C. R. GABRIEL.

TIME LOCK FOR SUBMARINE MINES.

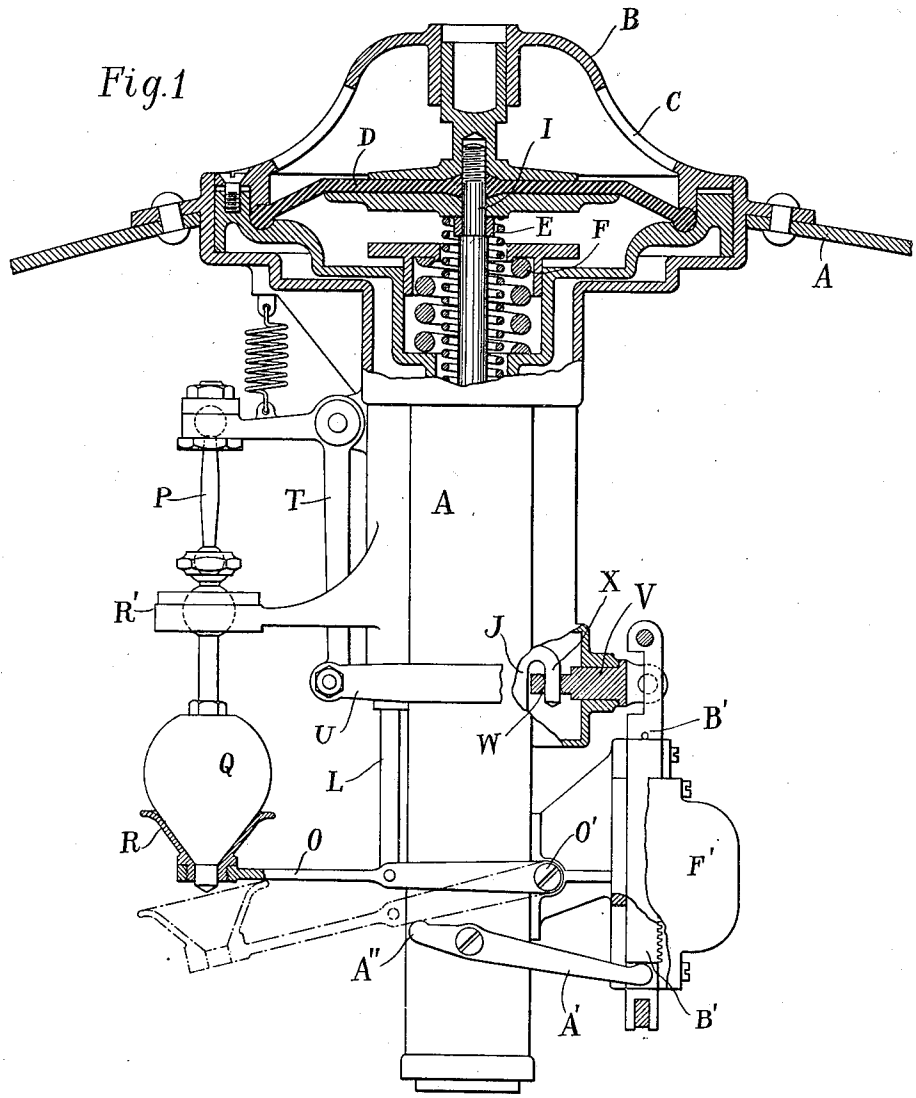
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1,010,039.

Patented Nov. 28, 1911.

3 SHEETS—SHEET 1.

Fig.1



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3 SHEETS—SHEET 2.

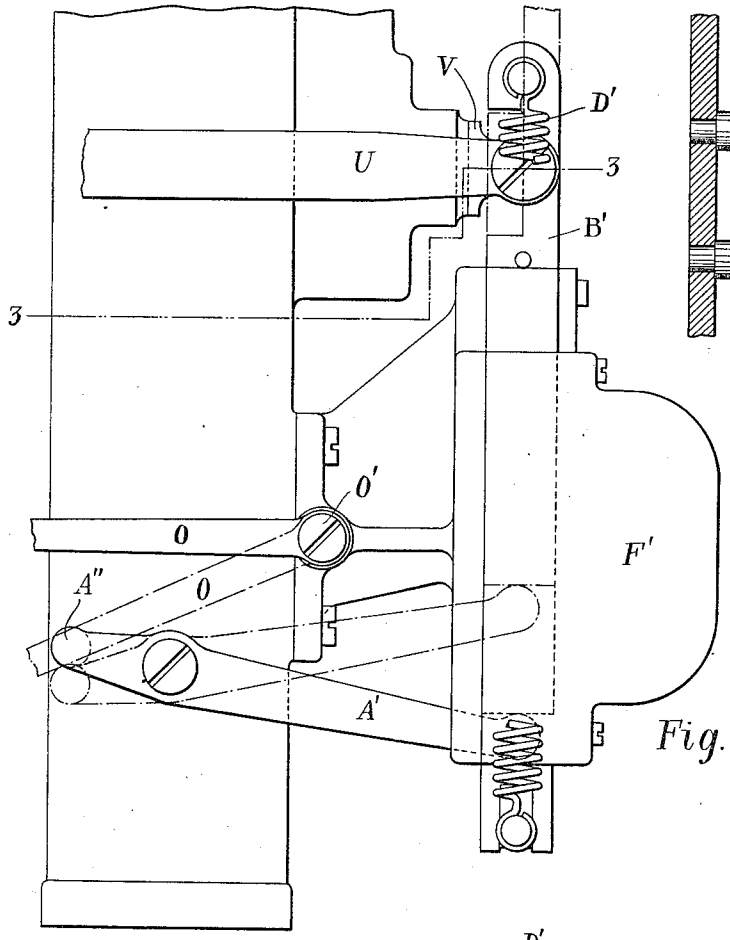


Fig. 2

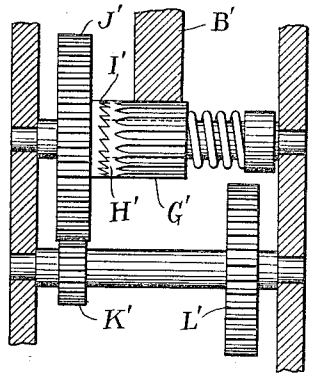


Fig. 6

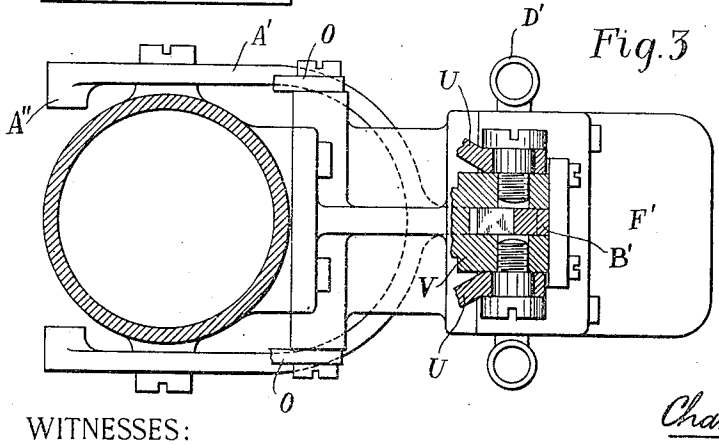


Fig. 3

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3 SHEETS—SHEET 3.

Fig. 5

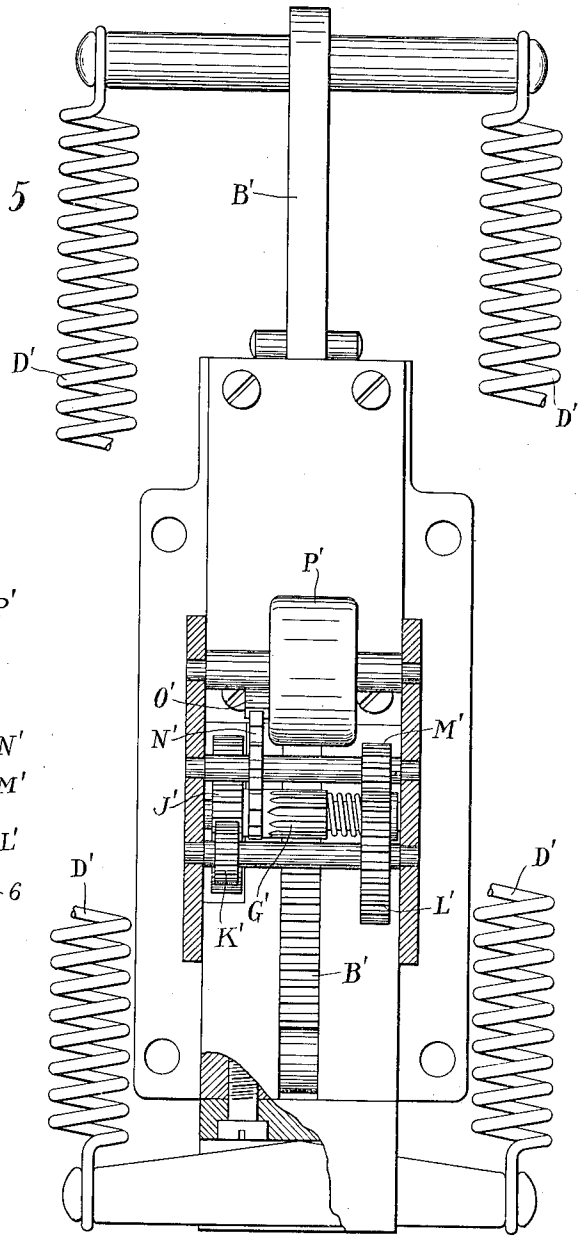
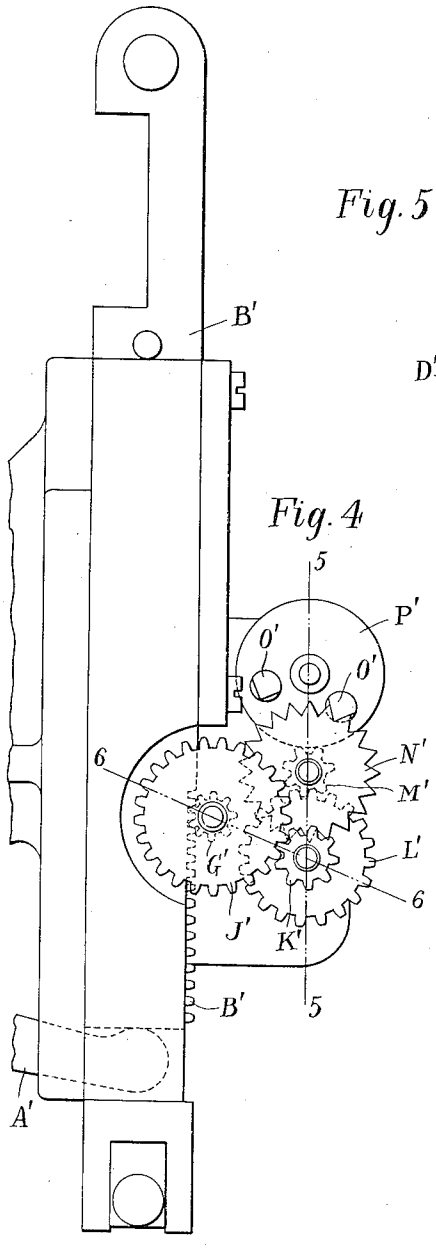


Fig. 4



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UNITED STATES PATENT OFFICE.

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TIME-LOCK FOR SUBMARINE MINES.

1,010,039. Specification of Letters Patent. **Patented Nov. 28, 1911.**

Application filed March 28, 1911. Serial No. 617,436.

To all whom it may concern:

Be it known that I, CHARLES R. GABRIEL, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Time-Locks for Submarine Mines, of which the following is a specification.

My invention relates to submarine mines, and particularly to means for preventing the undesired firing of such mines, by countermining or by the explosion of an adjacent mine. For this purpose, it is customary to provide a locking device for preventing the firing of the mine, which, when put in operation, is withdrawn slowly under the control of a retarding device, said locking means being known as a "time lock".

The object of my invention is to replace the present locking device in use with submarine mines by one which shall always be ready for action, and not subject to the defects inherent in the construction hitherto employed.

To carry out my invention I have devised and connected with the locking mechanism a retarding device comprising a one-way clutch permitting of quick locking action, and a retarding means which is wholly mechanical in its operation.

In order that my invention may be clearly understood, I have shown it applied to a well-known form of submarine mine, and in the accompanying drawings; Figure 1 is an elevation of a hydrostatically controlled mine partly in section; Fig. 2 is a side elevation of the part containing the locking mechanism; Fig. 3, a cross section on the line 3—3, of Fig. 2; Fig. 4 is a side view of a part of Fig. 2, the cover being removed, and showing the relation of the gear train and the rack; Fig. 5 is a back view, partly in section, of the gear-train, and Fig. 6 is a detail on the line 6—6 of Fig. 4.

Referring to Fig. 1 of the drawings: A is a mine of well-known construction provided at the top with a shield B having holes C fashioned therein for admission of the water pressure to the flexible diaphragm D. The diaphragm D is actuated by hydrostatic pressure, and is controlled by two springs E and F. Of these springs, E is the weaker and is in action as soon as the mine is submerged to the desired depth, while F is much stiffer and adapted to be actuated only by excessive pressures. I is the diaphragm stem, J the trigger, O is the pendulum locking lever connected to the rod L. R is the pendulum locking cup, in which rests, when not in operative condition, the pendulum Q which is mounted universally at R′, and through toggle rod P controls the bell-crank T and link U, which latter in its turn moves the trigger actuating slide V, which at W engages a perforated lug X attached to the trigger J. A′ is a lever actuating the locking bar B′ which when pushed up comes behind the slide V and locks the firing mechanism. The downward movement of the bar B′ is controlled by a retarding or slow-motion device constituting the "time-lock". D′ are springs against which the locking bar is forced upward and which return is downward against the action of the retarding mechanism.

Hitherto in mines such as I have illustrated, there has been employed a retarding device consisting of a dash-pot, allowing the locking bar to rise into place easily and quickly, but retarding its descent to a prearranged speed. Such devices after a period of use are liable to develop defects which interfere with their proper operation. The mines are sometimes submerged for months, or even years, and cannot be kept under constant supervision. The lubricating oil, for instance, may become gummed, some of the parts rusted, or undue friction may be developed. The dash-pot under these conditions may become clogged, and the mine permanently disarmed, due to the locking bar failing to return to its normal position after an adjacent explosion, at which time it is forced into the locking position by the increased pressure on the diaphragm. To avoid these defects, I have constructed my time-lock mechanism with a positively acting mechanical retarding or time-measuring device, which acts preferably through a train of gears engaging rack-teeth on the locking bar. My device is certain and efficient in its action, requiring no packing, has no oil to become gummed, and no parts which offer the least liability of getting out of working order. I have shown as the preferred form a rack with a complete train of gears controlled in its retarding action by a balance and escapement. The essential parts of the mechanism are a retarding rack and a one-way clutch

allowing the rack to ascend freely, but bringing the retarding action into operation on its descent.

Within the cover F′ are contained the rack B′ meshing with the pinion G′. The pinion is provided with ratchet teeth H′ which, when the rack is ascending, slide freely over corresponding ratchet teeth I′ on the boss of the first gear J′. The gear J′ engages a pinion K′ mounted on the staff of the second gear L′, which in its turn meshes with the pinion M′ on the same staff as the escape wheel N′, forming one element of an escapement, the anchor of which is conveniently constructed as pallets O′ O′ on a heavy balance-wheel P′. By properly proportioning the strength of the springs D′ and the parts of the gear train, including the weight of the balance-wheel P′, the speed of the train can be regulated between any desired limits.

The operation of the device is as follows: Assume the mine shown in Fig. 1 to be lowered into the water to a predetermined depth, say 4 to 6 feet. As soon as the mine begins to descend into the water, the hydrostatic pressure becomes operative on the flexible diaphragm D, since the holes in the cover B freely admit the water. When the mine has reached the desired depth, the flexible diaphragm, forces down the spring E which is exerting pressure ready to force down the firing hammer, as soon as the latter is released by the trigger J. At the same time by the usual connection from the stem I to the rod L the latter is forced down and causes the pendulum locking lever O to turn on its pivot O′, bringing the lever O to rest against the upwardly projecting lugs A″ of the rack and gear controlling lever A′ (see dotted lines Fig. 1). Thus by the descent of the hydrostatic diaphragm the firing mechanism is released, the locking lever O′ remaining in the position shown in dotted lines so long as the mine remains submerged to the prescribed depth. The pendulum Q is now free to swing, and a push, for instance, by a vessel striking the top or side of the submerged mine, would cause the pendulum to swing, and such swing, in any direction, will displace lever T, which pushing through links U, moves outwardly the trigger controlling slide V which pulls off the trigger J, thus causing the firing mechanism to explode the charge.

Should the enemy seek by countermining, to explode a mine field, or should an adjacent mine in the field be exploded by contact, the results are as follows:—It has been determined by experiment, that the explosion of one of a group of mines first produces a condition of extreme pressure on the water which is imparted to the neighboring mines. This is followed by a violent agitation of the surrounding water, due to the enormous displacement which takes place, and which extends to a considerable distance and depth. It is this agitation which causes the other mines to be fired, as the sudden swaying of a mine will have the same effect on the firing mechanism as if the mine were struck by the hull of a vessel. As the first effect of an explosion is to produce an abnormal pressure on the hydrostatic diaphragm D, the locking of the firing mechanism is accomplished before the agitation of the water begins. For this, the stiff spring F which is unaffected by the ordinary pressure on the diaphragm D, is compressed by the sudden pressure of the explosion, which drives down the diaphragm against the stress of this spring, and through the stem I and rod L forces farther down the locking lever O to the position shown in dotted lines in Fig. 2, thus rocking lever A′ to the extent there shown. The result of this movement is to lift the rack into its upper position (also shown in dotted lines), so that it rises behind the trigger-actuating slide V, thereby preventing the displacement of this slide and hence preventing the release of the trigger. By a predetermined adjustment of the gear train, the time that will elapse before the slide V will be unlocked and the mine again put in operative condition, can be made as long as desired. This time should be for a period sufficient to allow the water to come to a state of comparative rest.

Having thus fully described and illustrated my invention, what I claim is:—

1. In a submarine mine, a hydrostatically controlled member, a firing mechanism, locking means for said firing mechanism, and a train of gears for retarding the unlocking operation of the locking means adapted to be set in operation by the hydrostatically controlled member.

2. In a submarine mine, a firing mechanism, means for locking said firing mechanism, hydrostatically controlled means for actuating said locking mechanism upon abnormal pressures, and means including a train of gears for retarding the unlocking action of said locking mechanism.

3. In a submarine mine, a hydrostatically controlled member, a firing mechanism, locking means for said firing mechanism, a train of gears adapted to be set in motion by the hydrostatically controlled member for retarding the unlocking action of the locking mechanism, and means for regulating the rapidity of the retarding action.

4. In a submarine mine, a hydrostatically controlled member, a firing mechanism adapted to be held operative at mean pressures by the said hydrostatic member, a locking device for said firing mechanism, means controlled by the hydrostatic member for holding the firing mechanism inoper-

ative under excessive pressures, and mechanism including a train of gears for retarding the unlocking action of the locking mechanism.

5. In a submarine mine, a hydrostatically controlled member, a firing mechanism adapted to be maintained operative at mean pressures, a locking device for said firing mechanism, means controlled by the hydrostatic member for holding the firing mechanism inoperative under excessive pressures, and mechanism including a rack and gear train for retarding the unlocking action of the locking device.

6. In a submarine mine, a flexible diaphragm adapted to be operated by hydrostatic pressure, a firing mechanism, locking mechanism for said firing mechanism, means operative within predetermined mean pressures for releasing said locking mechanism, means operative upon excessive pressure imparted to said diaphragm to lock said firing mechanism, and means including a train of gears for retarding the releasing action of said named locking means.

7. In a submarine mine, a hydrostatically controlled member, a firing mechanism, locking means for said firing mechanism, means for retarding the unlocking operation of the locking means, and a one-way clutch connecting the locking means with the retarding mechanism, all adapted to be set in operation by the hydrostatically controlled member.

8. In a submarine mine, a hydrostatically controlled member, a firing mechanism, locking means for said firing mechanism, and means including a rack and a one-way clutch for retarding the unlocking action of said locking mechanism.

9. In a submarine mine, a hydrostatically controlled member, a firing mechanism, locking means for said firing mechanism, and means, including a rack free to move upward and a one-way clutch operating on the downward movement of the rack, for retarding the unlocking action of the locking mechanism.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES R. GABRIEL.

Witnesses:
RICHARD BIGGONE,
C. S. SNIFFEN.