

Nov. 29, 1960

W. S. MACDONALD
DEPTH CHARGE ARMING DEVICE

2,961,955

Filed Feb. 11, 1946

3 Sheets-Sheet 1

FIG. 1.

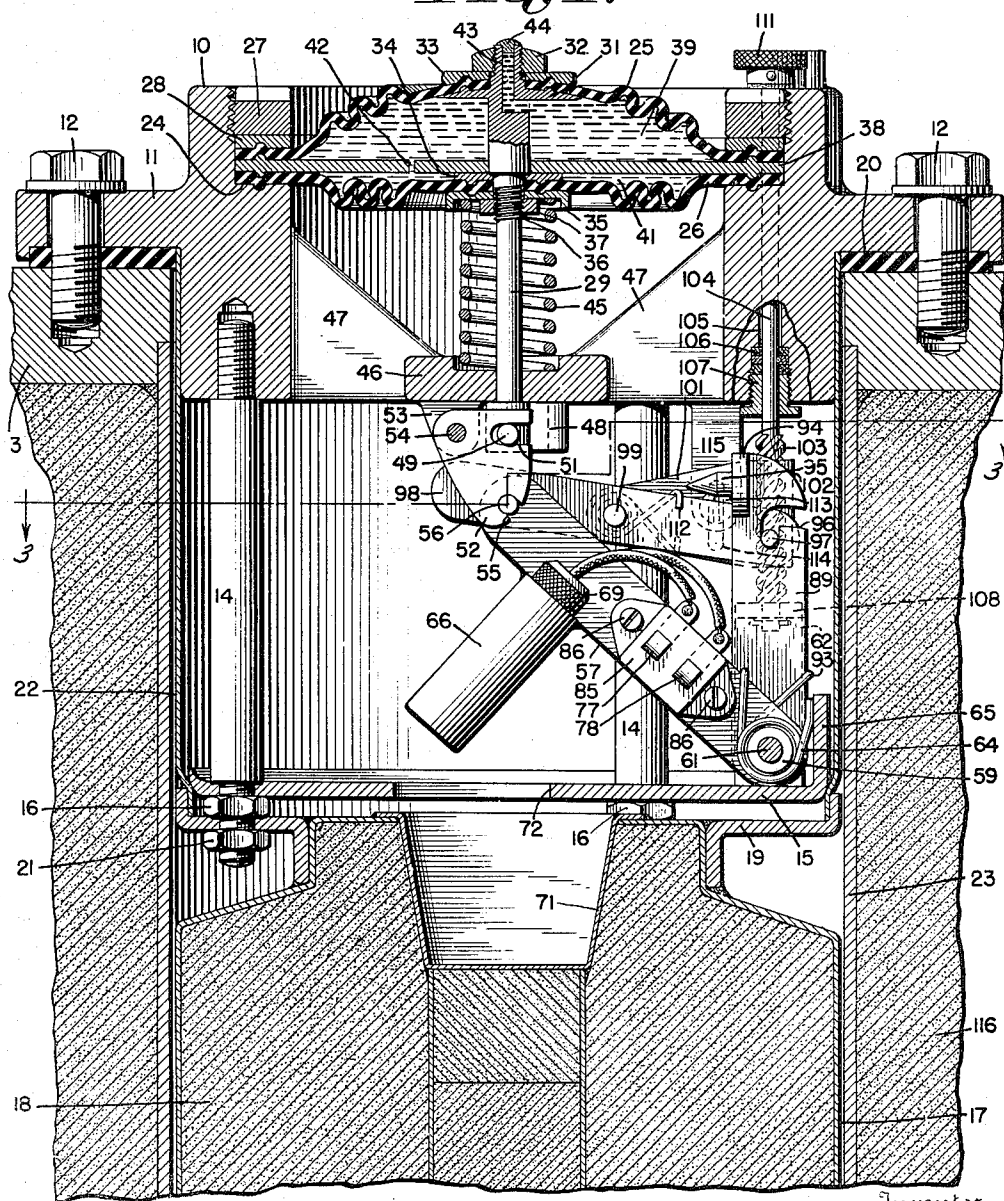
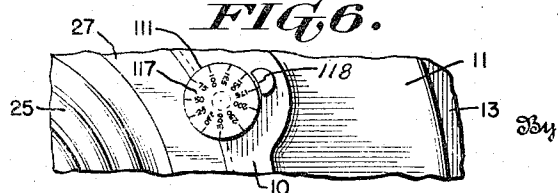


FIG. 6.



W. S. Macdonald

McNayes

Attorney

Nov. 29, 1960

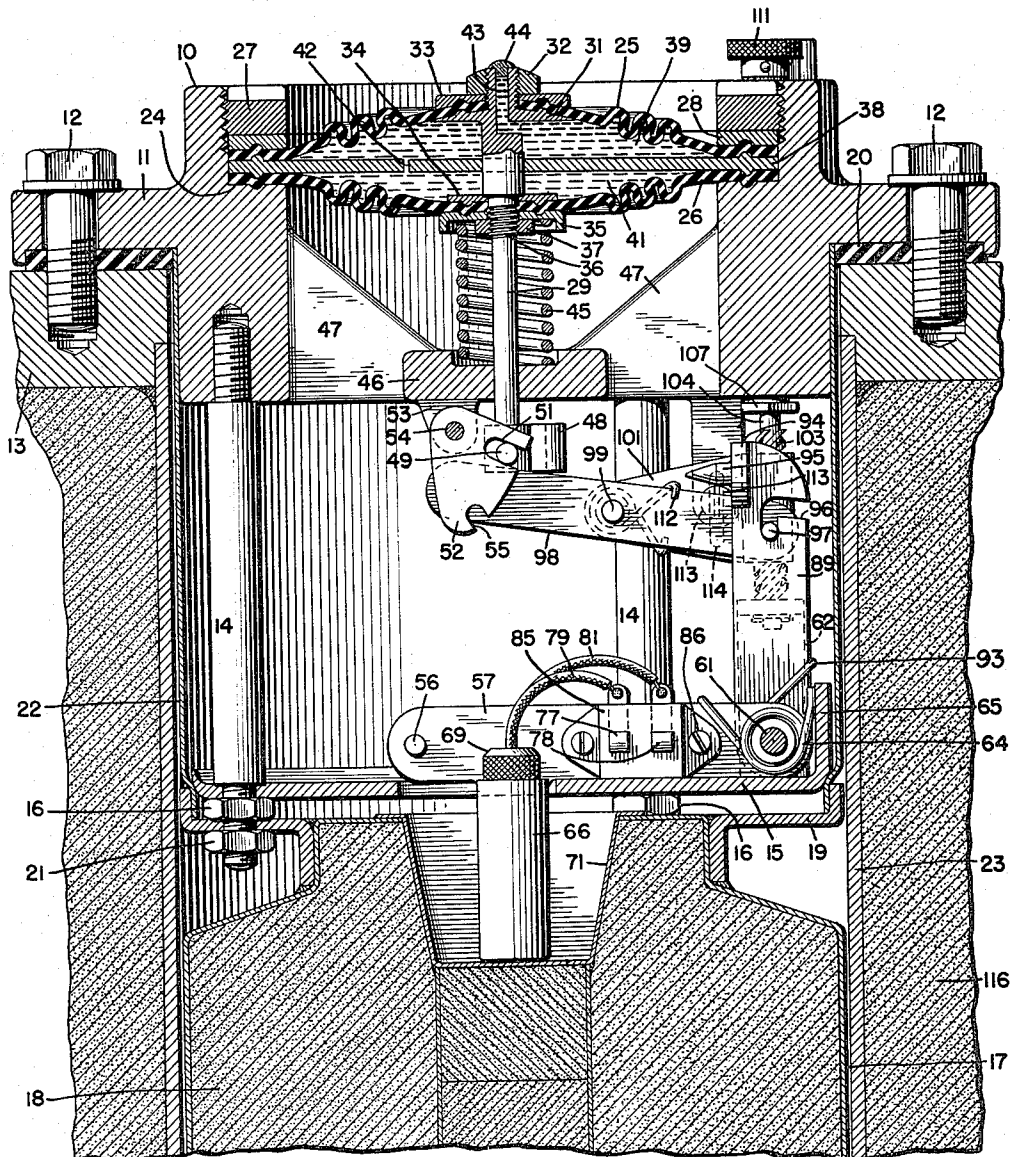
W. S. MACDONALD
DEPTH CHARGE ARMING DEVICE

2,961,955

Filed Feb. 11, 1946

3 Sheets-Sheet 2

FIG. 2.



Inventor
W. S. Macdonald

By

M. O. Hayes
Attorney

Nov. 29, 1960

W. S. MACDONALD
DEPTH CHARGE ARMING DEVICE

2,961,955

Filed Feb. 11, 1946

3 Sheets-Sheet 3

FIG. 3.

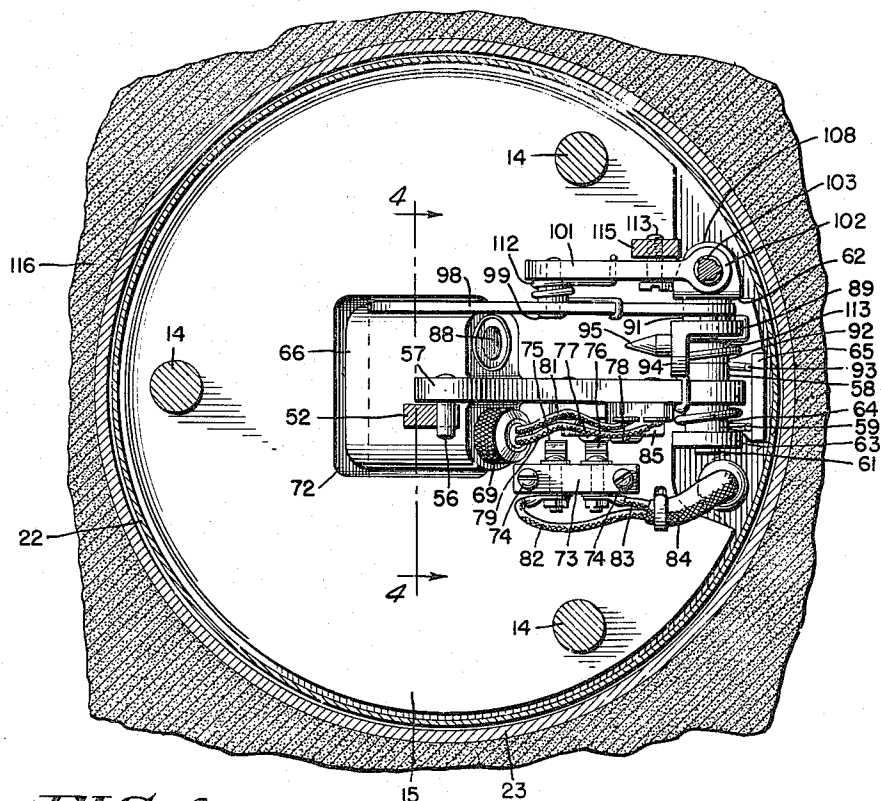


FIG. 4.

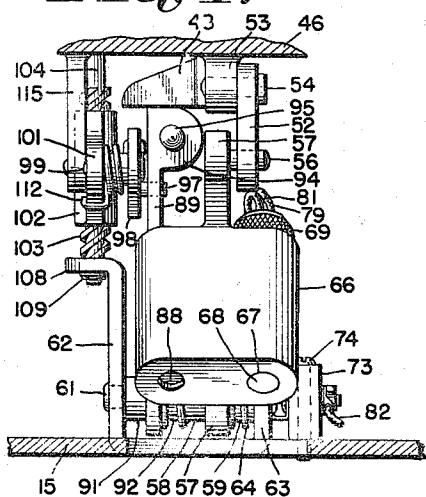
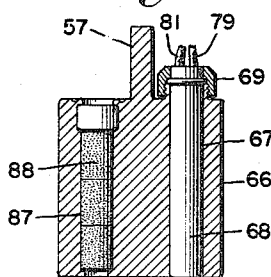


FIG. 5.



1

2,961,955

DEPTH CHARGE ARMING DEVICE

Waldron S. Macdonald, West Newton, Mass.
(Belmont, Mass.)

Filed Feb. 11, 1946, Ser. No. 646,943

8 Claims. (Cl. 102—7)

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

The present invention relates generally to devices adapted to arm a marine mine, depth charge or the like. More particularly, the invention relates to an arming device for a depth charge adapted to fire selectively mechanically or electrically in which the detonating means thereof is rotated into operative relation with respect to the booster charge thereof after the depth charge reaches a predetermined depth of submergence thereby to arm the firing circuit and in which the depth charge is caused to be fired mechanically when it reaches a further predetermined depth of submergence.

It is an object of the present invention to provide new and improved means for moving a detonator into operative relation with respect to a booster charge.

Another object is the provision of a new and improved arming device for a depth charge in which the detonating means thereof is caused to rotate from an initial locked position into operative relation with respect to the booster charge at a predetermined depth of submergence.

Another object is the provision of an arming device of the aforescribed character in which the detonating means is prevented from moving into the armed position thereof when sudden increases in pressure of the surrounding water are produced, as by counterming shocks.

Another object is to provide a new and improved arming device for a depth charge having an electrical detonator adapted to be connected into a firing circuit therefor as the detonator moves into the armed position thereof.

A further object in a depth charge adapted to be fired selectively mechanically or electrically as it descends through the water is to provide new and improved means for firing the depth charge mechanically at a predetermined depth of submergence.

Another object is to provide a depth charge adapted to be fired mechanically in which the firing pin therefor is caused forcibly to be rotated from an initial locked position into engagement with the detonating means associated therewith.

A still further object is the provision of a new and improved arming device for a depth charge of the above character which may be adjusted to control the depth at which the depth charge is fired mechanically.

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 the preferred embodiment of the present invention, reference is made to the following description, taken in connection with the accompanying drawings, of which:

Fig. 1 is a vertical sectional view, with certain parts in elevation, of the device of the present invention according to the preferred embodiment thereof;

Fig. 2 is a view similar to Fig. 1 and shows the device of the present invention in the armed position thereof;

2

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a view in elevation taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a detailed sectional view of the detonators included in the arming device of the present invention; and

Fig. 6 is a fragmentary top view of the present device showing the indicia means associated with the adjustable mechanical firing means.

Referring now to the drawings, wherein like characters of reference refer to like parts throughout the several views, the numeral 10 designates a ring member having a flanged periphery 11 provided with a plurality of holes adapted to receive screws 12 whereby the ring member is secured to the casing 13 of a depth charge, a suitable gasket 20 being arranged intermediate the flange 11 and casing 13 in order to provide a watertight connection therebetween. The inner end of ring member 10 is provided with a plurality of threaded openings respectively adapted to receive a plurality of posts 14 having threaded extremities. A circular plate 15 is affixed to posts 14 by nuts 16, a booster can 17 carrying the booster charge 18 also being secured to the posts by a circular member 19 affixed to the booster can in any suitable manner as by nuts 21. A tubular member 22 is disposed between the wall 23 of the depth charge casing and the ring member 10 for enclosing the operating elements of the device of the present invention, member 22 being held in fixed position at the inner end thereof by plate 15 and circular member 19.

Supported on a shoulder 24 of the ring member 10 by a ring nut 27 and washer 28 are two flexible diaphragms 25 and 26 composed of any suitable material such, for example as a natural or synthetic variety of rubber, the outer diaphragm 25 being in communication with the surrounding water and depressible by the pressure thereof. Diaphragm 25 is connected to diaphragm 26 by means of a plunger 29 which extends through the diaphragms and which is secured to the outer diaphragm 25 by a shoulder 31 formed on the plunger and a nut 32 received on the threaded outer extremity of the plunger, a suitable washer 33 being arranged between screw 32 and diaphragm 25 for convenience in drawing up tightly the screw 32. The plunger is secured to diaphragm 26 by means of a washer 34 arranged on one side thereof and a spring centering device 35 arranged on the other side thereof, the plunger having a threaded portion 36 adapted to receive a nut 37 whereby the centering device 35 is drawn up against diaphragm 26.

A partition 38 is disposed intermediate diaphragms 25 and 26, thereby forming chambers 39 and 41, a metered opening 42 being cut into the partition whereby the chambers are in communication with each other. The chambers are adapted to be filled with any suitable fluid such, for example, as brake fluid, which fluid is charged into the chambers through a suitable channel 43 provided in the plunger. After filling, the channel is sealed off as by a plug 44.

As the outer diaphragm 25 is depressed by the pressure of the surrounding water, fluid from chamber 39 is forced into chamber 41 through the opening 42, thereby causing the plunger to move inwardly against an opposing force provided by a coil spring 45 sleeved about the plunger whereby the amount of displacement of the plunger in accordance with the value of water pressure reacting on diaphragm 25 is controlled. The outer end of spring 45 abuts against the spring centering device 35 while the inner end thereof abuts against another spring centering device 46 which is held in position by, and se-

cured in any suitable manner to, a plurality of ribs 47 extending from the ring member 10.

Suitable tripping means 48 is affixed to the inner end of plunger 29 by means of a rivet 49 which is adapted normally to engage a slotted opening 51 provided in a substantially triangularly shaped, rotatable element 52. Element 52 is rotatably secured to a depending portion 53 of the centering device 46 by a pin 54 such that the element is adapted to be rotated in a clockwise direction as the plunger is caused to move inwardly. Element 52 is provided with an additional slotted opening 55 adapted to receive a pin 56 which extends from one end of a lever 57. The other end of lever 57 is provided with two hubs 58 and 59 through which extends a shaft 61 supported at the ends thereof by upright portions 62 and 63 formed from plate 15. A biasing spring 64 is sleeved about hub 59, one end of the spring being hooked over lever 57 and the other end of spring 64 abutting against an upright portion 65 of the plate 15. Formed integrally with and depending from lever 57 is a housing 66 having a cylindrical bore 67 extending therethrough adapted to receive an electroresponsive detonator 68, the detonator being maintained in the housing by a knurled nut 69 arranged on the upper portion thereof.

By reason of the foregoing arrangement, the electroresponsive detonator is held in a safe position, displaced angularly from the booster charge, until the depth charge has descended a predetermined distance in the water and the plunger has moved inwardly a sufficient distance to release pin 56. When this occurs, lever 57 is moved by spring 64 into the position shown in Fig. 2, thereby to place the electroresponsive detonator in a well 71 provided in the booster charge, a suitable opening 72 being cut into plate 15 to allow passage therethrough of the housing 66.

A terminal block 73 is secured to plate 15 as by screws 74 and comprises electrical contacts 75 and 76 adapted to be engaged respectively by contacts 77 and 78 carried by lever 57 when the detonator 68 is moved into operative position with respect to the booster charge 18, as shown in Fig. 2. The engagement of the aforesaid contacts connects the electroresponsive detonator into the depth charge firing circuit, electrical connection being maintained between contacts 77 and 78 and the detonator by conductors 79 and 81. Conductors 82 and 83 extend from contacts 75 and 76 on the terminal block to the depth charge firing circuit, not shown, through suitable conduit means 84 arranged to pass through the opening in plate 15 provided by the formation of the upright portion 63. Contacts 77 and 78 carried by lever 57 are affixed thereto in any suitable manner as by an insulating plate 85 and screws 86.

In the event that the depth charge is not fired electrically during its descent through the water, it is desirable that means be provided for firing the depth charge mechanically at some greater depth, thereby preventing the depth charge from resting on the bed of the water in an armed condition.

Accordingly, an additional cylindrical bore 87 is provided in the housing 66 and is charged with a suitable explosive powder 88 adapted to be discharged by impact of a suitable firing pin therewith. An additional lever 89 is also provided and is sleeved about shaft 61, hubs 91 and 92 being formed on the lever in order to prevent lateral movement thereof with respect to the shaft. A biasing spring 93 is sleeved about hub 92, one end of the spring being hooked around the lever 89 and the other end being arranged to abut against the upright portion 65. An ear 94 is formed on the upper end of lever 89 and is adapted to carry a firing pin 95 which is adapted forcibly to engage and explode charge 88 when lever 89 is released and driven by spring 93 in a counter-clockwise direction.

Lever 89 is provided with a bayonet slot 96 adapted to receive a pin 97 formed on the lever 98. The lever

98 is pivotally mounted about a pin 99 which is secured to an arm 101 provided with a substantially cylindrical, internally threaded portion 102 adapted to receive a threaded portion 103 of rod 104. The ring member 10 is provided with a bore 105 through which rod 104 extends, the inner end of the bore being of a slightly larger diameter and threaded whereby suitable packing means 106 is disposed about the rod and held in position by nut 107 to prevent rotary movement of the rod in response to shock, vibration and the like. The inner end of rod 104 passes through an ear-like portion 108 of the upright 62 and a cotter pin 109 is passed through the rod at the inner end thereof thereby to prevent upward motion of the rod when it is rotated. For convenience in rotating the rod, a knurled nut 111 is provided at the upper end thereof externally of the ring member 10.

Rotation of rod 104 causes the pivot point of the lever 98 to be moved up or down in accordance with the direction of rotation of the rod, thereby to bring the lever into or out of proximity with the tripping means 48. In order to prevent pin 97 from escaping the bayonet slot 96 as lever 98 is moved into proximity with the tripping means 48, a biasing spring 112 is sleeved about pin 99, the ends of the spring being hooked over lever 98 as shown in dashed outline in Figs. 1 and 2. Lateral movement of arm 101 and lever 98 is prevented by reason of an arrangement comprising a screw 113 passed through an elongated slot 114 in the arm 101 and through a threaded hole in depending portion 115 of the ring member 10, the screw being tightened sufficiently to prevent such lateral movement and still permit raising and lowering of lever 98 by rod 104.

In the event that the electroresponsive detonator 68 is not exploded during the descent of the depth charge, plunger 29 continues to move inwardly until the tripping means 48 engages lever 98. When this occurs, pin 97 formed on lever 98 is caused to escape the bayonet slot 96 thereby releasing lever 89 whereupon the firing pin 95 carried by the lever is driven by spring 93 into engagement with the explosives charge 88 thereby causing detonation thereof and of the booster charge 18 and main charge 116 in succession.

It will be understood that the proximity of the lever 98 with respect to the tripping means 48 is indicated externally of the arming device by the provision of indicia means 117, Fig. 6, formed on nut 111 and adapted to cooperate with reference mark 118 whereby one of a plurality of depths at which the depth charge is to be fired mechanically may be preselected.

It further will be understood that rapid increases in pressure of the surrounding water which prevail for a short interval such, for example, which may be produced by countermine explosions and shocks received during launching, will not cause the plunger 29 to be driven inwardly a sufficient distance to release the detonator 66 for rotation for the reason that the flow of fluid between chambers 39 and 41 is restricted.

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 described 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, modifications and changes may be made therein 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. An arming device for a depth charge comprising, in

5

combination, means responsive to changes in water pressure, an element operatively connected to and controlled by said pressure responsive means and positionable thereby in accordance with changes in water pressure, an explosive charge, a rotatably mounted lever having an initial position out of alignment with said charge and a moved position, electroresponsive detonating means carried by said lever, resilient means connected to said lever for rotating said lever into said moved position thereof thereby to place said detonating means into aligned operative relation with respect to said explosive charge, and means forming a part of and controlled by said element for preventing rotation of said lever until the element reaches a predetermined position.

2. A firing mechanism of the character disclosed comprising, in combination, an explosive charge, a spring biased lever mounted for rotation from an initial position out of alignment with said charge to a moved position under power of the spring, electroresponsive detonating means carried by said lever for movement therewith into operative relation with said explosive charge when the lever is rotated into said moved position thereof, releasable means for normally maintaining said lever in said initial position thereof, a movable element in engagement with said releasing means for releasing the releasing means when the element has moved a predetermined distance, and means responsive to changes in water pressure and in engagement with said element for moving the element variably in accordance therewith.

3. In a depth charge having a firing circuit, an arming device of the character disclosed comprising, in combination, means responsive to changes in water pressure, an element operatively connected to said pressure responsive means and positionable thereby in accordance with changes in water pressure, an explosive charge, a rotatably mounted lever having an initial position out of alignment with said charge and a moved position, electroresponsive detonating means carried by said lever, resilient means in engagement with said lever for rotating the lever into said moved position thereof thereby to place said detonating means into operative relation with respect to said explosive charge, switch means including at least one contact element carried by the lever and effective as said lever is rotated into said moved position to connect said electroresponsive detonating means in said firing circuit, and means including a latch member operatively connected to said element for preventing rotation of said lever until the element reaches a predetermined position.

4. A firing mechanism of the character disclosed comprising, in combination, means responsive to changes in water pressure, an element operatively connected to said pressure responsive means and movable thereby to different positions selectively in accordance with changes in water pressure, a rotatably mounted lever having an initial position and a moved position, a percussion cap carried by said lever, an explosive charge disposed within the firing mechanism out of alignment with said percussion cap when the lever is in said initial position, resilient means connected to said lever for rotating the lever into said moved position thereof thereby to place said percussion cap into operative relation with respect to said explosive charge, means operatively connected to said element for preventing rotation of said lever until the element reaches a predetermined position, a spring biased lever having a firing pin formed thereon and rotatable from an initial position to a moved position to cause the firing pin forcibly to engage and fire said percussion cap, and releasable means in engagement with said element for maintaining said spring biased lever in said initial position thereof and releasable by said element when a different predetermined position has been reached thereby.

5. A firing mechanism of the character disclosed comprising, in combination, hydrostatically controlled means including a movable element, a rotatably mounted lever

6

operatively connected to said hydrostatically controlled means and having an initial position and a moved position, a percussion cap carried by said lever, an explosive charge disposed within the firing mechanism out of alignment with said percussion cap when the lever is in said initial position, resilient means engaging said lever for rotating said lever into said moved position thereof thereby to place said percussion cap into operative aligned relation with respect to said explosive charge, means operatively connected to said element for preventing rotation of said lever until the element has moved a predetermined distance, a spring biased lever having a firing pin formed thereon and rotatable from an initial position to a moved position to cause the firing pin forcibly to engage said percussion cap, releasable means engaged by said movable element for maintaining said spring biased lever in said initial position thereof and releasable by said element upon a different predetermined movement thereof, and means settable at will for varying the initial position of said maintaining means with respect to said element thereby to vary the depth at which the maintaining means is released.

6. In a depth charge adapted to be launched into a body of water having a firing circuit, a device of the character disclosed and comprising, in combination, an explosive charge, a pivotally mounted lever, electroresponsive detonating means carried by said lever in predetermined spaced relation out of alignment with said explosive charge and adapted to be rotated thereby into aligned proximity therewith, means for releasably locking the lever with said detonating means in said spaced relation, hydrostatically controlled means normally engaging said locking means for releasing the locking means when a gradual increase in the pressure of the surrounding water occurs and for preventing the release thereof when a rapid increase in the pressure of the surrounding water occurs, means operatively connected to said lever and effective as the locking means is released for rotating said detonating means into proximity with said explosive charge, and switch means including a switching element on said lever and effective when said detonator means is in proximity with said explosive charge to connect the detonating means in said firing circuit.

7. An arming device for a depth charge comprising, in combination, a pressure responsive device, a device connected to said pressure responsive device and movable thereby in accordance with variations in the pressure applied thereto, explosive means, a rotatably mounted lever having an initial position out of alignment with said explosive means and a moved position, detonating means on said lever, means connected to said lever for rotating the lever into said moved position and aligning the detonating means with said explosive means, and latching means connected to said movable device for preventing rotation of said lever until the device reaches a predetermined position.

8. A depth charge arming device comprising, in combination, a firing circuit, pressure responsive means, an element connected to said pressure responsive means and movable thereby in accordance with the variations in the pressure applied thereto, an explosive charge, rotatably mounted lever means having an initial position and a moved position, resilient means for rotating said lever means, electroresponsive detonating means carried by said lever means, means for positioning the detonating means into operative relation with said charge as the lever means is rotated, switch means carried by said lever means for connecting said detonating means in said firing circuit as the lever means is rotated, and means including a latch connected to said movable element for preventing rotation of said lever means until the element reaches a predetermined position.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

1,368,569	Minkler	Feb. 15, 1921	
1,670,080	Pratt	May 15, 1928	5
1,780,592	Johansson	Nov. 4, 1930	

442,772

334,992

257,335

263,985

336,080

FOREIGN PATENTS

France	June 28, 1912
Germany	Mar. 24, 1921
Great Britain	Aug. 27, 1926
Italy	Apr. 10, 1929
Great Britain	Oct. 9, 1930