April 23, 1957 G. N. WILLIS ET AL 2,789,502

DEPTH CHARGE ARMING DEVICE

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FIG. 1.

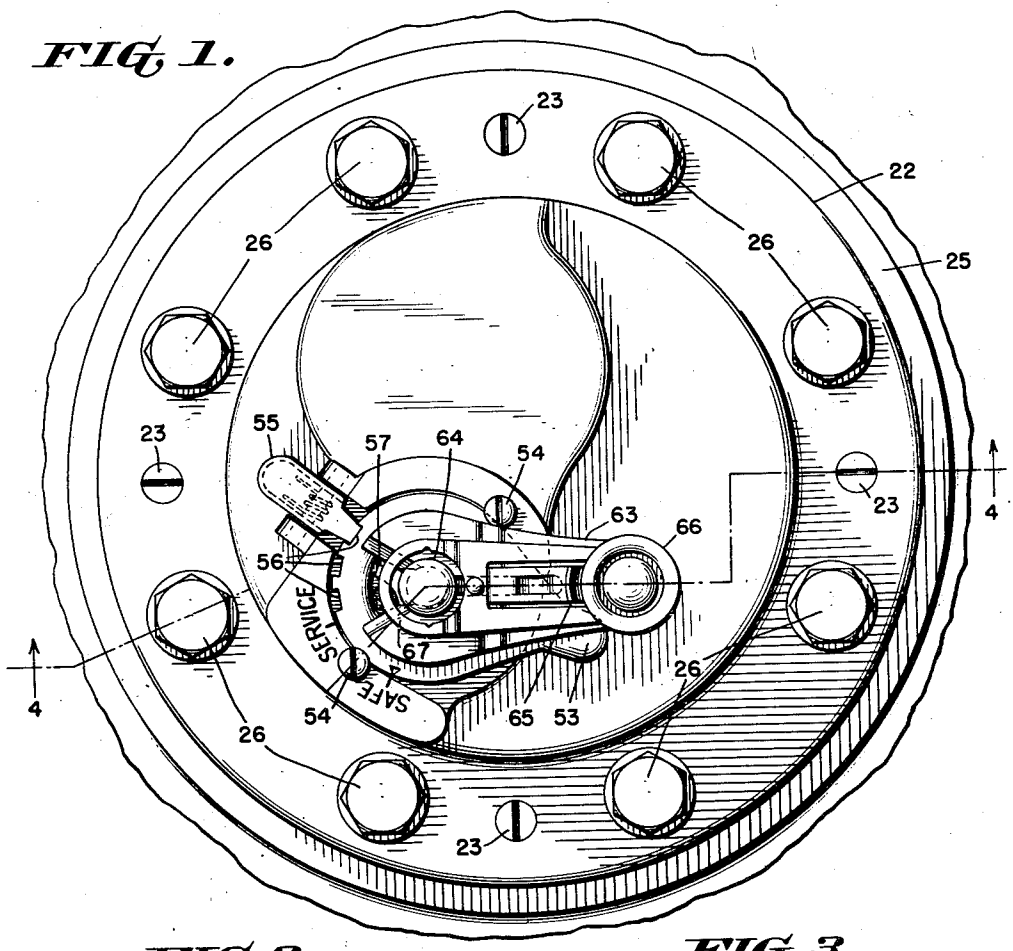


FIG. 2.

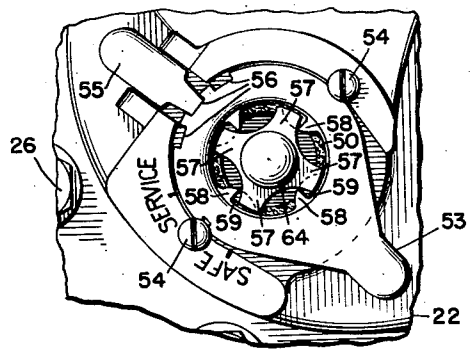
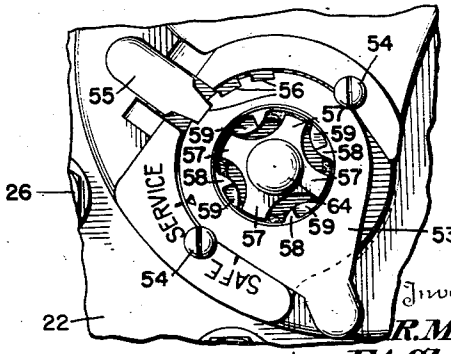


FIG. 3.



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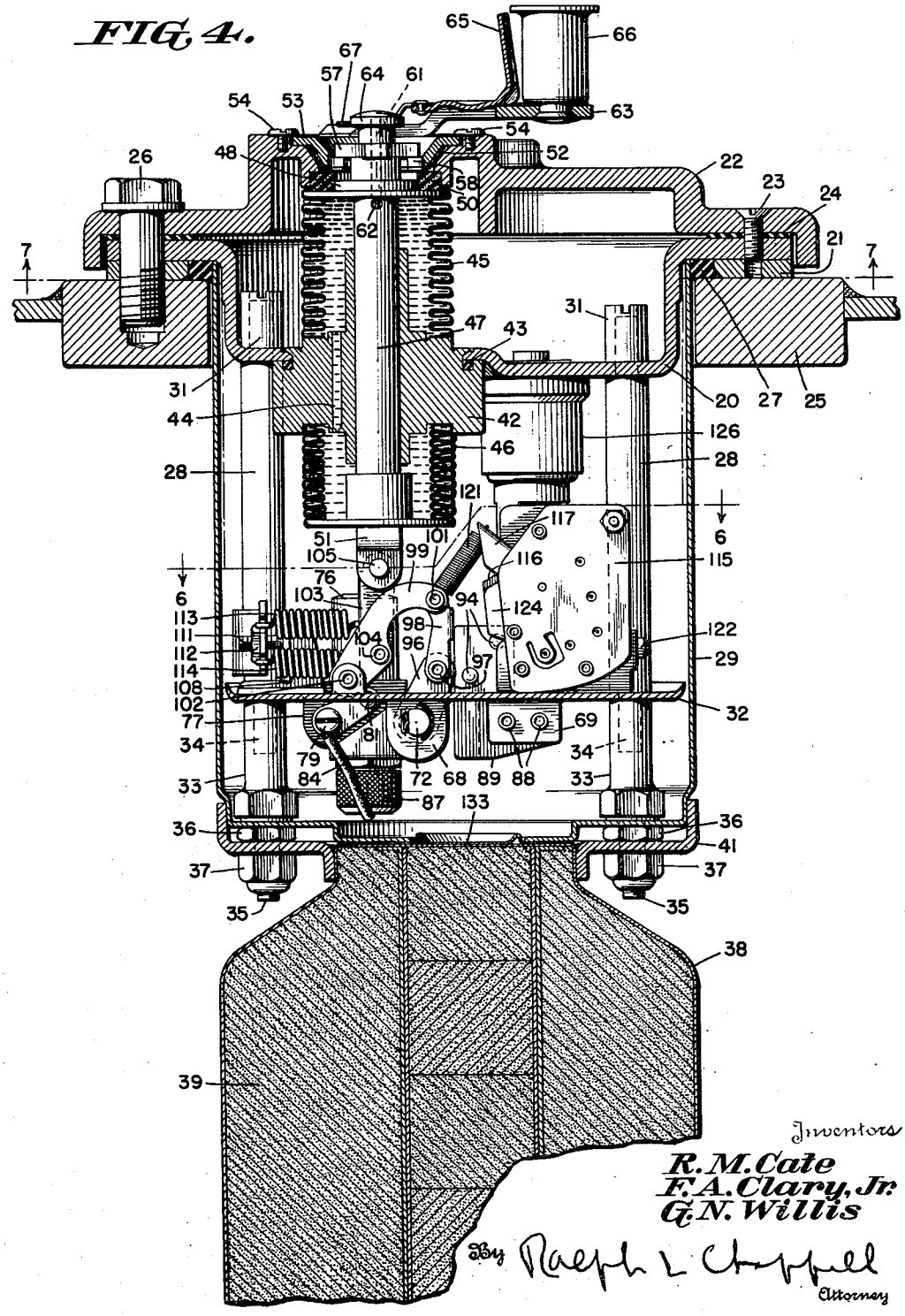
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DEPTH CHARGE ARMING DEVICE

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FIG. 4.



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DEPTH CHARGE ARMING DEVICE

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FIG. 5.

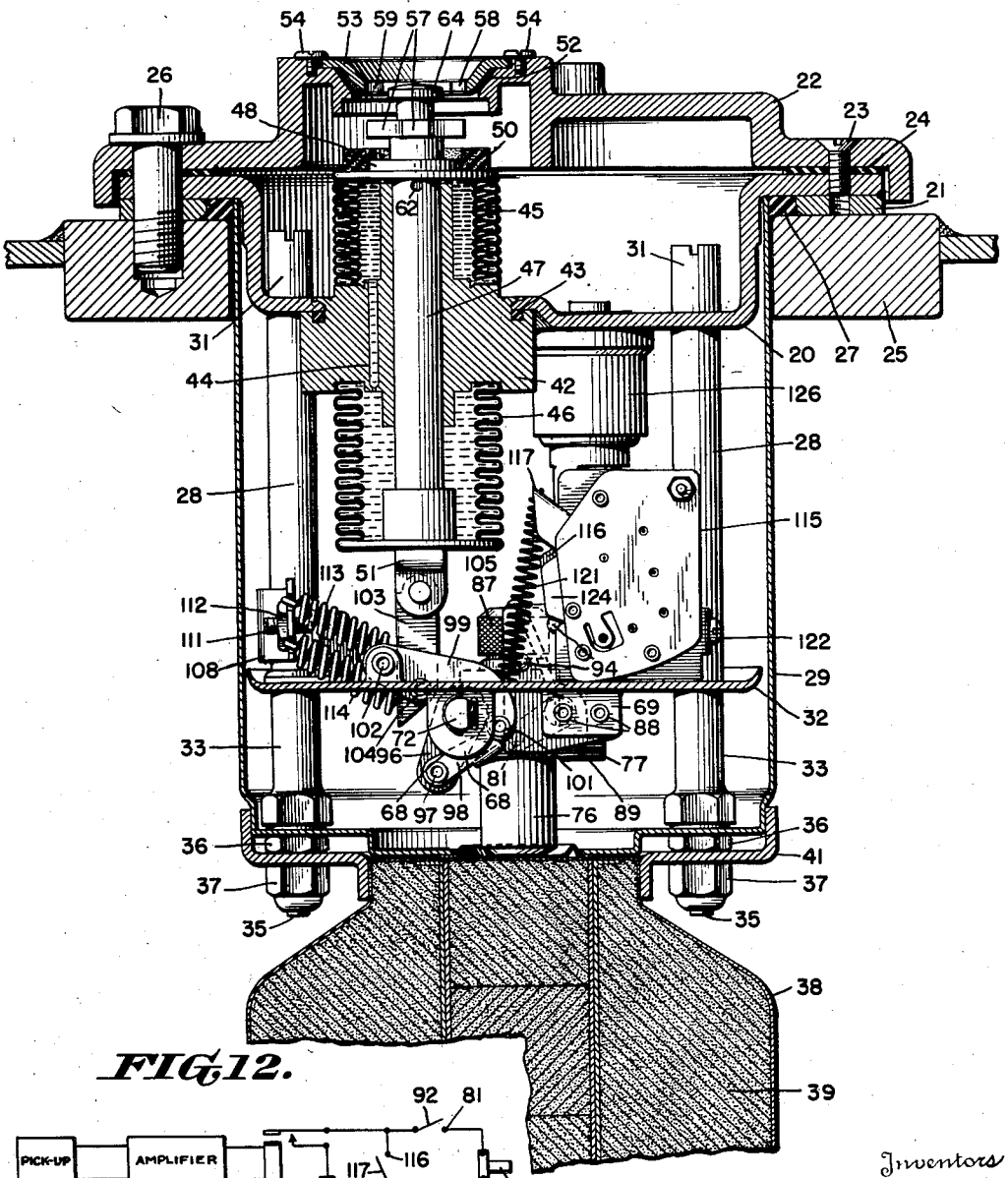
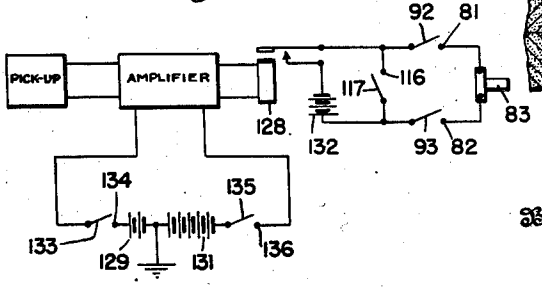


FIG. 12.



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DEPTH CHARGE ARMING DEVICE

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FIG. 6.

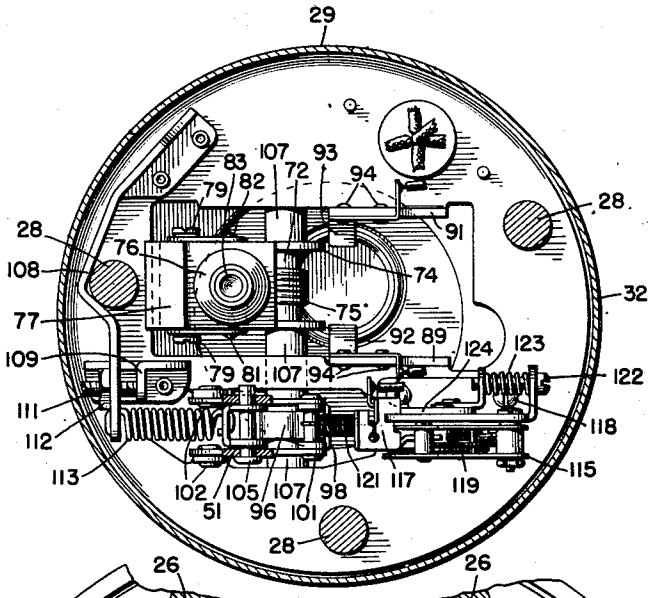
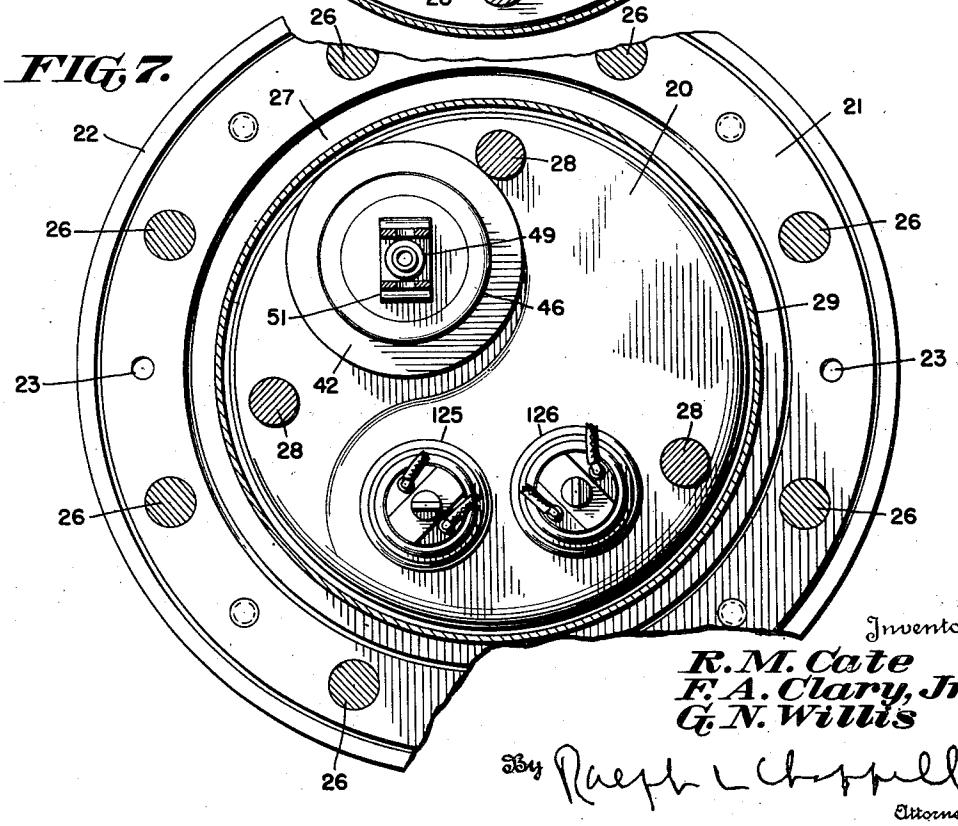


FIG. 7.



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DEPTH CHARGE ARMING DEVICE

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FIG. 8.

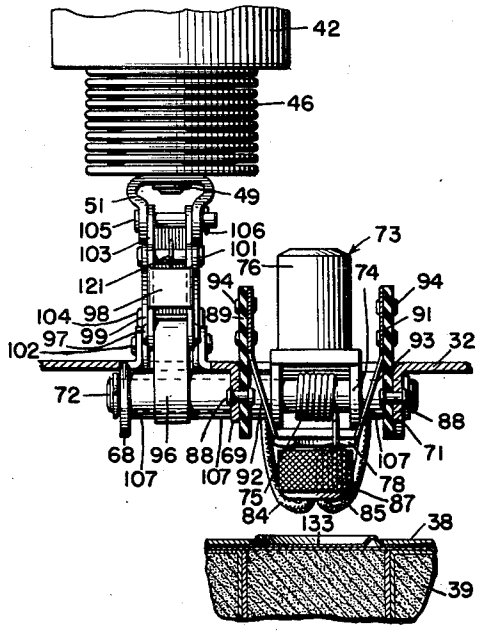


FIG. 9.

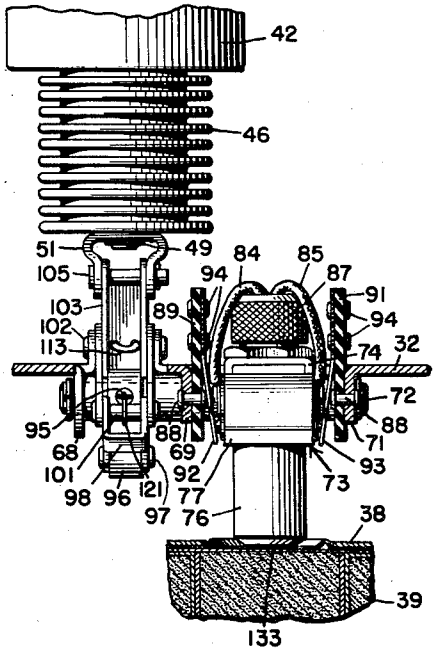


FIG. 10.

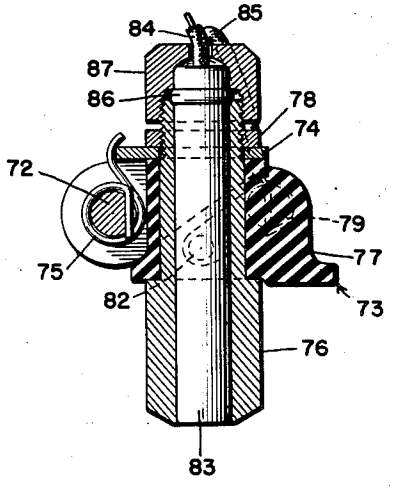
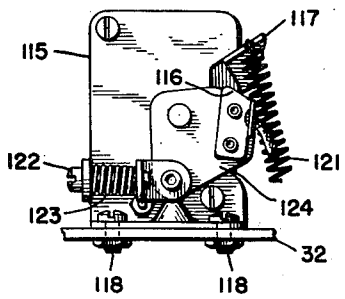


FIG. 11.



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United States Patent Office 2,789,502 Patented Apr. 23, 1957

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DEPTH CHARGE ARMING DEVICE

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Application May 26, 1945, Serial No. 596,065

17 Claims. (Cl. 102—7)

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

This invention generally relates to devices for arming a marine mine, depth charge or the like and more particularly to a device adapted to arm the firing circuit of a depth charge a predetermined interval after the launching thereof and wherein hydrostatic means are employed to rotate an electroresponsive detonator included in the firing circuit from an initial safe position to an armed position and wherein a plurality of hydrostatically controlled switches operate to render said firing circuit effective as the depth charge descends through the water.

An object of the present invention is to provide new and improved means for moving a detonator into close proximity with an explosive charge.

Another object is the provision of a depth charge in which the detonator thereof is caused to rotate from an initial safe position to an armed position in response to gradual changes in pressure of the surrounding water and in which the detonator is prevented from rotating into the armed position when a sudden shock such, for example, as a countermine shock or the shock due to launching is received by the depth charge.

Another object is the provision of a new and improved depth charge in which the firing circuit thereof is rendered effective gradually as the depth charge descends through the water.

Another object is to provide a new and improved arming device for a depth charge which may be adjusted to control the arming depth of the depth charge.

A further object is to provide a new and improved device which will readily arm a depth charge and automatically recock for test purposes.

A further object is the provision of a novel device adapted to arm a depth charge as it descends through the water and to render the depth charge ineffective a predetermined interval after the launching thereof.

A still further object is the provision of a new and improved arming device for a depth charge which is rugged in construction, reliable in operation and economical to manufacture.

Additional objects and advantages will become more clearly apparent as the description proceeds.

For a more complete understanding of a preferred embodiment of the present invention and the operation thereof, reference is made to the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a top plan view of the device of the present invention according to a preferred embodiment thereof;

Fig. 2 is a fragmentary plan view showing the depth selector in the deep arming position;

Fig. 3 is a fragmentary plan view showing the depth selector in the shallow arming position;

Fig. 4 is a vertical sectional view with certain parts in elevation taken substantially along the line 4—4 of Fig. 1 and showing the device of the present invention in an initial locked position;

Fig. 5 is a view similar to Fig. 4 and showing the device in an armed position;

Fig. 6 is a sectional view taken substantially along the line 6—6 of Fig. 4;

Fig. 7 is a sectional view taken substantially along the line 7—7 of Fig. 4;

Fig. 8 is a detail sectional view showing the detonator in the safe position;

Fig. 9 is a view similar to Fig. 8 and showing the detonator in the armed position;

Fig. 10 is a sectional view through the detonator;

Fig. 11 is a view in elevation of a sterilizing mechanism included in the present invention; and,

Fig. 12 illustrates in diagrammatic form an electrical system suitable for use with the device of the present invention.

Referring now to the drawings wherein like numerals refer to like parts throughout the several views, the device of the present invention comprises a cup-shaped member 20 to which is secured a reenforcing plate 21. A cover 22 is secured to the member 20 and the plate 21 by means of a plurality of screws 23, suitable gasket means 24 being disposed between the cover and cup-shaped member to provide a watertight connection therebetween. In accordance with the preferred embodiment, the instant device is adapted for use in a depth charge and is secured to the casing 25 thereof by the screws 26 with a suitable gasket 27 being provided between the casing 25 and the cup-shaped member 20 to insure a watertight connection therebetween.

Cut into the cup-shaped member 20 are a plurality of holes through which a plurality of posts 28 extend, which posts are adapted to support a casing 29 housing several component parts of the device of the present invention. The upper ends of the posts 28 are threaded to receive the nuts 31, the lower ends thereof being adapted to receive a circular mounting plate 32. The plate 32 is held in a fixed position by the internally threaded, tubular members 33 which are screwed to the threaded extremities 34 of the posts 28. The threaded extremities 34 are provided with threaded studs 35 upon which are screwed the nuts 36 and nuts 37, the nuts 36 being adapted to hold the casing 29 in a proper position with respect to the cup-shaped member 20 and the nuts 37 being adapted to secure a container 38 which carries a booster charge 39 to the casing 29 by means of the circular member 41 soldered to the booster charge container.

Swaged to the cup-shaped member 20 is a partition or bulkhead 42 with a suitable gasket 43 mounted between the member 20 and the bulkhead 42 to provide a watertight connection therebetween. The bulkhead 42 is provided with a metered opening or orifice 44, the purpose of which will be set forth in greater detail hereinafter. Soldered superjacent the bulkhead 42 and covering one end of the orifice 44 is a metallic bellows 45 and soldered subjacent the bulkhead and covering the other end of the orifice 44 is another metallic bellows 46. A rod or plunger assembly 47 is adapted slideably to pass through a hole in the bulkhead provided therefor, which plunger assembly 47 is soldered to the free end of bellows 45 by means of the washer-like portion 48 of the assembly and is clamped to the free end of bellows 46 by another washer-like portion 49 and the U-shaped member 51.

The cover 22 is provided with a recessed portion 52 having a hole therein through which the rod 47 extends. A suitable gasket 50 is mounted between the recessed portion 52 and the free end of bellows 45 to provide a watertight connection therebetween. Arranged within the recessed portion 52 of the cover 22 and held therein by the screws 54 is a variable locking member or depth selector member 53, which member is adapted to be rotated into any one of three positions and held therein by means of a pivotally mounted, spring biased arm 55

which engages one of three indentations 56 cut into the member 53 when the member is rotated into a desired position. Formed integrally with the plunger 47 are a plurality of ears 57 which are adapted to engage a plurality of ears 58 formed on the locking member 53 when the member 53 is in the position shown in Figs. 1 and 4. When the locking member 53 is in the position shown in Fig. 2, the ears 57 engage a plurality of ears formed on a copper disc soldered to the locking or depth selector member, and when the member 53 is rotated to the position shown in Fig. 3 the plunger is free to move. The function of the structure described in the foregoing will appear in greater detail as the description proceeds.

A central bore 61 is cut into the plunger 47 to provide communication with the interior of the bellows 45 and 46 through another bore 62 horizontally cut into the plunger 47. The interior of the bellows 45 and 46 is normally filled with fluid introduced into bellows 45 through the bore 61 and 62, the fluid thereafter flowing through the orifice 44 into bellows 46. When the bellows have been filled with fluid, the bore 61 is sealed as by soldering.

An arming fork 63 having bifurcated ends is mounted beneath the flanged portion 64 of the plunger 47 for preventing movement of the plunger. The fork is removed by pressing the upright portion 65 thereof against the cylindrical portion 66 thereof, thereby lifting the arm 67 away from the plunger, and exerting a force on the cylindrical portion in a direction proper for removing the fork. The arm 67 fits over the flanged portion of the plunger and prevents the fork from being jarred out of position. In actual practice, surface vessels are provided with automatic means for removing such arming forks as depth charges are launched.

The circular mounting plate 32 is provided with a plurality of depending portions 68, 69, and 71, the portions 68 and 71 being adapted to serve as bearing housings for a shaft 72 having a flat portion extending its length. Mounted on the shaft 72 is a detonator assembly indicated generally by the numeral 73 and comprising a substantially U-shaped member 74 through which extends the shaft 72. Sleeved about the shaft is a coil spring 75 having one end thereof hooked around the U-shaped member 74 and the other end engaging the flat portion of the shaft. The detonator assembly further comprises a detonator housing 76 carried by a Bakelite mount 77 and clamped therein by the nut 78, the U-shaped member 74 also being clamped to the mount by the nut 78. Secured to the mount 77 by the screws 79 are a pair of suitable electrical contact elements 81 and 82, electrical connection being maintained between the elements 81 and 82 and the detonator 83 by the conductors 84 and 85. The detonator 83 is held within the housing 76 by means of a flanged portion 86 on the detonator and the knurled nut 87.

Secured to the depending portions 69 and 71 of the plate 32 by the rivets 88 are two strips of suitable insulating material 89 and 91 to which are secured respectively the leaf spring contact elements 92 and 93 by the rivets 94.

The shaft 72 passes through an arm 96 having a hole therein shaped to conform with the shaft and which is secured to the shaft by a screw 95. Pivoted to one end of the arm 96 by a pin 97 is one end of a link 98, the other end of the link 98 being pivoted to another arm 99 by the pin 101. The arm 99 is pivoted to a fixed point on the plate 32 by a rivet 102, with another link 103 being pivoted at one end to the arm 99 by the pin 104. The other end of the link 103 is secured to the U-shaped member 51 by means of a shaft 105 and a cotter pin 106. The arm 96, link 98, arm 99 and link 103 will be referred to hereinafter as the linkage mechanism. Disposed about the shaft 72 are a plurality of spacer tubes 107 adapted to maintain the various elements mounted on the shaft substantially in a predetermined spaced relation.

Riveted to the plate 32 is a spring supporting arm 108 and a backup plate 109, the arm 108 having a hole therein adapted to receive the screw 111. The screw 111 is adapted to engage the plate 109 in an abutting relation therewith and to be held in position by a locking nut 112. The arm 108 has two holes therein adapted to receive one end of the springs 113 and 114 respectively, the other ends of the springs being hooked into holes provided in the link 103. Screwed to the plate 32 by the screws 118 is a timing device indicated generally by the numeral 115 which comprises an adjustable electrical contact 116 and a movable contact 117. Contact 117 is adapted to be moved gradually into engagement with contact 116 by means of a train of gears 119, including an escapement device, the gears being set in operation by the expansion of a spring 121, the spring having one end thereof secured to the contact 117 and the other end secured to the pin 101. The position of contact 116 with respect to contact 117 may be varied by adjusting a screw 122, thereby varying the tension on another spring 123 and moving the trip of insulating material 124 upon which contact 116 is mounted.

Also swaged to the cup-shaped member 20 are the adjustable, hydrostatically controlled switches 125 and 126, well known in the art to which the instant invention appertains, and for a purpose to be disclosed hereinafter.

The operation of the arming device as employed in a depth charge will now be described with reference to the drawings. For the purpose of description, let it be assumed that the instant device is arranged within a depth charge having a firing circuit of the type described and claimed in the copending application of Harry H. Hall et al. for Means for Firing an Explosive Charge. Serial No. 520,074, filed January 28, 1944. Fig. 12 of the accompanying drawings shows in diagrammatic form the firing circuit disclosed in the aforesaid application and comprises a signal pick-up device which controls the operation of a suitable amplifier, the amplifier being adapted to control the operation of a firing relay 128. A plurality of batteries 129, 131 and 132 are included in the circuit, the battery 129 being arranged to supply electric potential to the filaments of the electron discharge devices included in the amplifier and battery 131 being arranged to supply electric potential to the plates thereof. Battery 132 is arranged in the detonator circuit for firing the detonator. It will be noted that potential will not be supplied to the cathodes and plates of the electron discharge devices included in the amplifier until the contacts 133 and 134 associated with switch 125 and contacts 135 and 136 associated with switch 126 are closed respectively in a well known manner.

Before the depth charge is launched into a body of water, the locking or depth selector member 53 is in the position shown in Figs. 1 and 4 whereby the plunger is prevented from moving and the device is maintained safe. Moreover, the arming fork 63 further prevents movement of the plunger in the event the member 53 is inadvertently rotated to either of the positions shown in Figs. 2 and 3.

Let it be assumed now that the member 53 is rotated to the position shown in Fig. 3 and that the depth charge is to be launched. As the depth charge is projected from a surface vessel, means provided on the surface vessel removes the arming fork 63. When the depth charge strikes the water and begins to descend therein, the pressure of the surrounding water exerts a force against the gasket 50 and the washer-like portion 48 of the plunger 47, thereby causing the plunger to move downward and causing the bellows 45 to compress and bellows 46 to expand. Coincident therewith, fluid is caused to flow from bellows 45 through the orifice 44 into bellows 46 by reason of the decrease in volumetric capacity of bellows 45.

As the plunger moves downward, water is admitted into a chamber comprising the cup-shaped member **20** and the cover **22**, the pressure thereof acting upon the switches **125** and **126** to cause them to operate and apply static operating potentials to the filaments and plates respectively of the electron discharge devices included in the amplifier.

As the depth charge continues to descend through the water, the hydrostatic pressure on the plunger and bellows **45** increases and forces the plunger to continue its downward movement by further compressing bellows **45** and causing fluid to flow into bellows **46**. Directly connected to the plunger by the U-shaped member **51** is the linkage mechanism which is adapted to rotate the shaft **72** and detonator assembly **73** as the plunger moves under pressure of the surrounding water. When the detonator is rotated into the position shown in Fig. 5, the contact elements **81** and **82** included in the detonator assembly **73** move into engagement with contacts **92** and **93** respectively and the detonator **83** is placed in operative relation with respect to the booster charge **39**, which position of the detonator is referred to hereinafter as the armed position, Figs. 5 and 9.

After the detonator is rotated into the armed position, the circuit shown in Fig. 12 is armed, the hydrostatically controlled switches having operated previously to close contacts **133** and **134** and contacts **135** and **136**, and when the contacts of the firing relay **128** are closed, battery potential is applied to the detonator and the depth charge is exploded.

The depth at which the detonator is rotated into the armed position may be varied several ways in the present device. The tension of the springs **113** and **114** connected to the link **103** of the linkage mechanism tends to oppose the rotation of the detonator and by adjusting the screw **111** such tension may be varied and the depth at which the detonator is rotated into the armed position is controlled thereby. In the foregoing description the selector member **53** was set in a position allowing the plunger to move freely under hydrostatic pressure. If, however, it is desired to delay rotation of the detonator into the armed position until the depth charge has descended a further predetermined distance in the water, the member **53** is rotated into the position shown in Fig. 2 wherein the ears **57** on the plunger are in engagement with the ears **59** whereby the plunger is held in an initial position until the pressure of the surrounding water is sufficient to bend the ears **59** and thereafter drive the plunger. Moreover, the inherent spring rate of the bellows **45** and **46** controls to some extent the arming depth of the detonator.

As the detonator is rotated from the initial position to the armed position, the spring **121** is expanded and the timing device **115** is set in operation. A predetermined interval after the timing device is set in operation, contact **117** thereof moves into engagement with contact **116** whereby battery **132** is short-circuited, Fig. 12, and the firing circuit is short-circuited.

In the event that a countermining explosion occurs within the vicinity of the depth charge, the rapid increase in pressure of the surrounding water prevailing for a short interval as a result of the explosion, will not cause bellows **45** to be displaced for the reason that the flow of fluid through the orifice is restricted or damped, thereby preventing the detonator from being rotated into the armed position. It should be noted that a dynamic balance is provided between the plunger and detonator for the reason that the axis of the detonator is offset from the axis of rotation thereof and an inertia force which tends to drive the plunger in a direction to rotate the detonator into the armed position also acts upon the detonator in a direction to oppose this movement, thereby preventing rotation of the detonator when sudden shocks such, for example, as the shock due to launching and the shock due to impact with the deck of a vessel, are received.

It will be understood that the springs **113** and **114** provide for automatic recocking for test purposes by restoring the detonator to its initial position when the driving pressure has been removed from bellows **45** with the inherent spring rate of the bellows contributing to the restoring action. Moreover, the instant position of the detonator with respect to the booster charge is indicated exteriorly by the position of the plunger, whereby an observer may note the condition of the device before the launching thereof.

When the detonator is rotated into the armed position, Fig. 9, it engages the circular copper portion **133** of the booster charge container in substantially abutting relation therewith. The spring **75** sleeved about the shaft **72** is adapted to absorb a further increase in the pressure of the water whereby the detonator is prevented from rotating past the portion **133**.

It will be noted that the instant device is designed of thin metal sections with sufficient clearance between sections to prevent ice formation as the depth charge strikes the water, it being well known that thick metal sections retain cold temperatures sufficiently long to develop ice formations thereon.

From the foregoing, it should now be apparent that an arming device for a depth charge has been provided which is well adapted to fulfill the aforesaid objects of the invention. While the invention has been disclosed in particularity with respect to an example thereof which gives satisfactory results, it readily will be apparent to those skilled in the art, after understanding the invention, that further embodiments and variations may be made without departing from the spirit and scope of the invention as defined by the claims appended hereto.

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. In a device of the character disclosed adapted to be launched into a body of water, a movable electroresponsive detonator having a safe position and an armed position, means for rotatably mounting said detonator, a hydrostat, a linkage comprising a plurality of pivotally connected arms, means pivotally connecting said linkage to said hydrostat and said detonator for rotating said detonator from said safe position to said armed position as the hydrostat operates in response to an increase of hydrostatic pressure as the device descends through the water.

2. In a device of the character disclosed adapted to be launched into a body of water, a movable electroresponsive detonator having a safe position and an armed position, means for rotatably mounting said detonator, a hydrostat, a linkage comprising a plurality of pivotally connected arms, means pivotally connecting said linkage to said hydrostat and said detonator for rotating said detonator from said safe position to said armed position as the hydrostat operates, and means operatively connected to said hydrostat for delaying the operation of the hydrostat until the pressure of the surrounding water exceeds a predetermined value after the mine has been launched.

3. In a depth charge adapted to be launched into a body of water, the combination of a detonator supported within said depth charge and having a safe position and an armed position, a bellows assembly supported in said depth charge in communication with the surrounding water and adapted to be displaced thereby as the depth charge descends through the water, means for rotatably mounting said detonator, and means interconnecting said detonator and said bellows assembly for rotating said detonator from said safe position to said armed position as said bellows assembly is displaced, said last named means comprising a plurality of linked members pivotally connected to said bellows and to the detonator.

4. In a depth charge adapted to be launched into a body of water, the combination of a firing circuit, electroresponsive detonating means having a safe position and an armed position, means for rotatably mounting said detonating means, a first fluid-filled bellows having the exterior thereof in communication with the surrounding water and adapted to be compressed by the pressure thereof, a second fluid-filled bellows in fluid communication with said first bellows and arranged to be expanded by the fluid displaced from the first bellows, a bulkhead interposed between said first and second bellows and having a metered orifice therein whereby the flow of fluid from said first bellows into said second bellows is retarded thereby to prevent premature arming of said detonator as the depth charge descends through the water, linkage means interconnecting said detonator and said bellows and adapted to rotate the detonator from said safe position to said armed position as the fluid is displaced from said first bellows into said second bellows, and switch means on said detonating means and effective when the detonating means is in said armed position to connect the detonating means in said firing circuit.

5. In a depth charge device of the character disclosed adapted to arm the depth charge at a predetermined depth and comprising a detonator movable from a safe position to an armed position, means for rotatably mounting said detonator, the combination of hydrostatically controlled means adapted to be operated as the depth charge descends through the water, means interconnecting said detonator and said hydrostatically controlled means for rotating the detonator between said positions as the hydrostatically controlled means operates, resilient means for yieldably opposing the rotation of the detonator thereby to control the depth at which the rotation of the detonator is terminated, and means settable at will for varying the opposing force exerted by said resilient means thereby to vary the depth at which the detonator is rotated into said armed position.

6. In a depth charge, a device of the character disclosed comprising an explosive charge, detonating means supported in predetermined spaced relation with said explosive charge and adapted to be rotated into proximity therewith, means for rotatably mounting said detonating means, hydrostatically controlled means comprising an expansible fluid filled bellows in communication with the surrounding water for rotating said detonating means into proximity with said explosive charge when a gradual increase in the pressure of the surrounding water occurs, a second fluid filled bellows connected to said rotating means for retarding movement thereof, a fixed baffle member interconnecting one end of each of said bellows and having a minute orifice therein for restricting the flow of said fluid therebetween thereby to prevent rotation of the detonating means into proximity with the explosive charge when a rapid increase in the pressure of the surrounding water occurs, resilient means for yieldably opposing the rotation of said detonating means thereby to control the depth at which the rotation thereof is terminated, and means settable at will for varying the opposing force exerted by said resilient means thereby to vary the depth at which the detonating means is rotated into proximity with said explosive charge.

7. In a depth charge, the combination of a firing circuit, an explosive charge, an electroresponsive detonator mounted within the depth charge and normally disconnected from said firing circuit, said detonator being mounted in predetermined spaced relation with said explosive charge and rotatable into operative relation therewith, means for rotatably mounting said detonator, hydrostatically controlled means including an expansible bellows for rotating said detonator into operative relation with said explosive charge when a gradual increase in the pressure of the surrounding water occurs means including a second bellows in communication interiorly with the first named bellows for preventing the rotation of the detonator into operative relation with the explosive charge when a rapid increase in pressure of the surrounding water occurs, resilient means for yieldably opposing the rotation of said detonator thereby to control the depth at which the rotation thereof is terminated, means settable at will for varying the opposing force exerted by said resilient means thereby to vary the depth at which the detonating means is rotated into operative relation with said explosive charge, and switch means supported by said detonator and effective as rotation thereof is terminated to connect the detonator into said firing circuit.

8. In a depth charge adapted to be armed gradually as it descends through the water, a cup-shaped member and a cover therefor comprising a chamber, said cover having a port therein for admitting water into said chamber, valve means for controlling the flow of water through said port into said chamber, electroresponsive detonating means rotatable from a safe position to an armed position, means including said valve means and responsive to the pressure of the surrounding water for rotating said detonating means into said armed position as the depth charge descends through the water, a firing circuit including said detonating means, a plurality of normally open switches included in said firing circuit, and hydrostatically controlled means in communication with the water in said chamber and adapted to close said plurality of switches in predetermined sequential order as the depth charge descends through the water.

9. In a depth charge adapted to be armed gradually as it descends through the water, the combination of a cup-shaped member and a cover therefor comprising a chamber, said cover having a port therein for admitting water into said chamber, valve means for controlling the flow of water through said port into said chamber, a firing circuit, electroresponsive detonating means normally disconnected from said firing circuit and rotatable from a safe position to an armed position, means including said valve means and responsive to the pressure of the surrounding water for rotating said detonating means into said armed position as the depth charge descends through the water, a plurality of normally open contacts included in said firing circuit, hydrostatically controlled means in communication with the water in said chamber and adapted to close said plurality of contacts in predetermined sequential order as the depth charge descends through the water, and switch means effective when said detonating means is in said armed position to connect the detonating means into said firing circuit.

10. In a depth charge adapted to be launched into a body of water from an attacking craft, the combination of a firing circuit, an electroresponsive detonator movable from an initial locked position to an armed position, means for rotatably mounting said detonator, a depth selector having means for releasably locking said detonator in said initial position and adapted to be removed therefrom when the depth charge is launched, pressure responsive means in communication with the surrounding water for rotating said detonator between said positions as the depth charge descends through the water, switch means effective when the detonator is in the armed position for connecting the detonator into said firing circuit, and means controlled by said detonator for short circuiting said firing circuit a predetermined interval after the launching of the depth charge.

11. In a depth charge adapted to be launched into a body of water, detonating means mounted within the depth charge and rotatable from an initial position to a final position, means for rotatably mounting said detonating means, hydrostaticaly controlled means for rotating said detonating means into said final position as the depth charge descends through the water, and depth selecting means having a plurality of deformable ears for releasably locking said hydrostatically controlled means in an initial position until the pressure of the

surrounding water reaches a predetermined value sufficient to bend said ears and thereby unlock the hydrostatically controlled means.

12. In a depth charge adapted to be armed gradually as it descends through the water, the combination of a cup-shaped member and a cover therefor comprising a chamber, said cover having a port therein for admitting water into said chamber, valve means mounted in said port and adapted to control the flow of water through the port into said chamber, means for releasably locking said valve means in an initial position until the pressure of the surrounding water reaches a predetermined value, electroresponsive detonating means rotatable from an initial position to an armed position, means including said valve means and responsive to the pressure of the surrounding water for rotating said detonating means into said armed position as the depth charge descends through the water, a firing circuit including said detonating means, a plurality of normally open switches included in said firing circuit, a plurality of hydrostatically controlled means associated respectively with each one of said plurality of switches and arranged in communication with the water in said chamber for closing said plurality of switches in predetermined sequential order as the charge descends through the water, and means controlled by said detonating means for sterilizing said depth charge a predetermined interval after the depth charge has been launched into a body of water.

13. In a depth charge adapted to be armed gradually as it descends through the water, a cup-shaped member and a cover therefor comprising a chamber, said cover having a port therein for admitting water into said chamber, valve means mounted in said port and adapted to control the flow of water through the port into said chamber, means for releasably locking said valve means in an initial position until the pressure of the surrounding water reaches a predetermined value, a firing circuit, electroresponsive detonating means normaly disconnected from said firing circuit and rotatable from an initial position to an armed position, means including said valve means and responsive to the pressure of the surrounding water for rotating said detonating means into said armed position as the depth charge descends through the water, a plurality of normally open contacts included in said firing circuit, hydrostatically controlled means associated with each one of said plurality of contacts and arranged in communication with the water in said chamber for closing said contacts in predetermined sequential order as the depth charge descends through the water, switch means effective when said detonating means is in said armed position to connect the detonating means into said firing circuit, and means controlled by said detonating means for sterilizing said depth charge a predetermined interval after the depth charge has been launched into a body of water.

14. In a depth charge, an arming device of the character disclosed comprising a rotatable detonator having a safe position and an armed position, means for rotatably mounting said detonator, means settable at will to different settings for preselecting one of a plurality of depths respectively corresponding to said settings at which said detonator will be rotated into said armed position, pressure responsive means in communication with the surrounding water for rotating said detonator from said safe position to said armed position as the depth charge descends through the water and in accordance with the setting of said depth selector means, and means controlled by said detonator for rendering said depth charge ineffective a predetermined interval after the depth charge has been launched into a body of water.

15. In an arming device for a depth charge adapted to be launched from an attacking craft, a firing circuit, an electroresponsive detonator normally disconnected from said firing circuit and adapted to be rotated from

an initial locked position to an armed position, means adapted to releasably lock said detonator in said initial locked position and to be released as the depth charge is launched from the attacking craft, means settable at will for preselecting one of a plurality of depths at which said detonator will be rotated into said armed position, pressure responsive means in communication with the surrounding water and adapted to rotate said detonator between said positions as the depth charge descends through the water and in accordance with the setting of said depth selector means, switch means effective when said detonator is in said armed position to connect the detonator into said firing circuit, and means controlled by said detonator for sterilizing said depth charge a predetermined interval after the depth charge is launched into a body of water.

16. An arming device for a depth charge comprising a bulkhead having an orifice therein, a first fluid filled bellows assembly mounted superjacent said bulkhead and covering one end of said orifice, said first bellows assembly being in communication with the surrounding water and adapted to be displaced thereby when the pressure thereof increases at a predetermined rate, a second fluid filled bellows assembly mounted subjacent said bulkhead and covering the other end of said orifice, a plunger secured to the free ends of said first and second bellows assemblies and adapted to pass through said bulkhead slideably, said second bellows assembly and said plunger being adapted to be displaced by said first bellows assembly when a displacement thereof is produced, a rotatably mounted shaft, detonating means secured to said shaft and rotatable therewith, an explosive charge having an axis tangential to the circular path described by an axis of the detonating means and arranged to be operatively engaged by the detonating means when the axis thereof is brought into coincidence with said axis of the explosive charge, and a linkage mechanism interconnecting said shaft and plunger and adapted to move said detonating means into said operative engagement with said explosive charge when said plunger is displaced.

17. An arming device for a depth charge comprising a bulkhead having an orifice therein, a first fluid filled bellows assembly mounted superjacent said bulkhead and covering one end of said orifice, said first bellows assembly being in communication with the surrounding water, a second fluid filled bellows assembly mounted subjacent said bulkhead and covering the other end of said orifice, a plunger secured to the free ends of said bellows assemblies and adapted to pass through said bulkhead slideably, a rotatably mounted shaft, a rotatable detonating means having an axis offset from the axis of rotation thereof, an explosive charge, resilient means sleeved about said shaft and adapted yieldably to secure the detonator thereto, and a linkage mechanism interconnecting said plunger and said shaft, said orifice being adapted to permit a flow of fluid between said bellows when the pressure of the surrounding water increases gradually thereby causing a movement of said plunger and linkage mechanism to rotate said detonating means into operative relation with said explosive charge, said resilient means being adapted to absorb a further increase in pressure of the surrounding water thereby preventing further rotation of said detonating means, said orifice also being adapted to restrict fluid flow between said bellows assemblies when sudden increases in water pressure occur to prevent rotation of said detonating means into operative relation with said explosive charge, said axis of said detonating means being offset from the axis of rotation thereof whereby the inertia force developed by the plunger as the depth charge receives a sudden shock is opposed by the inertia force developed by the detonator.

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