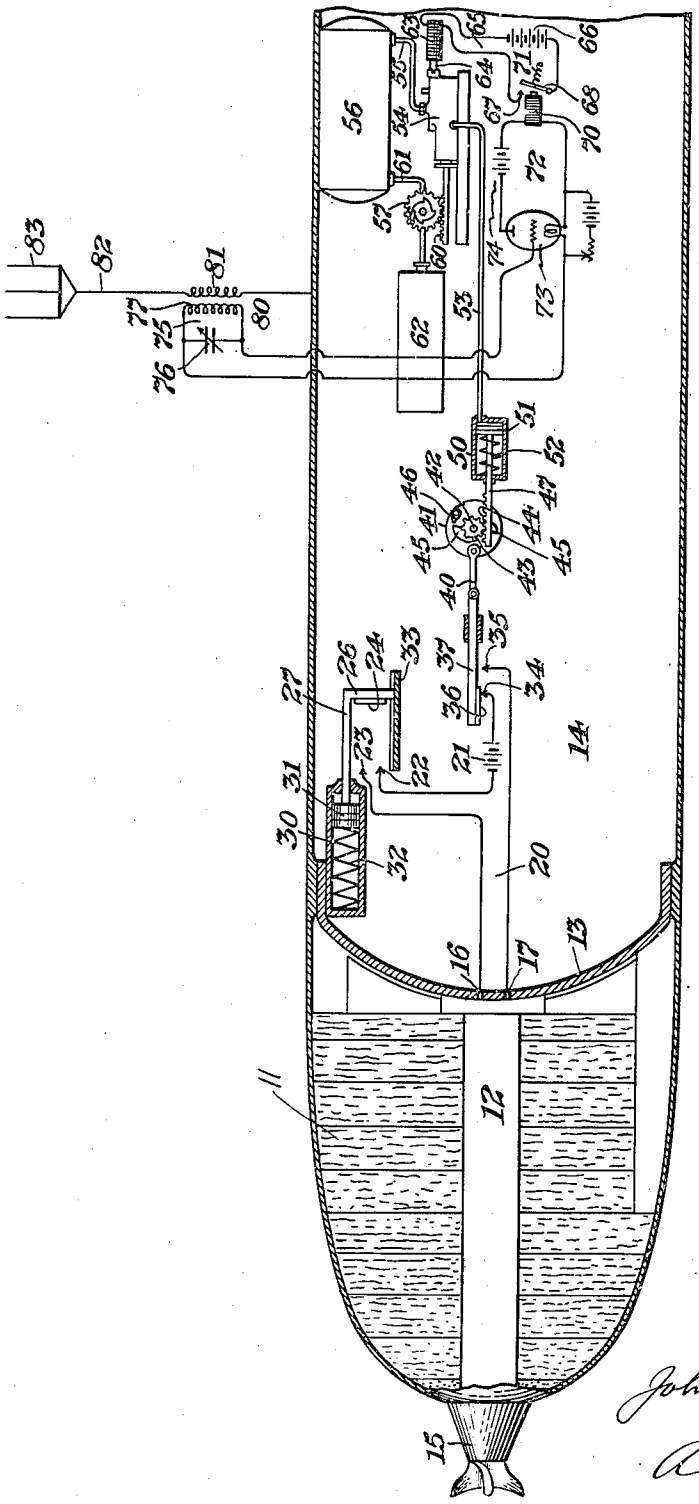
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DETONATOR CONTROL MECHANISM

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DETONATOR-CONTROL MECHANISM.

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Some of the objects of the present invention are to provide means for safe-guarding the detonator of a torpedo; to provide means operative at will from a distance to render the detonator firing means of a mine or torpedo responsive or unresponsive to impact according to requirements; to provide means, including an electric circuit arranged to be closed by impact to fire a detonator, operable by radiant energy for controlling the operation of the electric circuit; and to provide other improvements as will be hereafter explained.

In the accompanying drawings the figure represents a fragmentary longitudinal section of an explosive body showing a mechanism embodying the present invention.

Referring to the drawing one form of the invention is shown wherein the explosive body is a torpedo 10 having a suitable explosive agent 11 at its forward end arranged to be exploded by a detonating means 12 which, in the present instance, is fired electrically. A head 13 is rigidly secured to the torpedo body 10 and serves as a partition confining the explosive agent 11 on one side and providing a chamber 14 on the other side designed to contain the control mechanism. The nose of the torpedo 10 is, preferably, provided with a projecting member 15 to receive the impact of collision with an extraneous body.

For igniting the detonating means 12 the terminals 16 and 17 of an electric circuit 20 are passed through the head 13 and lie adjacent, but in spaced relation, in the detonating means 12 so that upon closing the circuit 20 the detonator is fired. A battery 21 or other source of current is included in the circuit 20 to supply the required electrical energy.

In order to cause the circuit 20 to function automatically in response to an impact caused by the torpedo 10 striking its target, a break is made in the circuit 20 thus providing two auxiliary terminals 22 and 23 which are arranged in spaced relation and so positioned as to be simultaneously engaged by a movable bridge piece 24 of conducting material. This bridge piece or circuit closer 24 is here shown as fixed to an arm 26 extending laterally from a stem or rod 27 which passes within a cylinder 30 and terminates in a weighted piston 31. The construction is such that the piston 31 is free to move within the cylinder 30, though it is normally held at one end of the cylinder 30 by a spring 32 so that the bridge piece 24 does not close the circuit 20. When the circuit 20 is closed except for the break between the terminals 22 and 23 it will be evident upon impact of the torpedo 10 with a body that the inertia of the weighted piston 31 will cause it to move in a direction to compress the spring 32 and bring the bridge piece 24 quickly into position to close the circuit 20 and thereby explode the agent 11. A suitable fixed guide 33 is provided for the support of the arm 26 to prevent it from getting out of alignment with the cooperating terminals 22 and 23.

For the purpose of controlling the circuit 20, so that it may be rendered potential at will, another break is made in the circuit 20 at a convenient point to provide a pair of spaced terminals 34 and 35 so arranged and located as to be simultaneously engaged by a bridge contact 36 which is fast to a reciprocable bar 37. At one end of the stroke of the bar 37 the bridge contact 36 is out of engagement with one of the terminals 34 and 35 and the circuit 20 is broken and inoperative, while at the other end of the stroke of the bar 37 the contact 36 bridges both terminals 34 and 35 and the circuit 20 becomes potential to fire the detonator when the break at the terminals 22 and 23 is closed.

In order to actuate the bar 37 it is connected at one end to a link 40, which is pivotally attached to a disk 41 mounted to rotate freely upon a shaft 42 which has a pinion 43 fast thereon and arranged to receive a rocking movement through the medium of a rack 44 in mesh therewith. The shaft 42 also has a double ended ratchet 45 keyed to it and arranged to engage a spring pressed pawl 46 which is pivoted upon the disk 41. This construction permits the pinion 43 to be rocked back and forth while the disk 41 is turned in one direction only, being stationary for one half a revolution while the pinion 43 is returning to normal position. The rack 44 is formed upon the portion of a piston rod 47 which projects from a cylinder 50, into which the rod 47 extends and where it terminates in a piston 51. A spring 52 is arranged within the cylinder 50 to hold the piston 51 normally in such a position that the bridge contact 36 is in its inoperative position that is breaking the circuit 20.

For operating the piston 51 at will from a distance, the end of the cylinder 50, on the opposite side of the piston 51 from the spring 52, is in communication with a pipe 53 which leads to a control valve 54 interposed between the pipe 53 and a pipe 55 leading to a source of pressure fluid, such as a reservoir 56. The construction of the control valve 54 is fully described in my copending application Ser. No. 67,947, filed Dec. 20, 1915 wherein also appears detailed description of the main rotary control valve 57 which is actuated by a reciprocable rack 60 projecting from the casing of the valve 54 and under the control of that valve mechanism. The control valve 57 serves to admit pressure fluid from a pipe 61, communicating with the reservoir 56, to the steering mechanism 62 which governs the direction of movement of the torpedo 10.

For actuating the valve 54 a solenoid 63 is provided having as its core a stem 64 which passes within the casing of the valve 54 where it is secured to the movable element of the valve. This solenoid 63 is in a circuit 65 including a battery 66 and a terminal 67, the latter being in the path of a pivoted armature 68 which forms the other terminal of the circuit 65. A relay magnet 70 is arranged when energized to close the circuit 65 by drawing the armature 68 into contact with the terminal 67 and when de-energized a spring 71 returns the armature 68 to its normal open position. The magnet 70 is in a circuit 72, including a battery 73, which is arranged to be controlled by a suitable detector 74 operatively positioned in shunt relation to a closed oscillatory circuit 75 including a variable condenser 76 and a secondary coil 77. The coil 77 forms the secondary of a transformer 80 having a primary coil 81 in an open aerial circuit 82 including an antenna 83. The electrical control circuits are so arranged with respect to the control valve 54 that a long impulse of energy is required to shift the valve mechanism so that the pressure fluid has access to the pipe 53 in order to operate the circuit closer bar 37.

In the operation of the device the mechanism is set as shown in the drawing when the torpedo 10 starts on its course and the detonating circuit 20 is inoperative because it is broken at two points. If therefore the torpedo 10 for any reason should be deflected from its course and strike an object, other than its intended target, no explosion would take place. When the torpedo 10 is safely on its course toward the target a long impulse is sent to energize the solenoid 63 and shift the valve 54 into a position to admit pressure fluid to the pipe 53. This results in a movement of the piston 51, to the left as seen in the figure, thereby causing the rack 44 to rock the pinion 43 in a clockwise direction and through the ratchet 45 and pawl 46 turn the disk 41 half a revolution in a clockwise direction. The rotary movement of the disk 41 is transmitted to the bar 37 which brings the contact 36 into bridging position across the terminals 34 and 35. The circuit is thus rendered potential and when the torpedo strikes its target the inertia of the weighted piston 31 throws the arm 26 to the left as shown in the figure and brings the contact 24 into bridging position across the terminals 22 and 23. This fires the detonator 12 and causes the charge 11 to explode.

In case the torpedo 10 should miss its target or not be used and it is desired to return it to its base, the detonating circuit 20 can be rendered inert or inoperative by again sending a long impulse to admit pressure fluid to the cylinder 50 and cause the disk 41 to be turned through another half revolution in a clock-wise direction, whereupon the bar 37 is returned to its former position with the circuit 20 broken between the terminals 34 and 35. In this condition the detonator 12 would not be fired even though the torpedo should strike an object and cause the weighted piston 31 to bridge the terminals 22 and 23.

From the foregoing it will be apparent that a complete unitary structure has been devised for safe-guarding the detonating means of a torpedo whereby accidental operation of the same is prevented and wherein the detonating means can be made responsive or unresponsive to impact at will from a system controlled by radiant energy.

Although only a few of the many forms in which this invention may be embodied have been described herein, it is to be understood that the invention is not limited to any specific construction, but might be embodied in various forms without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention, what I claim is:

1. A torpedo having in combination, a detonator, and igniting circuit for igniting said detonator comprising a contact closing device having contacts included in said circuit, a ponderable mass having a predetermined mass arranged to control said device, resilient means for maintaining said mass in fixed position, said mass being arranged upon sudden deacceleration of the torpedo to overcome the resilient means and to actuate said device to close its contacts, a second contact closing device having contacts included in series in said circuit, and means controlled by radiant energy for operating said last named contact closing device.

2. A torpedo having in combination, a detonator, an ignition circuit for igniting said detonator comprising a pair of circuit

controlling devices having contacts in series in said circuit, means responsive to radiant energy for actuating one of said devices to close its contacts, a weight movable in a longitudinal line arranged to actuate the other of said devices, and resilient means for maintaining said weight normally in the rear portion of its travel, said weight being arranged to be moved forward upon sudden stopping of the torpedo to actuate said second named device to close the contacts thereof.

3. A torpedo having in combination an electrically controlled detonator, means actuated by sudden stopping of the torpedo for firing said detonator, and means operated by radiant energy for rendering said control effective.

4. A torpedo having in combination, a detonator, a ponderable mass arranged to fire the detonator when the torpedo is suddenly stopped, and means normally to disable the detonator and controlled by radiant energy to render the detonator effective.

5. A torpedo having in combination, a detonator, a ponderable mass arranged to fire the detonator when the torpedo is suddenly stopped, and an electrical circuit arranged normally to disable the detonator and controlled by radiant energy to render the detonator effective.

6. A torpedo having in combination, a detonator, an ignition circuit for igniting the detonator comprising a contact closing device having contacts in series in said circuit, a mass slidably mounted to move longitudinally of the torpedo arranged to control said device, resilient means for normally maintaining said mass in the rearward portion of its line of movement, said mass being arranged upon impact of the torpedo with an extraneous object to be moved to close said contacts for igniting the detonator, a second contact closing device having contacts included in series in said circuit, and means controlled by radiant energy for operating said last named contact closing device.

7. A torpedo having in combination a detonator, means actuated by impact of the torpedo for firing said detonator, and means operated by radiant energy for rendering said control effective.

8. A torpedo having in combination a detonator, means including a ponderable mass actuated by impact of the torpedo for firing said detonator, and means operated by radiant energy for rendering said control effective.

Signed at New York in the county of New York and State of New York this 19th day of December A. D. 1918.

JOHN HAYS HAMMOND, JR.