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MINE DETONATOR.

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1,295,097. Patented Feb. 25, 1919.

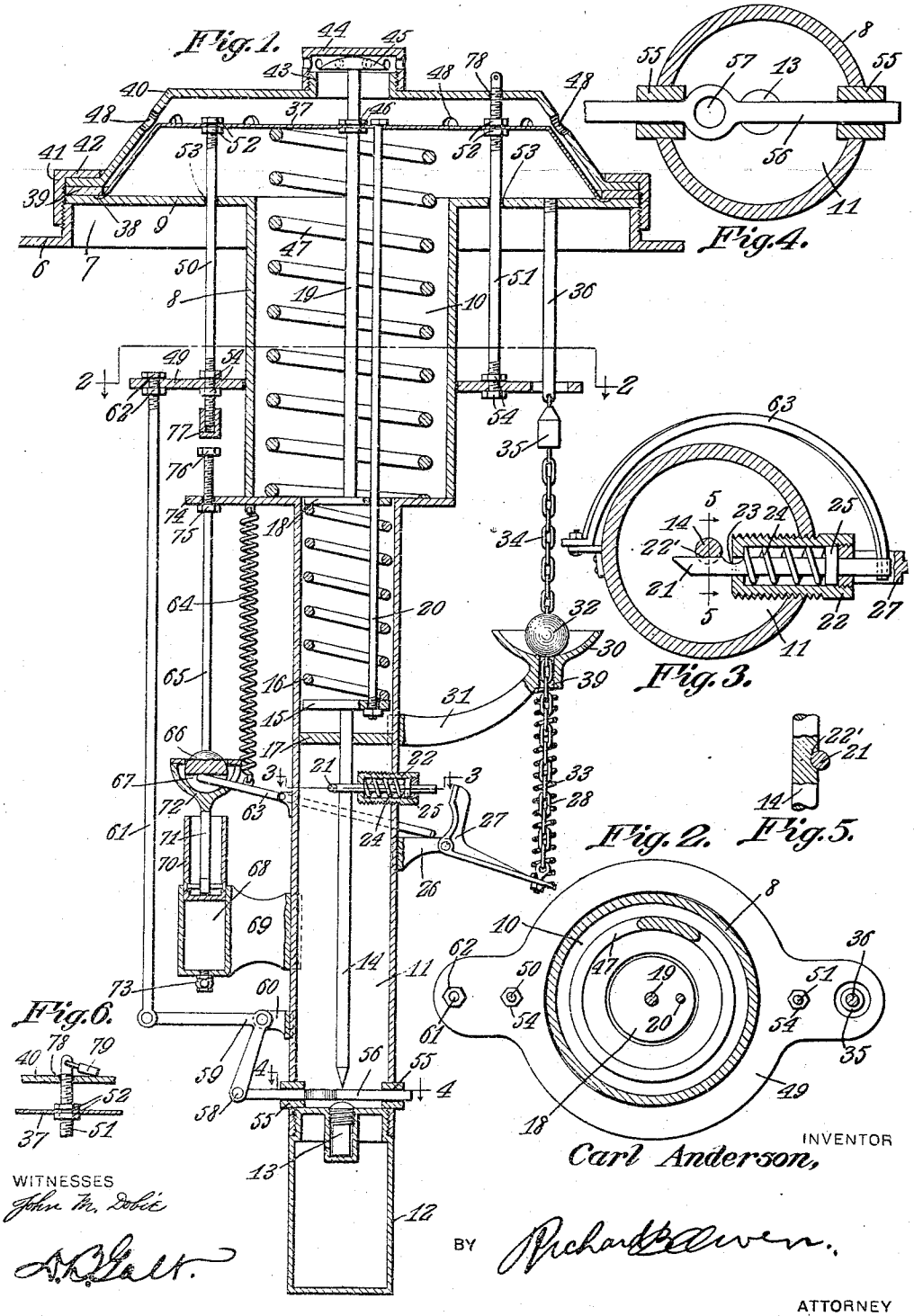


Fig. 1.

Fig. 4.

Fig. 3.

Fig. 5.

Fig. 2.

Fig. 6.

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MINE-DETONATOR.

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To all whom it may concern:

Be it known that I, CARL ANDERSON, a subject of the King of Sweden, residing at New York city, borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Mine-Detonators, of which the following is a specification.

This invention relates to submarine mines, and more specifically to means for preventing the untimely firing or explosion of such mines. The invention aims primarily to provide improved means for rendering the firing mechanism of the mine inactive or inoperative should the mine be submerged below a predetermined depth and also for rendering said mechanism inactive or inoperative should the mine float or not be submerged the desired depth. A further object is to provide in a mine of this character, improved means for locking the firing mechanism from the exterior of the mine, whereby handling of the mine may be carried on without danger of untimely explosion. A still further object of the invention is to provide improved means for use in connection with mines of this character whereby the "sympathetic" firing of the mine will be obviated.

Still further objects reside in providing a mine of the character set forth which is equipped with firing mechanism controlling devices capable of minute adjustment whereby the mine may be enabled to operate at various depths; which is equipped with improved means for setting and resetting the firing mechanism; and which may be readily rendered inactive or inoperative when desired.

With these objects in view together with others which will appear as the description proceeds, the invention resides in the novel formation, combination, and arrangement of parts, all as will be described more fully hereinafter, illustrated in the drawings, and particularly pointed out in the claims.

In the drawings:—

Figure 1 is a longitudinal sectional view taken through a firing mechanism actuating and controlling means constructed in accordance with the invention;

Fig. 2 is a sectional view taken upon line 2—2 of Fig. 1;

Fig. 3 is a similar view taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is a detail section taken substantially upon line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary detail sectional view illustrating the manner in which the firing mechanism may be locked from the exterior of the mine casing.

Referring to the drawings, 6 indicates generally the casing of a submarine mine of any preferred type, and to which the mechanism to be hereinafter detailed is applied. The casing is provided in its upper portion with an opening through which access may be had to the interior of the casing, and an upstanding annular flange 7 defines the opening.

A shell or casing 8, which is adapted to support the firing mechanism and the controlling means therefor, is provided, and is to be detachably secured within the mine casing proper. This shell 8 is relatively large adjacent its upper end, and has an annular flange 9 which seats upon the upper edges of the upstanding flange 7 on the mine casing.

The casing or shell 8 is cylindrical in form, and may be described as comprising upper and lower compartments 10 and 11 respectively, the latter being of relatively small diameter, and being adapted to house the firing mechanism. The lower end of the cylindrical casing may have threaded thereto a cartridge casing 12, within which may be arranged a detonator to be ignited or exploded by firing of the percussion or explosive cap 13. This cap is disposed at the lower end of the chamber 11 and is adapted to be contacted by the firing pin 14.

The firing pin comprises an elongated bar or rod as shown, preferably pointed at its cap engaging end, and the said pin is mounted to slide or move longitudinally of the compartment 11 of the casing. A head or plate 15 is provided at the upper end of the pin, and against which one end of an expansion spring 16 engages, the said spring tending to force the pin downwardly and into engagement with the explosive cap 13. A web or diaphragm 17 is arranged within the chamber 11 and is provided with a central aperture through which the pin slidably extends, and by this means the firing pin is held properly positioned within the casing.

The upper end of the expansion spring 16 rests against a plate or disk 18 secured to the lower end of a bar or rod 19, the latter extending centrally through the enlarged or upper compartment 10 of the shell 8 and protrudes at its upper end beyond the mine casing. A setting and resetting rod 20 is connected to the head 15 of the firing pin and extends upwardly through an opening in the disk 18 and to the upper part of the mine casing to be within convenient reach or grasp of the operator. The spring 16 tends to force the firing pin downwardly and into contact with the cap 13, and after the cap has been properly positioned within the cartridge and the cartridge applied to the casing, the firing pin is raised and maintained in set position by a latch or bolt 21.

A latch bolt casing 22 is threaded through the side of the tubular casing 11, and the latch carried thereby is engaged at its inner end with the firing pin. The firing pin is notched on one side as at 22′, and the latch is normally engaged in this notch to prevent longitudinal sliding movement of the firing pin. The latch or bolt 21 is also provided with a notch indicated at 23, and when the bolt is moved inwardly of its casing so that the notch 23 is passed within the notch 22′, the pin will be released, and the spring 16 will force the same downwardly into engagement with the cap 13. An expansion spring 24 is arranged within the latch casing 22, and bears at one end against a collar or shoulder 25 affixed to the bolt, and normally holds the said bolt so that its notch 23 is disalined from the firing pin or stem 14. The arrangement is such that the firing pin is normally held against movement longitudinally of the casing, and inward pressure upon the latch against the tension of the spring 24 is requisite to effect a release of the firing pin.

Secured to the exterior of the casing of the chamber 11 and below the latch pin or bolt 21 is a bracket 26, to which is pivoted an actuating member 27 in the form of a bell crank lever. One of the arms of the bell crank lever when swung inwardly is adapted to engage the outwardly protruding end of the latch pin or bolt 21 and to force the same inwardly to release the firing pin, but when the lever is in inoperative position, the said arm of the bell crank is spaced beyond the outer extremity of the latch pin. The other of the arms of the bell crank is connected at its extremity to a flexible member, such as a chain 28, and the said chain extends upwardly from the bell crank and through an opening 29 formed in the bottom of a bowl or cup 30 secured as by a bracket 31 to the casing. The upper end of this chain is secured to a ball 32 which is adapted to roll within the cup when the mine is tilted or its equilibrium displaced. An expansion spring 33 surrounds the flexible member 28 and bears at its upper end against the stationary cup 30 and at its opposite end against the bell crank arm, the said spring being relatively light, and being adapted to maintain the bell crank with its pin operating arm in inoperative position. Should the mine be tilted, the ball 32 will roll within the cup, and the ball is of a weight sufficient to overcome the tension of the spring 33, whereupon the flexible member 28 will be drawn upwardly and the bell crank 27 rocked upon its pivot and into engagement with the latch pin 21. A flexible member or chain 34 is connected to the upper end of the ball 32 and extends upwardly therefrom and is secured at its opposite end to a weight 35 pivoted to the lower end of a rod or stem 36 secured at its upper end to the flange 9 of the casing 8.

From the foregoing, it is apparent that when the explosive cap has been properly applied to the cartridge, the firing pin may be cocked by drawing upwardly upon the resetting rod 20. When the notch 22′ in the pin alines with the end of the latch bolt 21, the said bolt will be projected inwardly by the spring 24, and the said bolt will maintain the firing pin against movement either upwardy or downwardly within its casing. Should the mine be contacted by a floating body, such as a ship, and the equilibrium of the mine disturbed or overcome, the ball 32 will roll within the cup 30, and rolling action of the ball will pull the flexible member or chain 28 upwardly against the tension of the spring 33, whereupon the bell crank lever 27 will be rocked so as to force the latch pin or bolt 21 inwardly. This action will cause the latch bolt to move so as to bring the notched portion thereof within the corresponding portion of the firing pin, whereupon the latter is released, and will be forced downwardly by impulse of the spring 16. This action, obviously, operates to explode the cap or detonator 13.

Associated with a firing mechanism of this character is improved means for preventing the mine from being fired by concussion or shock due to the explosion of another mine in the same field or in the immediate vicinity, and such means also operates to prevent the mine firing when submerged beyond a predetermined depth or when the mine floats. To these ends, a flexible or elastic diaphragm 37 is arranged across the upper open end of the casing 8, and is adapted to be flexed or moved by hydrostatic pressure. This diaphragm in the present instance comprises a relatively thin disk of rubber or other such material capable of being readily flexed, and the edges of the said disk may be thickened or beaded, and the bead engaged in an annular groove or channel 38 in the upper face of the flange

9 of the casing 8. A gasket 39 is positioned over the beaded portion of the disk, and the outer edges of a dome or shell 40 rest upon the gasket. This dome extends above the upper open end of the casing 8 as shown, so as to provide a compartment between the top part of the dome and the flange 9. To secure the dome firmly upon the gasket and to secure the dome, gasket and casing 8 firmly upon the mine casing, a band 41 is threaded upon the upstanding flange 7 upon the mine casing, and the said band carries at its upper end an inwardly extending flange 42, which engages the edges of the dome member and forces the same tightly upon the gasket 39. This construction in effect creates a slip joint, whereby the various parts above mentioned are firmly held upon the mine casing, but it permits of ready removal of the parts, and the said construction also forms a water tight joint at the upper part of the mine casing.

The dome is provided with a central annular opening, the edges of which are defined by an outwardly projecting exteriorly threaded flange 43, over which is threaded a cap 44, and into the chamber formed by this cap projects the head 45 secured to the upper end of the rod 19. This rod passes through the central portion of the diaphragm 37, and a suitable packing member 46 may be provided in the diaphragm to prevent water passing to the interior of the mechanism casing.

An expansion spring 47 is arranged within the enlarged chamber 10 of the firing mechanism casing, and engaged at its upper end against the diaphragm 37, causing the latter to be forced upwardly. The dome and cap 40 and 44 are provided with openings 48, through which water may gain access to the interior of the dome to create pressure upon the diaphragm.

Surrounding the upper portion of the casing 8 is a slidable plate 49. Bolts or rods 50 and 51 connect the plate with the diaphragm as shown, and fluctuations of the diaphragm will operate to impart vertical sliding movement to the plate 49. The bolts or rods 50—51 may be firmly connected at their upper ends to the diaphragm by the lock or jam nuts 52 and extend downwardly through suitable openings 53 in the flange 9, being secured adjacent their opposite ends by lock nuts 54 to the slidable plate 49. The lock nut connection of the bolts or rods with the slidable plate permits of adjustment being made in the latter.

Mounted for sliding movement within suitable bearings 55 at the lower end of the chamber 11 of the casing 8 is a movable member in the form of a plate 56. This plate is disposed directly over the cap 13, and between the cap and the lower end of the firing pin 14. This plate is provided with an aperture 57 of such size as will permit of the firing pin passing through the said plate to engage and explode the cap 13, but the opening is so positioned upon the plate that when the latter is moved to its limit in either direction, the opening will be disalined from the pin end, and the firing pin, should the latter be released, will be prevented from contacting the explosive cap. One end of the plate 56 projects beyond the casing 8, and is pivotally connected as at 58 with the extremity of one arm of a bell crank lever 59. This bell crank lever is supported by a bracket 60, secured to the casing and its opposite arm is connected with the slidable plate 49 by means of a rod or link 61. The upper end of this link is connected with the said slidable plate by means of jam nuts 62, as shown.

The expansion spring 47 tends to force the diaphragm outwardly, such movement operating through the bolts or rod 50—51 to move the slidable plate 49 upwardly. This movement operates through the link 61 to rock the bell crank and to move the plate 56 to the position indicated in Fig. 1, or so as to disaline the opening 57 from the end of the firing pin. When the mine is submerged, however, water entering the openings 48 in the dome and cap will create pressure upon the diaphragm, whereupon the latter will be forced downwardly against the tension of spring 47. This movement operates to slide the plate 49 downwardly, whereupon the bell crank lever 59 is rocked upon its pivot, and the plate 56 is moved so that the opening 57 therein is disposed directly above the cap 13. Should the mine become submerged a depth greater than that which it is desired that the same shall operate, the increased water pressure will cause the diaphragm to move farther downwardly against the pressure of the spring 47, whereupon the plate 56 will be moved farther inwardly of the chamber or compartment 11, and the opening 57 in the said plate will be moved beyond alinement with the firing pin 13. When in such position, it is obvious that the releasing of the firing pin can not operate to explode the cap 13. The degree or tension of the spring 47 may be determined before inserting the same in the mine, and adjustment of the plate 49 toward or away from the diaphragm may be also made to regulate the depth to which the mine must be submerged before explosion can be brought about.

A safety mechanism is used to prevent the bell crank lever 27 operating to release the firing pin after the mine has been submerged a depth at which it is desired the same should operate. Pivoted inwardly from its ends upon the casing 8 and in substantially horizontal alinement with the

latch bolt 21, is an arm 63. This arm is curved for the major portion of its length as shown in Fig. 6, and extends around the cylindrical casing, its free end being positioned near the outer extremity of the latch bolt. This arm is so arranged that when the curved portion of the same is swung upwardly, the extremity of the said arm will be interposed between the outer end of the latch pin 21 and the operating arm of lever 27. When in this position, actuation of the bell crank will be prevented from operating upon the latch pin. The rear end of the arm is connected to the upper portion of the casing 8 by a spring 64, the spring tending to maintain the safety arm in inoperative position. An arm operating rod 65 is mounted for vertical sliding movement adjacent the rear end of the arm 63 and is enlarged at its lower end as at 66. The rear end of the arm 63 extends into a slot or groove 67 formed in the lower end of the enlarged portion 66, and it is obvious that downward movement of the rod 64 will force the inner end of the arm downwardly against the tension of the spring 64; this action causing the outer end of the said arm to be swung to operative position. To prevent the spring from too rapidly raising the rod 65 to normal position, a dash pot is provided, and this dash pot includes a cylinder 68 carried by a bracket 69 secured upon the lower portion of the casing 8 and below the arm 62. A piston 70 works within the cylinder, and a piston rod 71 is secured to and extends above the piston, and is formed at its upper end with a bowl portion or cup 72. The enlargement 66 on the operating rod is held within this bowl portion or cup, and downward movement applied to the said rod will force the piston downwardly and into the cylinder 68. A check valve 73 of any approved design may be arranged in the cylinder, to permit of the escape of air therefrom during downward movement of the piston, but to retard the entrance of air to the cylinder during upward movement of the piston. This dash pot in the present instance is described as being designed to operate as a pneumatic cushion; however, a hydraulic dash pot of any approved type may, with equal facility, be used.

The upper end of the rod 65 extends loosely through a suitable opening in the outwardly extending portion 74 on the casing 8, and is alined with one of the bolts or rods connecting the slidable plate 49 with the diaphragm 37. A stop in the form of a lock nut 75 is arranged upon the rod 65 and limits the upward movement of the same. A similar stop 76 at the extreme upper end of the rod limits downward movement of the said rod. The lower extremity of the rod 50 with which the rod 65 is alined, is equipped with an adjustable head 77, which is adapted when the diaphragm is depressed sufficiently to engage with the upper end of the rod 64. By reason of the fact that the head 77 is adjustable upon the extremity of the bolt 50, the mechanism may be regulated to operate the trigger locking device at various depths of submergence of the mine.

For the purpose of locking the mechanism so as to prevent the explosion of the mine when the latter is removed from the water or appears upon the surface, the upper extremity of the rod or bolt 51 is extended beyond the diaphragm 30, and protrudes through an opening 78 in the dome or shield 40 when the said diaphragm is extended. The extremity of this locking rod may be provided with an opening as shown through which a locking key or the bar of a padlock 79 may be passed.

In operation, the cartridge is attached to the lower end of the casing 8 so that the cap 13 thereof is properly alined with the firing pin. The mechanism in its entirety is then inserted within the open end of the mine, and is secured therein by the band 41 as shown. The setting rod 20 may be operated to lock the firing pin in raised position by inserting the hand through the opening in the top of the dome. The cap 44 is then applied to the top of the dome, and the bar or rod 19 is forced downwardly so that pressure of the spring 16 is exerted upon the firing pin. The mine is then placed in the water with the parts in the position indicated in Fig. 1. When the mine has reached such depth in the water that pressure of the latter upon the diaphragm 37 overcomes the tension of the spring 47, the bell crank 59 will slide the movable member or plate 56 so that the opening therein alines with the firing pin. Should an explosion in the water adjacent the mine occur, the extreme pressure created thereby on the water will force the diaphragm downwardly against the tension of the spring 47, whereupon the bell crank lever 59 will be further rocked, and the plate 56 will be moved sufficiently to disaline the opening 57 therein with the firing pin 14. At the same time, the head 77 will engage and force the rod 65 downwardly, and the arm 63 will be rocked upon its pivot to position its free end over the protruding end of the latch pin. In this manner, the mine is locked against explosion, and the violent agitation of the water occurring directly after the explosion can not operate to explode the mine. Should the diaphragm assume normal position immediately subsequent to the explosion, the opening 57 in the plate 56 will again aline with the firing pin, however, the piston 70 working in the chamber 68 will not have had sufficient time to regain normal position, and the

locking arm 63 will still be in position to prevent actuation of the locking pin. After the piston 70 in the dash pot assumes normal position, the firing mechanism will be again in operative position, and it is preferred that the dash pot be constructed so as to move at relatively slow speed.

When the mine is brought to the surface, a locking key or padlock may be applied to the protruding end of the locking rod 51, whereupon the slidable plate 49 will be positively held against downward movement, and it will be observed that when in this position, the plate 56 obstructs operation of the firing pin.

From the foregoing, it is apparent that I have provided a mine firing mechanism which is of extremely simple construction and which will prove effective in operation. The automatic locking and timing mechanism is so constructed, arranged and assembled as to minimize the possiblity of breakage or derangement of the parts, and the same is therefore assured of positive operation.

While the present is a disclosure of the preferred embodiment of the invention, it is to be understood that the invention is not limited thereto, as various changes may be made in the construction, arrangement and proportion of parts, without departing from the scope of the invention, as defined in the appended claims.

What is claimed is:—

1. In a submarine mine, a firing mechanism including a pin, a plate slidably arranged between said pin and the explosive cap of said mine and provided with an opening, a member actuated by hydrostatic pressure, and a connection between said member and said plate and capable under mean pressure of holding said plate with its aperture alined with said pin, and under excess pressure of disalining said opening with said pin.

2. In a submarine mine, a firing mechanism, a latch for holding said mechanism in cocked position, an actuating lever adapted to contact said latch, an arm, and means actuated by hydrostatic pressure for moving said arm into the path of movement of said lever.

3. In a submarine mine, a firing mechanism, an actuating lever adapted when moved a predetermined distance to operate said mechanism, a swinging member, and means actuated by hydrostatic pressure for moving said swinging member into the path of travel of said actuating lever.

4. In a submarine mine, a firing mechanism, an actuating lever for rendering said mechanism active, a swinging member adapted to move into the path of travel of said actuating lever, means for normally holding said member in inoperative position, and means actuated by hydrostatic pressure for moving said member against the tension of said holding means.

5. In a submarine mine, a firing mechanism, an actuating lever for rendering said mechanism active, a swinging member adapted to move into the path of travel of said actuating lever, means for normally holding said member in inoperative position, a diaphragm susceptible to hydrostatic pressure, and a connection between said diaphragm and said swinging member, whereby excess hydrostatic pressure will cause said swinging member to move against the tension of said holding means.

6. In a submarine mine, a firing mechanism including a pin, an actuating lever for rendering said mechanism active, a swinging member adapted to intercept said actuating lever, a movable member adapted to be moved into the path of travel of said pin, and means actuated by hydrostatic pressure for moving said swinging member to intercept said actuating lever and to slide said movable member into the path of travel of said pin simultaneously under excess pressure.

7. In a submarine mine, a firing mechanism including a firing pin, a movable member adapted to slide between said pin and the explosive cap of said mine, means controlled by hydrostatic pressure for moving said member, and a locking bar connected with said means and adapted to protrude from said mine when said member has been moved to operative position.

8. In a submarine mine, a firing mechanism, an actuating lever for releasing said mechanism, a spring for holding said lever in inoperative position, a cup, a ball in said cup, a flexible member connecting said ball and lever, the weight of said ball being greater than the power of said spring, and the said ball being adapted upon tilting of said mine to roll in said cup and to pull said lever against the tension of said spring.

9. In a submarine mine, a firing mechanism, an actuating lever for operating said mechanism, means actuated by hydrostatic pressure for preventing actuation of the firing mechanism, and means simultaneously locking said actuating lever against operation.

10. In a submarine mine, a firing mechanism including a pin, a diaphragm actuated by hydrostatic pressure, a plate adapted to be interposed between the firing pin of said mechanism and the cartridge therefor, means connected with said diaphragm for moving said plate, and means actuated by said diaphragm for preventing movement of the actuating means of said firing mechanism.

11. In a submarine mine, a firing mechanism including a firing pin, a plate adapted

to be extended between said firing pin and the explosive cap, a diaphragm adapted to be operated by hydrostatic pressure, a slidable plate connected to said diaphragm, a link secured to said plate, a bell crank having one arm connected to said link, the other arm of said bell crank being connected to said first mentioned plate.

12. In a submarine mine, the combination with a casing having a firing pin therein; of a movable plate adapted to move in the path of travel of said pin, a sliding member, a connection between said sliding member and said movable plate whereby the latter will be actuated upon movement of the former, a rod connected to said slidable member and protruding to the exterior of said mine, and the said protruding end being provided with an opening to receive a locking member.

13. In a submarine mine, the combination with a casing having a firing pin therein; of a movable plate adapted to lock said pin in inactive position, means controlled by hydrostatic pressure for moving said plate, a rod connected with said means and protruding through said casing, and the protruding end of said rod having an opening therein to receive a locking device to hold the rod against movement.

In testimony whereof I affix my signature in presence of two witnesses.

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Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."