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L. H. CHASE

2,465,009

CONCUSSION DETONATOR

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Fig. 1.

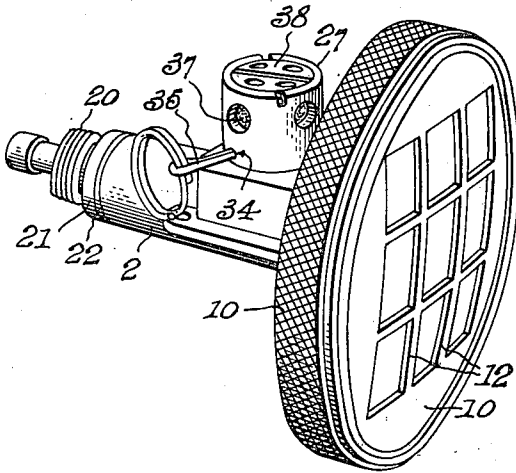


Fig. 4.

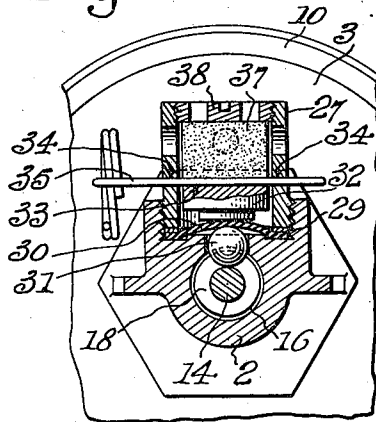


Fig. 2.

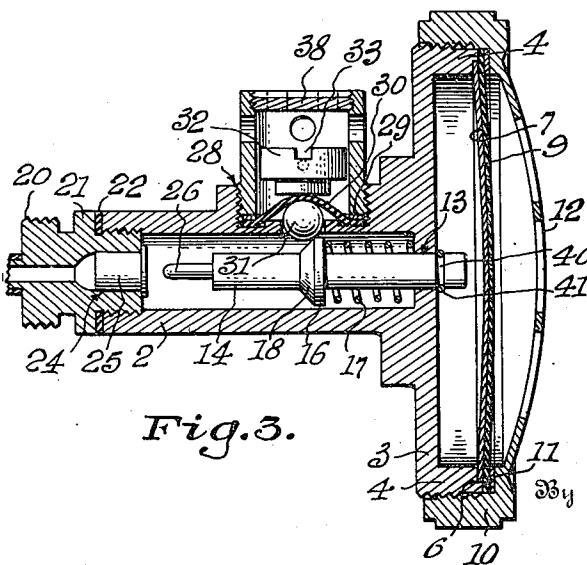
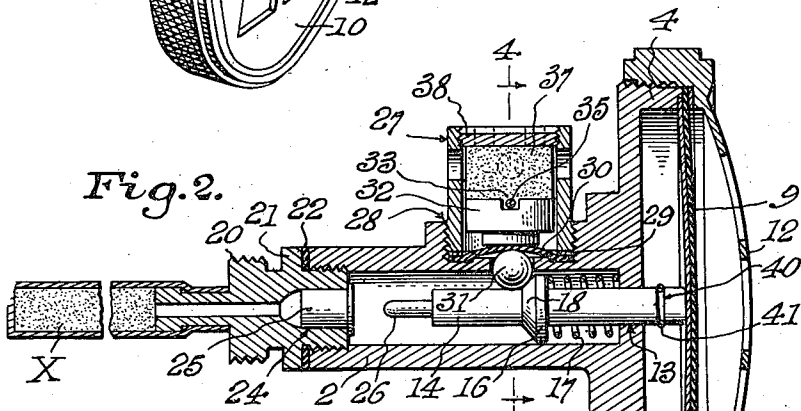
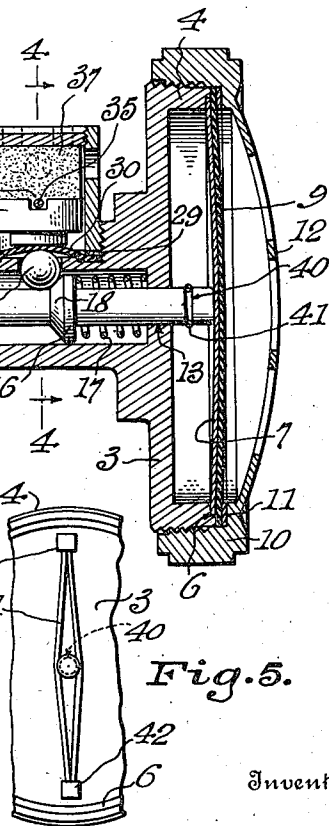


Fig. 3.

Fig. 5.



Inventor

Leland H. Chase

Francis E. Anderson and
Joseph H. Crow

Attorneys

UNITED STATES PATENT OFFICE

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CONCUSSION DETONATOR

Leland H. Chase, Port Washington, N. Y., assignor
to the United States of America as represented
by the Secretary of War

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3 Claims. (Cl. 102—16)

1

The invention relates to detonators for explosive charges, and more particularly to detonators which are actuated by concussion.

In the firing of a plurality of underwater explosive charges or mines the same are usually supplied with individual detonating devices which are interconnected by electrical wires or detonating cord; and the sowing of such mines or explosive charges is therefore troublesome and time-consuming. In addition, the interconnecting electrical wires or detonating cords are susceptible to breakage and disconnection, whereupon the previously connected explosive charges become inoperative.

It is among the objects of the present invention to provide a detonator which operates by concussion, whereby a plurality of the same may be disposed underwater in relative adjacency and operated by concussion waves produced by an underwater explosion.

Another object is the provision of a detonator of the class described which is cheap and easy to manufacture and durable in service.

The invention, then, comprises the features hereinafter fully described, and as particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail a certain illustrative embodiment of the invention, this being indicative of but one of several ways in which the principles of the invention may be employed.

In said drawings:

Figure 1 is a perspective of the device of the concussion detonator of the invention;

Figure 2 is an enlarged longitudinal view, mostly in section;

Figure 3 is a fragmentary view corresponding to the showing of Figure 2, but with certain of the operating instrumentalities of the device in other operative positions;

Figure 4 is a sectional view of the line 4—4 of Figure 2; and

Figure 5 is a fragmentary end elevation taken from within the device and illustrating the manner in which the firing pin is held against excessive inward movement prior to its intended manner of operation.

Referring more particularly to the drawings, the numeral 2 designates a cylinder which forms the body of the concussion detonator of the in-

2

vention. This cylinder terminates at one end in an enlarged radially extending circular head 3, the latter having at its periphery a right-angular outwardly-extending integral flange 4. The peripheries of the circular head 3 and its integral flange 4 are contiguous and provided with screw threads. The outer end of the flange 4 is recessed, as at 6, to receive the periphery of a stressed metal disk 7, the outer surface of the latter being flush with the extremity of the flange 4. This stressed metal disk 7 or snap diaphragm, constitutes a concussion responsive element, as will appear more fully hereinafter.

A resilient and waterproof disk 9 extends completely over the outer end of the flange 4 and, together with the stressed metal disk 7, is held in place by an internally threaded cap 10, which engages the screw-threaded contiguous peripheries of the circular head 3 and integral flange 4, a clamping ring 11 being provided between the said cap and the disk 9. The face of the internally-threaded cap 10 is grilled as at 12, to permit the water in which it is to be submerged to contact the outer face of the resilient and waterproof disk 9 and through the latter to actuate the immediately adjacent stressed metal disk, or snap diaphragm 7.

The circular head 3 is provided with a central aperture 13 which communicates with the center of the bore of the cylinder 2 as shown in Figures 2 and 3, the diameter of the said central aperture 13 being considerably smaller than the diameter of the bore of the cylinder 2. This construction and arrangement permits the central aperture 13 to receive a pin 14, one end of which extends into proximity with the center of the inner face of the stressed metal disk 7, while the other end thereof extends into the cylindrical body 2 for a substantial distance and has integrally formed thereon a radial flange 16. This radial flange 16 serves as an abutment for one of a coiled spring 17 which is fitted over the pin 14 and, at its other end, contacts the inner end of the cylinder 2. On its side which is remote from the coiled spring 17, the radial flange 16 merges into a frusto-conical surface 18 which terminates at the periphery of the pin 14. The purpose of this will be later described.

The end of the cylinder 2 which extends away from the circular head 3 is internally screw-

3

threaded to receive an externally screw-threaded centrally-bored plug 20. This plug 20 is provided with a radial flange 21 which cooperates with an annular gasket 22 to obtain a watertight seal for the end of the cylinder 2.

The inner end of the central bore of the plug 20 is enlarged, as at 24, to receive a percussion cap 25 which is exposed to contact by a firing pin 26 on the inner end of the pin 14. The outer end of the central bore of the plug 20 communicates with the main explosive charge which is generally indicated at X.

The device of the invention comprises an arming means which positively prevents the premature operation of the firing pin 26. This arming means comprises a short sleeve 27 which is disposed radially of the cylinder 2, and connected thereto in any suitable manner, as for example, by the screw-threaded relationship shown. The center of this short sleeve 27 is aligned with the center of a circular opening 28 in the wall of the cylinder. At the inner end of the short sleeve 27 there is disposed a gasket 29; and between the gasket 29 and the adjacent surface of the cylinder 2 there is clamped the periphery of a flexible disk 30 which is substantially impervious to water. This flexible disk rests against a ball 31 which is disposed in the circular opening 28 in the cylinder 2.

A plug 32 of metal or other suitable material is disposed within the sleeve 27 and rests on the flexible disk 30. The upper end of this plug 32 has a transverse slot 33 which is adapted to register with an aligned pair of apertures 34 in the sleeve 27.

A quickly removable cotter pin 35 extends through the apertures 34 in the sleeve 27 and the transverse slot 33 in the plug 32 and positively prevents the movement of the said plug away from the ball 31. In this position the ball 31 extends into the cylinder 2 and makes contact with the pin 14 and the adjoining frusto-conical surface 18 of the radial flange 16, all as shown in Figure 2. This relationship effectively prevents the movement of the firing pin 26 into contact with the percussion cap 25.

Referring to Figures 2 and 4, a plug 37 of salt or other water-soluble material rests upon the plug 32 and is held thereagainst by a cap 38 which is detachably secured to the outer end of the sleeve 27. This cap 38 is apertured, as are the adjacent portions of the sleeve 27.

Referring particularly to Figure 5, that portion of the pin 14 which is disposed within the circular head 3 is provided with an annular groove 49. Spaced inwardly of its annular groove 40, the pin 14 carries a pair of substantially straight spring wires 41 which are joined at their ends and connected by clips 42. The midsections of the substantially straight spring wires 41 are separated and straddle the pin 14. In this position, the clips 42 may be in contact with the circular head and, if desired, welded thereto. On the other hand, the spring wires 41 may initially be seated in the annular groove 40 in the pin 14 with the clips 42 substantially spaced from the enlarged head 3. In either case, when the water-soluble plug 37 dissolves, the coiled spring 17 causes the pin 14 to move toward the percussion cap 25 until the spring wires 41 lie flat against the enlarged head 3 with the said spring wires seated in the annular groove 40. This eliminates all necessity for pre-loading the snap diaphragm.

The coiled spring 17 only serves to position the

4

pin 14 after dissolution of the water-soluble plug 27. After the positioning of the pin 14, the coiled spring 17 is nearly expended, and it requires a force of only a few pounds to dislodge the substantially straight spring wires 41 from the annular groove 40. This dislodging force is much below the force delivered by the snap diaphragm 7 to drive the firing pin 26 toward the percussion cap 25.

10 Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. A concussion detonator for firing underwater mines, which comprises, in combination, a housing, a firing pin mounted in the housing, a percussion cap mounted in the housing and adapted to be engaged by the firing pin and exploded thereby, a concussion wave-sensitive, snap-acting diaphragm mounted adjacent to the firing pin for actuating the firing pin responsively to impact of concussion waves against the diaphragm, restraining instrumentalities for holding the firing pin in inoperative position for a predetermined time, means for shifting the firing pin into ready-to-fire position responsively to expiration of the said predetermined time, and yieldable means for restraining the firing pin in the ready-to-fire position until the firing pin is operatively engaged by the diaphragm responsively to impact of concussion waves against the diaphragm, when the restraining means yield to permit detonating engagement of the firing pin with the percussion cap.

2. A concussion detonator for firing underwater mines, which comprises, in combination, a housing, a firing pin mounted in the housing, a percussion cap mounted in the housing and adapted to be engaged by the firing pin and exploded thereby, a concussion wave-sensitive, snap-acting diaphragm mounted adjacent to the firing pin for actuating the firing pin responsively to impact of concussion waves against the diaphragm, restraining instrumentalities for holding the firing pin in inoperative position for a predetermined time, the restraining instrumentalities including a flange on the firing pin, a restraining member engaging the flange, and means yieldably urging the restraining member against the flange, a piston engaging the said yieldable means, a housing for the piston, and water-soluble material in the housing, a spring acting under compression against the flange on the firing pin, whereby upon solution of the water-soluble material in the housing in water in which the mine is submerged, the firing pin is shifted from inoperative position to ready-to-fire position, and yieldable means on the firing pin for holding the firing pin in ready-to-fire position until the yieldable means become released under impact of the diaphragm against the firing pin, whereby the diaphragm forces the firing pin against the percussion cap to explode the cap.

3. A concussion detonator for firing underwater mines, which comprises, in combination, a main housing, a firing pin mounted in the housing and adapted to be engaged by the firing pin and exploded thereby, a concussion wave-sensitive, snap-acting diaphragm mounted in the housing adjacent to the firing pin for actuating the firing pin responsively to impact of concussion waves against the diaphragm, a frusto-conical retaining flange on the firing pin, an auxiliary housing mounted on the main housing, a piston in the auxiliary housing, a ball-locking

5

member engaged by the piston and urged thereby against the frusto-conical surface of the said retaining flange, a water-soluble material in the auxiliary housing behind the said piston, means in the housing permitting access of water to the water-soluble material, a compressed spring between the said frusto-conical flange and the main housing for urging the firing pin against the ball-locking member which thereby is caused to become displaced upwardly along the said frusto-conical surface of the retaining flange and the firing pin is shifted from inoperative locked position to ready-to-fire position, and yieldable means on the firing pin adapted to engage a portion of the main housing responsively to the shifting of the firing pin to ready-to-fire position for holding the said firing pin out of engagement with the percussion cap, while being yieldable under actuating movements of the diaphragm against the firing pin responsively to concussion-wave impacts against the diaphragm.

LELAND H. CHASE.

6

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