

H. MAXIM.
METHOD AND MECHANISM FOR EXPLODING SUBMARINE MINES.
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1,382,374.

Patented June 21, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

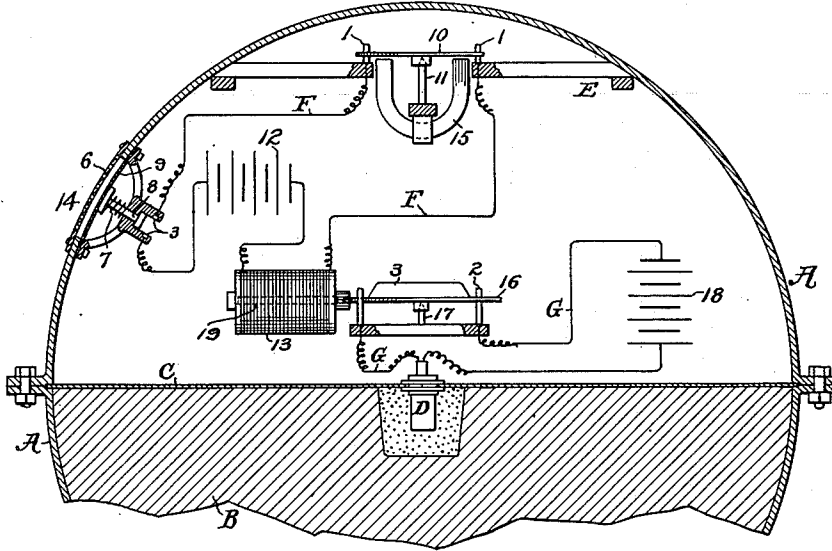
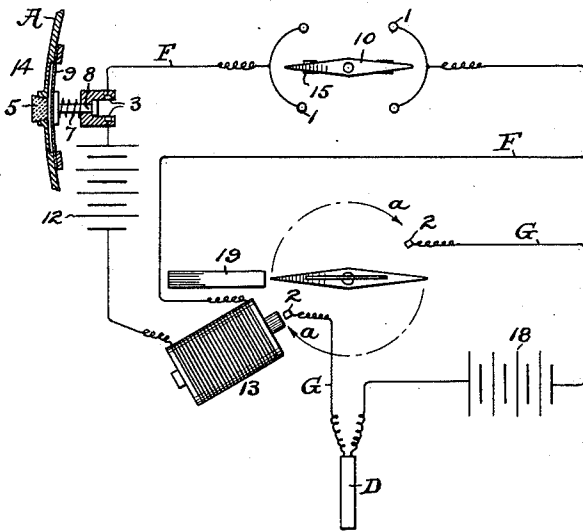


Fig. 2.



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1,382,374.

2 SHEETS—SHEET 2.

Fig. 4.

[illegible]

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METHOD AND MECHANISM FOR EXPLODING SUBMARINE MINES.

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To all whom it may concern:

Be it known that I, HUDSON MAXIM, of the borough of Hopatcong, county of Sussex, State of New Jersey, with post-office address Landing, New Jersey, have invented certain new and useful Improvements in Methods and Mechanism for Exploding Submarine Mines, of which the following is a specification.

10 The present invention relates to improvements in firing mechanisms for submarine mines and the like, wherein a magnetic needle or magnetized bar or rod is moved under or by the magnetic attraction or influence of a foreign or external mass of steel, such as that contained in the structure of a vessel approaching the mine, which movement, by establishing an electric circuit, is utilized to explode the mine, and which mechanism shall be functionally independent of the earth's magnetism, the main object of the invention being to provide a firing mechanism operable by such external influence or attraction, and which shall at the same time be functionally independent of the earth's magnetism, so that no device, means or mechanism will be required for the orientation with the earth's magnetism of any needle or needles or moving parts of the mechanism after launching. Also it is one of the main objects of the invention to provide a firing mechanism which shall be incapable of acting prematurely to explode the mine during transportation, handling or launching of the mine, or by any movement or agitation of the mine by the sea after it has been launched and anchored, there being interposed in the translating devices between the magnetic needle and detonator or exploder of the mine a delay-action device, which is sufficiently deliberate in its action as to render any momentary or flickering movement of the magnetic needle incapable of exploding the mine.

45 In carrying out the invention, I employ a magnetic needle or bar of steel, hereafter referred to as the influence needle, suspended or held in a fixed direction, and irrespective of the earth's attraction, by the action or influence of a permanent magnet or magnets placed in proximity to the needle, and positioned with respect to the needle in such wise that the needle will be

delicately balanced in lines of magnetic force or influence, sufficiently strong to maintain the needle in the desired position independently of the earth's attraction, so that when a mass of steel, like that contained in the structure of a submarine torpedo-boat or other vessel, comes near to the mine, say within preferably from twenty-five to fifty feet of the mine, the needle will be swayed, drawn or rotated from its normal position and caused to come in contact with metallic contact points, the contact points being connected each with the opposite pole of a suitable battery and in such wise that when the contacts are made an electric circuit is formed and an electric current passed between and through the needle and the contact points as and for the purpose herein-after described.

Another needle or magnetic bar or armature, but preferably a magnetic needle, hereinafter referred to as the firing needle, is mounted and held pointing in a fixed direction by a permanent magnet placed in proximity to the needle, while in another position, also in proximity to the said needle, is placed an electromagnet which is normally unmagnetized, but which is connected so as to form a part of the electric circuit first above-mentioned, so that when so energized it instantly becomes a much more powerful magnet than is the permanent magnet placed near to it and with which it is associated.

Consequently, when the electric circuit above-mentioned is established and the electromagnet energized and rendered strongly magnetic, the electric firing needle with which it and the permanent and weaker magnet is associated is immediately deflected and turned about upon its axis, and both ends of the needle are thereby brought in contact with metallic contact points, each of which is connected with the opposite pole of a suitable battery, the battery being independent of the battery already mentioned. When the firing needle comes in contact with the said contact points, an electric current is instantly established.

Placed in or connected up with the firing needle in the circuit is a suitable detonator or exploder for exploding the mine, so that when contact is made by the said firing needle with the contact points and the elec-

tric circuit is thus established, the mine is instantly exploded. Whereas this firing needle is held normally in a fixed direction by the permanent magnet, it is so unaffected by any vibration, swaying, or other agitation of the mine as to be entirely incapable of so far rotating upon its axis as to come in contact with the said contact points and causing the explosion of the mine. It is therefore impossible for the mine to be exploded unless or until the electromagnet shall become energized and the firing needle rotated upon its axis sufficiently far to come in contact with the contact points, thereby establishing an electric circuit to explode the mine.

The influence needle, being the one to be affected or influenced by the near approach of a vessel, such as a submarine torpedo-boat, must necessarily be quite sensitive and capable of being deflected or rotated considerably upon its axis, not only by a slight magnetic influence, but also it is necessarily more or less susceptible to being somewhat rotated by any violent agitation of the mine, such as may be caused by the waves of the sea, after the mine is launched and anchored.

Such deviation or rotation of the influence needle, however, may be reduced to a minimum by mounting it in a suitable manner, such as within or upon a liquid, or by mounting upon it suitable fins, which will cause the needle to encounter considerable resistance of the air or liquid in which it is mounted, thereby slowing its movement considerably.

It would, therefore, be a very rare occurrence that the influence needle would be swayed upon its axis sufficiently far as to come in contact with the contact points and set up an electric current through the electromagnet, but even if it should do so the needle would immediately move away from the contact points again and the period of time during which it would be in contact with the points would be very much less than the time required for the rotation of the firing needle on its axis under the influence of the electromagnet. Furthermore, the firing needle is preferably mounted upon or in a liquid, or is provided with such fins or fans as very much to retard or slow its movement of rotation. In fact, its movement may be made comparatively slow without rendering it ineffective, for the reason that while a submarine torpedo-boat or other vessel is passing near to such a mine, the time which must necessarily elapse while the vessel is passing a given point or position, such as the mine, is ample for the firing needle to be deflected and rotated even comparatively slowly around to the position to effect the explosion of the mine.

The firing needle, by being held fixedly in a given direction and at substantially

maximum distance from the contact points, a certain relatively considerable period of time is required for that needle to rotate sufficiently far upon its axis to make electrical connection through the contact points to fire the mine, and the needle may be provided with slowing fins or may be otherwise made to move as slowly as may be desired, and as the movement of this needle depends entirely upon the maintenance of the attractive force of the electromagnet, and as that force depends upon the continuance of an electric current through the magnet, and as that current depends upon the influence needle remaining in contact with its contact points, and as it would be practically impossible for the influence needle, without external magnetic influence or attraction, to remain against its contact points for a sufficient period of time to permit the firing needle to rotate far enough to come in contact with its contact points, the firing mechanism, therefore, can not act to explode the mine except by an external magnetic force.

Hence, by means of the expedient of employing two needles, one for the influence needle and the other for the firing needle, in the manner above described, the firing mechanism is made substantially proof against acting accidentally or prematurely to explode the mine.

Obviously, the firing needle may be an ordinary magnetized bar, or it may be an armature co-acting with an electromagnet.

The mine is preferably provided with a suitable depth contact-maker whereby an electric circuit can not be formed to explode the mine until the pressure of water under the required submersion shall act to render the establishment of the electric circuit necessary to the firing of the mine possible.

The opening for the admission of water to the depth contact-maker may be constricted to a narrow orifice which before immersion is normally closed with a plug or stopper consisting of a material soluble in water, such for example as a compound of sugar, glue, glycerin or similar materials. This plug effectually prevents the water from immediately coming in contact with the yielding diaphragm of the depth contact-maker until after the mine shall have been submerged for a sufficient length of time to allow the soluble plug to become dissolved or softened sufficiently by the action of the water to allow the water to come in contact with and exert its pressure upon the diaphragm.

Consequently, there will be absolutely no possibility of exploding the mine in handling or in transporting or in launching the same, the firing mechanism being disarmed and rendered entirely incapable of acting to explode the mine until a period of time

has elapsed after the mine shall have been submerged to a certain depth, thereby actuating the depth contact-maker. In fact, the mine must be subjected to considerable water pressure before the firing mechanism can possibly act to explode the mine, hence when one of the mines shall by any means break loose and come to the surface, it will thereby be rendered perfectly harmless, due to the release of the pressure upon its depth contact-maker and the consequent breaking of the electric circuit.

The accompanying drawings illustrate practical embodiments of the invention in which:—

Figure 1, is a sectional elevation, partly in diagram, of one form of the improvement.

Fig. 2, is a plan view in diagram of the same, with a modified form of the depth contact-maker.

Fig. 3, is a view similar to Fig. 1, showing a modified form thereof.

Fig. 4, is an elevation of the armature shown in Fig. 3, and

Figs. 5 and 6, are diagrams of further modifications.

Referring to Figs. 1 and 2, the submarine mine or other mine A is preferably of spherical form, of non-magnetic material and made of two hemispheres united at the equator by bolts passing through abutting flanges. The lower portion of the mine contains a suitable high explosive or bursting charge B, covered by a plate C, in which is seated a proper exploder or detonator D, in position to fire the said charge. Suitable framing E, in the upper half of the mine supports the firing mechanism now to be described.

A magnetic or magnetized needle, bar or rod 10 is supported, as magnetic needles are, upon a pivot 11, for rotation in either direction to make contact with certain properly positioned contact pins 1, thereby to complete an electric circuit F including an ordinary battery 12, which circuit includes an electro-magnet 13 and depth contact-maker 14 hereinafter referred to.

To avoid the needed orientation of the needle due to the earth's magnetism, when a magnetic needle is employed to effect the firing operation, and to minimize to a large extent its flickering and oscillations due to the unstable equilibrium of the mine, a permanent magnet 15 is positioned in such wise as to hold the magnetized needle, bar or rod, 10, more or less steadfast in its normal fixed position out of contact with its contacts 1. Otherwise considered the needle is delicately hung in the usual manner, so that when an exterior body or mass, such as the hull of a vessel, approaches the mine sufficiently near to influence the needle and to overcome the steady effect of the perma-

nent magnet 15, the needle will be caused to move in one direction or the other to bridge a pair of its contacts 1 and thereby close the circuit F and thus energize the electromagnet 13.

A second needle, bar, or rod 16 is supported upon a pivot 17, Figs. 1 and 2, to rotate in one direction only, as indicated by the arrows *a*, Fig. 2, to make contact with a pair of contact pins 2 and thus close an electric circuit G including an ordinary battery 18 as well as the detonator or exploder D. This needle 16, is also held to its normal fixed position by a permanent magnet 19, and its contact pins 2 are so located as to permit as great a movement of the needle as is possible before completing the circuit between them.

The electromagnet 13, before referred to, is so associated with the needle 16 that when energized by the closing of the electric circuit F its pole in propinquity to the like pole of the needle, immediately overcomes the holding effect of the permanent magnet 19 and causes it to be repelled and its opposite pole to be attached to an extent sufficient to bridge the two contacts 2, and close the circuit G, and fire the exploder D.

The needle, bar or rod 16, is not required to be delicately hung or so sensitive as to be influenced by the approach of a vessel, but must depend for its action upon the establishment of an electric circuit through the electromagnet by the previous action of the needle 10, and a delayed or sluggish action of the needle 16 may be brought about in many different ways. Thus it may be a much longer needle than the other; it may be heavier and thus require a greater force to move it; it may be floated on a liquid as in mariner's compasses, or it may have a projecting fin or fins 3, to be retarded by the air confined in the mine. Of course, the other needle 10 may be rendered less sensitive in a similar manner to avoid undue flickering, but not to such a degree.

The depth contact-maker 14, Fig. 1, consists of a movable diaphragm 9 closing an opening in the mine casing, that is guarded by a perforated screen 6. The center of the diaphragm is borne upon by the head of an outwardly spring-pressed rod 8, whose inner end, when the diaphragm is pressed inwardly by the predetermined water pressure, completes the circuit between two contiguous points 3. The spring 7 of the rod 8 may be adjusted or be of such tension as to require the mine to be lowered below a certain depth before the circuit F shall be closed and hence until this occurs the mine will be unarmed and harmless.

In the form of this device shown in Fig. 2, the opening in the mine casing is bridged by a cap piece with a central opening for the admission of the water pressure to the

diaphragm, which opening is closed by a plug 5, of any suitable material soluble in water, so that only after a certain lapse of time following the full submersion of the mine will the depth contact-maker be operated.

While the depth contact-maker is shown as included in only one of the electric circuits, it is obvious it may be employed in either circuit or in both circuits, or any other device having the same purpose in view may be used.

In the modification, Fig. 3, which employs, as in Fig. 1, the needle 10, contacts 1, and permanent magnet 15; the needle 16 shown in Fig. 1 is replaced by an armature 26 rocking on a pivot 27 and held steady against a stop 30 either by a spring, as is common, or by a permanent magnet 29. The magnet 23 in the circuit F has both poles in position to attract and rock the armature when that circuit is closed to bring about the closing of the other circuit G, which occurs by the armature making contact with the pin 4 and thus firing the exploder D. The movement of the armature 26 may be delayed or rendered sluggish by adding fins 3 to its sides as in Fig. 4.

Although the depth contact-maker is not shown in this modified structure, of course it or a similar acting device may be employed.

In Fig. 5, the second electric circuit G, and its interposed devices are dispensed with and the single electric circuit F', including the magnetic needle 10, with its permanent magnet 15, its contact pins 1, the depth contact-maker 14, the battery 12 and the detonator D only are used, so that the detonator is fired directly by the making of the circuit through the needle 10 and its contact pins.

In the further modification shown in Fig. 6, a thermostat H is introduced in the electric circuit F² in lieu of the needle, bar or rod 16, or the armature 26. This thermostat may be of any usual form, but as shown consists of a coil of high resistance wire with its free end normally making sliding contact with a terminal b to which a branch f of the circuit F² leads. After a short lapse of time, when the temperature of the thermostat H is sufficient, the coil will expand so that its free end will slide on to and make contact with the terminal c, and thus close the circuit with the detonator D, and fire it. Of course the depth contact-maker 14, including the soluble plug 5, or similar device may be interposed in the circuit F² if desired.

What is claimed is:

1. In a firing mechanism for an explosive, a magnetic needle, an electric circuit including an electro-magnet energized by the de-

65 flection of said needle, an armature, and another electric circuit including an exploder operable on the movement of the armature.

2. In a firing mechanism for an explosive, a magnetic needle deflected by the approach of the object to be destroyed, an electric circuit including an electro-magnet, an armature, another electric circuit including an exploder closed by the movement of the armature.

3. In a firing mechanism for an explosive, a magnetic needle deflected by the approach of the object to be destroyed, an electric circuit including an electro-magnet effective upon the deflection of the needle, another magnetic needle movable when said electro-magnet is energized and another electric circuit including an exploder controlled by said other needle.

4. In a firing mechanism for an explosive, two electric circuits, an electro-magnet in one circuit, an exploder in the other circuit, a magnetic needle in each circuit, whereby the deflection of one needle causes the deflection of the other and the firing of the exploder.

5. In a firing mechanism for an explosive, a magnetic needle, an electric circuit operable by the deflection of the needle, an electro-magnet in said circuit, another magnetic needle controlled by said magnet, a second electric circuit operable by the movement of said other needle and a detonator in the latter circuit.

6. In a firing mechanism for an explosive, a magnetic needle having a limited range of movement when deflected, an electric circuit including an electro-magnet energized by the deflection of said needle, another magnetic needle having a wider range of movement than the other needle and an electric circuit including a detonator fired by the movement of said second needle.

7. In a firing mechanism for an explosive, two normally open electric circuits one including an electro-magnet and the other a detonator, a magnetic needle in one circuit whose deflection energizes said magnet and another magnetic needle in the other circuit movable to close said circuit when the electro-magnet is energized.

8. In a firing mechanism for a submarine mine, a normally open electric circuit including a battery and a detonator, a magnetic needle, also in said circuit and capable of closing the same, a permanent magnet normally holding the needle in open circuit position but ineffective to prevent the movement of the needle to close the circuit and fire the detonator by the influence due to the presence of a vessel to be destroyed.

9. In a firing mechanism for a submarine mine, an electric circuit, a magnetic needle therein, a permanent magnet normally hold-

ing the needle in open circuit position and movable by the influence due to the presence of a vessel to be destroyed, a detonator, and a delay-action device operating to fire the
5 detonator.

10 10. In a firing mechanism for a submarine mine, an electric circuit, a magnetic needle therein, a permanent magnet normally holding the needle in open circuit position and movable by the influence due to the presence of a vessel to be destroyed, an electromagnet

energized by the closing of said circuit, a detonator, and a delay action device operating to fire the detonator.

In testimony whereof I have signed my
name to this specification in the presence of
two subscribing witnesses.

HUDSON MAXIM.

Witnesses:

AUGUSTUS S. BRYANT,
LILLIAN MAXIM.