been planted in the water, means slidably arranged on said mine for establishing an electrical connection between said anode and cathode as

the slidable means is moved into engagement therewith, yieldable means in engagement with said slidable means for moving the slidable means into engagement with the anode and cathode, means in engagement with the extender and slidable means for releasing the extender when said cathode has been decomposed and the slidable means is forcibly ejected from the mine by the yieldable means, and pressure responsive means for moving the extender to said armed position.

2. In a marine mine having a releasably locked extender therein adapted to be actuated to an armed position when released, the combination of a mine casing, a housing secured to said casing, an electrolytic cell enclosed within said housing and comprising a positive and negative electrode, said electrodes being adapted to develop a potential difference as the mine is planted in a body of sea water thereby to cause electrolytic decomposition of the negative electrode, a conducting sleeve slidably arranged on the casing, yieldable means in engagement with said sleeve and casing for moving said sleeve into engagement with said electrodes to complete a circuit therebetween, locking means including a pair of devices in engagement with said extender and sleeve and controlled by the movement of the sleeve for releasing the extender for movement to said armed position when the negative electrode is decomposed and the sleeve is forcibly ejected from said casing by said yieldable means, and means sealed to the casing and extender and actuated by the pressure of the water for moving the extender to said armed position in predetermined time delay relation with respect to the planting of the mine in the water.

3. In a marine mine, a mine casing, a releasably locked extender therein, a primer arranged within said casing, a detonator carried by said extender and normally spaced from the primer, a housing secured to the casing, a cathode element and an anode element arranged within the housing for communication with the surrounding water as the mine is planted therein, said cathode element and anode element being rendered effective to develop a differential voltage in response to contact of said water therewith thereby to cause electrolytic decomposition of the cathode element, a conducting sleeve slidably arranged on the casing and normally spaced from said elements, yieldable means for moving the sleeve into engagement with the elements whereby to complete an electrical circuit between said elements, locking means in engagement with the extender and sleeve and controlled by the movement of the sleeve for releasing the extender as the cathode element is decomposed and the sleeve is forcibly ejected from the casing by said yieldable means, and means sealed to the casing and extender and actuated by the pressure of the water for moving the extender into firing engagement with said detonator.

References Cited in the file of this patent

UNITED STATES PATENTS

1,372,617	Fullinwider	Mar. 22, 1921
2,551,608	Kissinger	May 8, 1951