J. H. HAMMOND, JR.

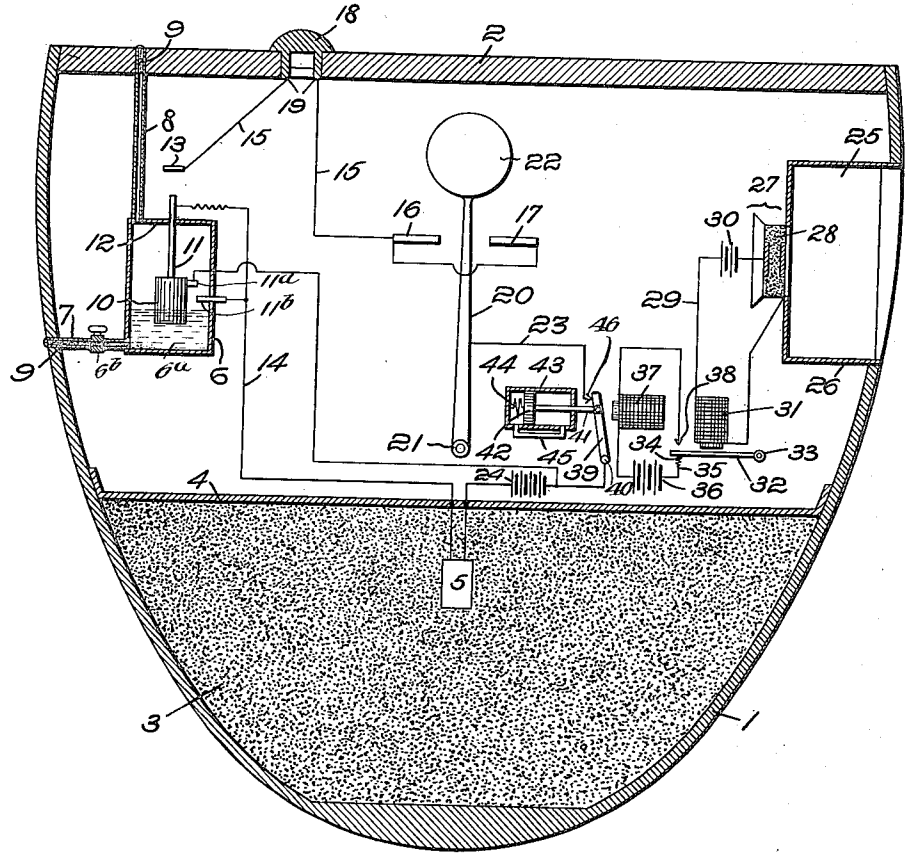
FLOATING MINE AND METHOD OF CONTROLLING SAME.

APPLICATION FILED AUG. 24, 1914. RENEWED JULY 12, 1921.

1,407,653. Patented Feb. 21, 1922.

4 SHEETS—SHEET 1.

Fig. 1



Witnesses:
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4 SHEETS—SHEET 2.

Fig. 4.

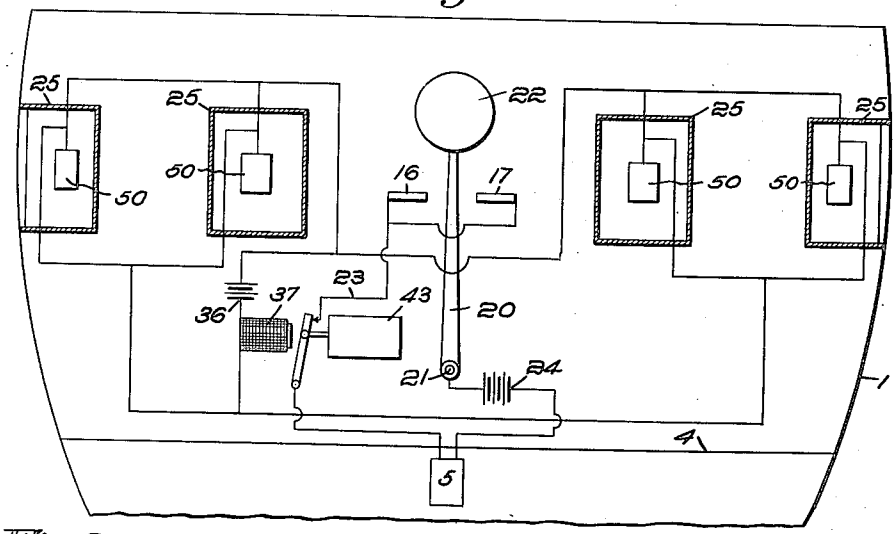


Fig. 2.

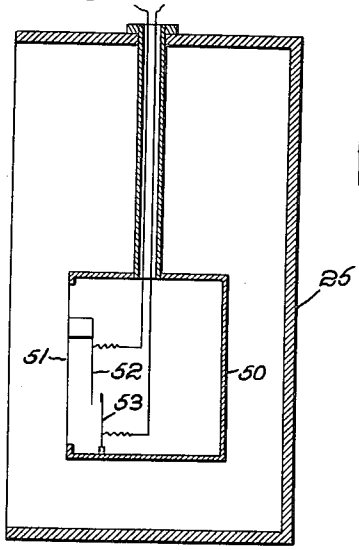
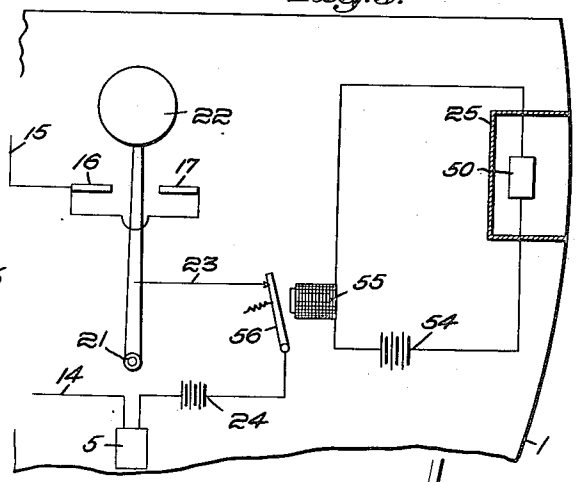


Fig. 3.



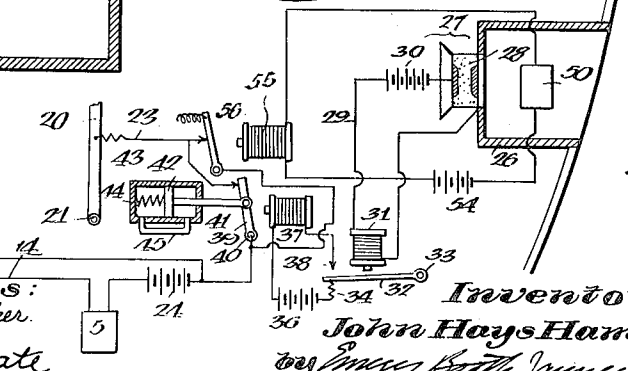


Fig. 9.

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4 SHEETS—SHEET 3.

Fig. 5.

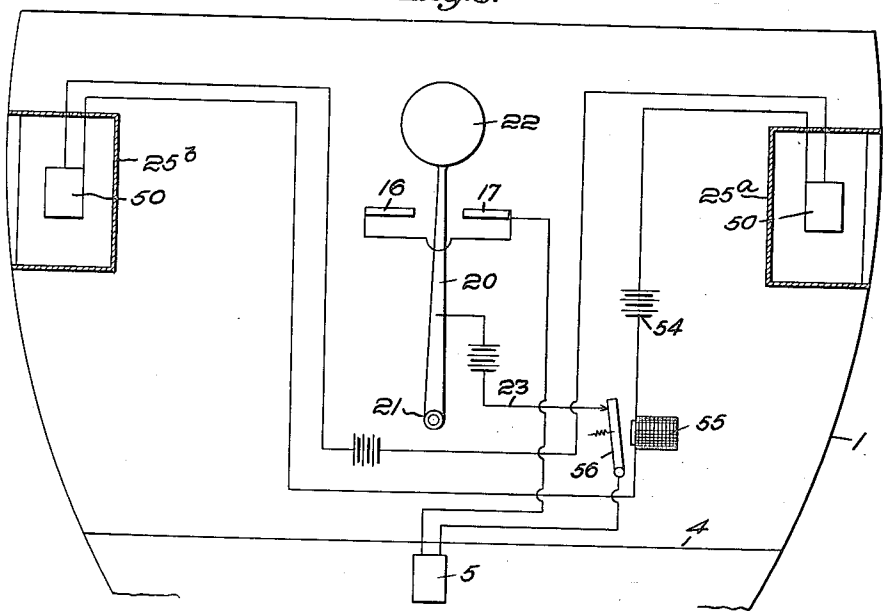
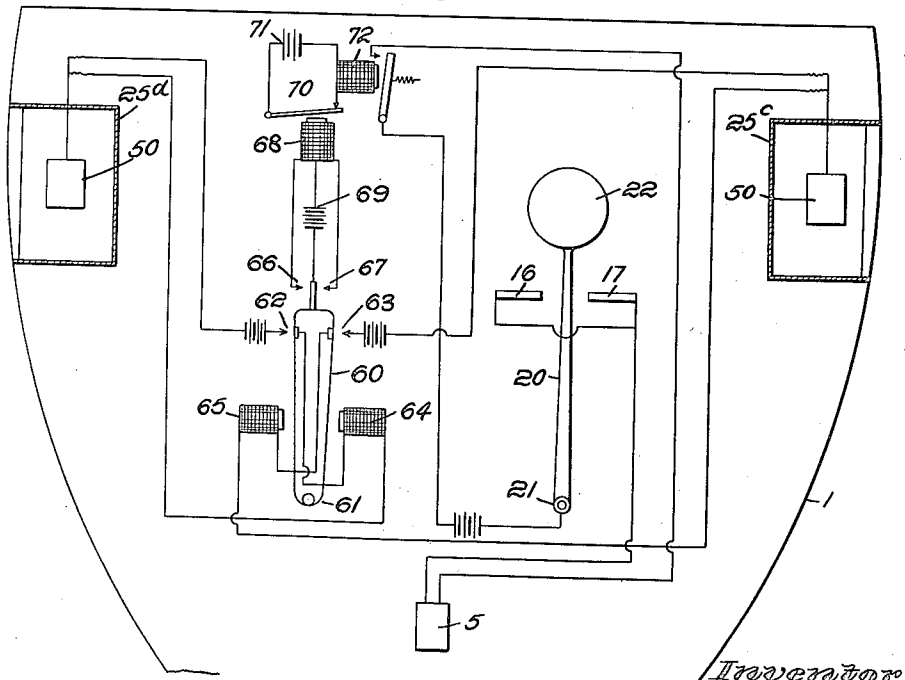


Fig. 6.



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FLOATING MINE AND METHOD OF CONTROLLING SAME.

APPLICATION FILED AUG. 24, 1914. RENEWED JULY 12, 1921.

1,407,653.

Patented Feb. 21, 1922.

4 SHEETS—SHEET 4.

Fig. 7.

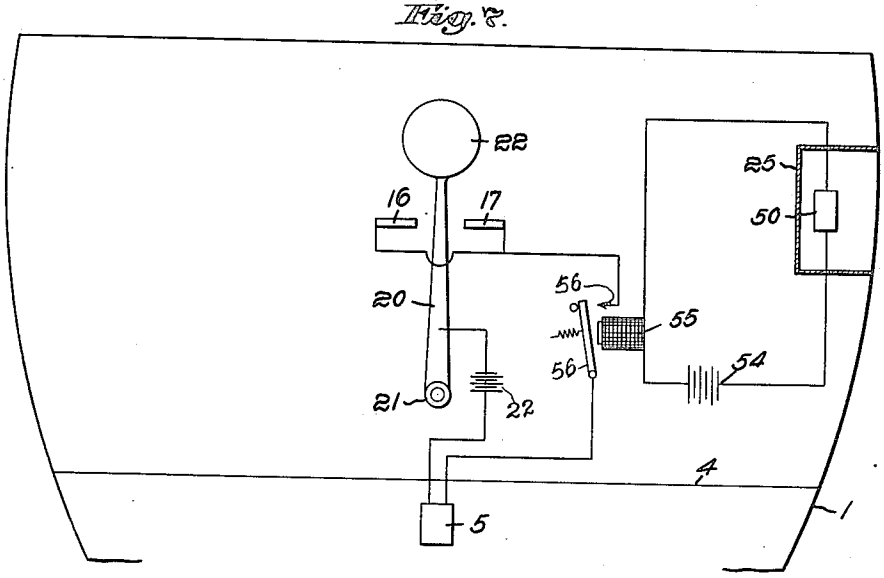
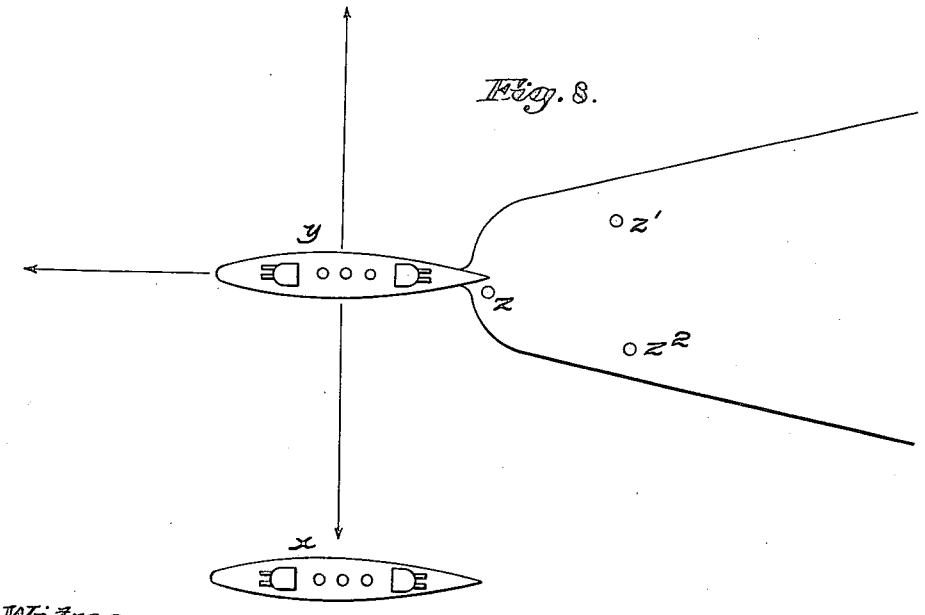


Fig. 8.



Witnesses:

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UNITED STATES PATENT OFFICE.

JOHN HAYS HAMMOND, JR., OF GLOUCESTER, MASSACHUSETTS.

FLOATING MINE AND METHOD OF CONTROLLING SAME.

1,407,653. Specification of Letters Patent. Patented Feb. 21, 1922.

Application filed August 24, 1914, Serial No. 858,202. Renewed July 12, 1921. Serial No. 484,190.

To all whom it may concern:

Be it known that I, JOHN HAYS HAMMOND, Jr., a citizen of the United States, and a resident of Gloucester, in the county of Essex and State of Massachusetts, have invented an Improvement in Floating Mines and Methods of Controlling Same, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to explosive mines, and to methods of controlling the same.

In naval warfare it is customary to cast into the sea explosive mines intended to float either at or near the surface or to be submerged at a predetermined depth, and which when struck by a vessel will explode and injure or destroy the striking vessel. These mines are frequently thrown into the high seas, and are a menace not only to the enemy's ships but also to those of the nation by whom they are positioned. Instances are recorded, not only of the sinking by these mines of ships belonging to the nation by whom the mines are positioned, but also of the sinking of ships of neutral nations.

The object of my invention is to provide means whereby an explosive mine for use in the sea may be rendered harmless to certain ships, for example the ships of the nation by which the mines are planted, while at the same time they are potential or effective to destroy the enemy's ships.

My invention comprehends the employment of any suitable means to accomplish this purpose and also the method of rendering the mine harmless with respect to vessels suitably equipped with apparatus or devices as hereinafter set forth.

The advantages of my invention are many. Not only may the ships of the nation by whom the mines are planted safely pass through a sea sown therewith, but a warship of the nation by whom the mines are planted may lie surrounded more or less by the mines, to which it is itself immune. An enemy's ship would not suspect the presence of mines in proximity to the ship which it wishes to attack, and might approach the same, and, in so doing, strike a mine to which it is not itself immune.

I have shown herein two different types of mine equipped with the same apparatus. The first type is rendered inoperative on the receipt of a sound wave signal of proper frequency. The second type of mine, while normally inoperative, will be placed in an operative position on receipt of said signals.

In the drawings:

Fig. 1 is a vertical cross section illustrating one embodiment of my invention of the type wherein the mine, normally operative, is arranged to be made temporarily inoperative for protection of approaching friendly vessels;

Fig. 2, a vertical, transverse sectional detail showing a different type of receiver from that illustrated in Fig. 1, but capable of being used conjointly therewith;

Fig. 3, a diagrammatic detail showing one system for connecting up the receiver, Fig. 2;

Fig. 4, a diagrammatic figure illustrating the arrangement of a plurality of receivers in or for the control of a single mine;

Fig. 5, a diagrammatic view illustrative of one means of connecting up a plurality of receivers to require the use of a plurality of impulses of different character for control of the mine;

Fig. 6, a diagrammatic view illustrative of a different means for requiring a plurality of different character of impulses for its control;

Fig. 7, a diagrammatic view illustrative of means for rendering a mine that is normally inoperative, temporarily operative for destruction of a hostile vessel;

Fig. 8, a diagrammatic view illustrative of preferred means for projecting the controlling impulses to limit the area within which mine control may be effected; and,

Fig. 9, a diagrammatic view of another form of this invention.

Referring more particularly to the drawings, in which I have disclosed one embodiment of my invention, the hull or body of the mine is represented at 1, the top thereof being indicated at 2. The mine shown is of the floating type and may be of such character as to float substantially awash, or it may be so constructed as to float at a predetermined depth. Within the scope of my invention I may provide suitable means, not herein necessary fully to disclose, for carrying the mine to within a predetermined distance from the bottom of the sea. Such means, if employed, may include a connection provided at its end with a weight which automatically releases itself from the mine upon the discharge of the latter from

the vessel and sinks to the sea bottom. If desired, the mine may be provided with suitable means, not herein shown, for controlling or regulating the depth or submergence of the mine or its distance from the ocean bed. For this purpose, I may employ any suitable means, such, for example, as shown in the patent to Castro, No. 322,900, July 28, 1885, or Bergstrom, 953,181, Mar. 19, 1910, or Bruck, 1,011,153, Dec. 12, 1911, or Carteron, 1,039,254, Sept. 24, 1912.

The mine is provided with a suitable quantity of explosive, indicated at 3 as placed beneath a suitable partition 4. This may be of any suitable nature or material, not herein necessary more fully to disclose. Such material is preferably detonated by a suitable detonator, indicated diagrammatically at 5. For this purpose, fulminate of mercury may be employed, but any suitable material may be utilized within the scope of my invention.

The mine may be provided with suitable means whereby electrical contact for rendering the mine operative is established only after the mine has been thrown into the sea, as for example, by seepage of water into a chamber thereof, or in other manner, thus to render the mine safe from explosion during handling, before being placed in the water. For this purpose I have herein represented a chamber 6, which has passages 7, 8 leading to the exterior of the mine at any suitable points. Said passages may be plugged with some suitable material, such, for instance, as sodium, indicated at 9, which is dissolved more or less slowly by water, thereby admitting the water into the chamber 6. Within the chamber 6 I position a float 10, having a plunger 11 guided through the top 12 of the chamber and adapted to contact with a terminal 13 when sufficiently lifted by the inflow of water in the chamber 6. A suitable conductor 14 is connected with the plunger 11 and detonator 5, thereby placing them in circuit. Leading from the terminal 13 is a conductor 15 which leads to two contact members 16, 17 with which it is connected in series, as indicated. The said terminals are supported and insulated in any suitable manner. Preferably I provide a plug 18 carrying a conductor 19 which is adapted to be placed in and bridge over a break in the conductor 15. The said plug is inserted in position just before the mine is thrown into the sea. While it need not be employed, it preferably is provided in order to permit the handling of the mine with safety before placing it in the water, the float 10 supplementing this and furnishing also the requisite safety after the plug has been inserted and until the mine finally reaches its intended position.

I may provide any suitable means to cause the detonation of the explosive 3 upon contact of a vessel with the mine. Herein for the purpose I have represented a vibratile, metallic member 20 suitably mounted at its lower end 21 and provided at its upper end with a weight 22 of suitable size, so that the jar to which the mine is subjected by impact of a vessel causes the member 20 to vibrate into contact with either contact member 16 or 17, thereby to complete the circuit to the detonator 5. Connected with and leading from the vibratile member 20 is a conductor 23, suitably connected with the detonator 5 and preferably provided with a suitable generator or battery 24.

Assuming the conductor 23 to have an unbroken connection with the detonator 5, it will be understood that upon movement of the vibratile member 20 into electrical engagement with either contact 16 or 17, the explosive 3 would be detonated, provided the plug has been inserted and the plunger 11 has risen into contact with the terminal 13. Under such conditions, the mine would be exploded when struck by any vessel. Thus the mine is effectively protected against accidental detonation by interruption of the detonator circuit until it is deposited in the water, at which time the plug 18 is inserted, and thereafter the mine is protected against accidental explosion until, following immersion in the water, the plugs 9 dissolve and the chamber 6 fills with water to lift the float and close the circuit at the contact 13, thereby rendering the electrical circuit complete and in readiness for effecting detonation of the mine when the vibratile member 20 is disturbed by contact of a foreign ship with the mine.

The chamber 6 may also contain normally a body of liquid 6^a, held from contact with the plug 9 in the passage 7 by a suitable stop cock 6^b, which liquid is not sufficient in volume to lift the float to close the circuit between the plunger 11 and terminal 13 but is sufficient to maintain said float in position with its lateral contact 11^a removed from the stationary contact 11^b in the wall of the chamber. Said contacts 11^a and 11^b are electrically connected through the detonator 5 with opposite poles of the battery 24. If, however, having once been deposited in the water—the stop cock 6^b of course having been opened at the time the mine is so deposited—the mine be raised by a hostile party in an attempt to remove it, the liquid contained in the chamber 10 will escape through the passage 7, permitting the float to drop to close the detonator circuit at the contacts 11^a, 11^b, thereby to explode the mine in the hands of such hostile party, and by its self-destruction, maintain the secret of its construction from knowledge by the enemy. Through this device the secret construction of the mine will be preserved.

In order to render the mine harmless to friendly vessels, I provide any suitable means under the control of friendly vessels for accomplishing this result. Preferably, and in accordance with the preferred embodiment of my invention, I equip each friendly vessel with a suitable submarine signaling device by which sound or other waves may be emitted, and which will so act upon the mine as temporarily to interrupt the circuit leading to the detonator 5. For this purpose, I preferably provide the friendly ships with means for emitting sound waves. Since such devices are, broadly stated, well known, it is unnecessary for me to describe the same in detail. Preferably, however, I so construct them that they may emit several different signals, one of which only is the signal to which a part or device upon the mine is tuned or responsive. The other signals may be employed so that all of them may be emitted, and the enemy, if it be aware of any of them, will be confused or misled and not know the particular one to which alone the sensitive device on the mine is preferably responsive.

The mine is provided in accordance with the preferred embodiment of my invention with one or more devices responsive to the signal emitted from a friendly ship. Preferably I employ three such devices, distributed at equidistant points about the periphery thereof. These devices may be of any suitable character, as, for example, either of those shown in the patents to Lucien I. Blake, Nos. 852,646 and 852,648, dated May 7, 1907, or any other suitable device.

I have herein diagrammatically indicated a suitable device or receiver at 25 as supported by a suitable steel or other casing 26. In suitable relation to said casing, I preferably provide a microphone 27 containing granular carbon 28 or other suitable material. Suitably connected with the microphone, I provide a circuit 29 having therein a battery 30, and positioned therein a magnet 31 which, when energized, is adapted to move a reed 32 which is fixedly secured at one end as at 33 in any suitable manner. Said reed is preferably tuned to the frequency of the signal to which the receiver 25 is responsive.

Connected to the reed 32 is one terminal 34 of a suitable circuit 35 having therein a battery 36 and electromagnet 37 and a second terminal 38 positioned in proximity to the tuned reed 32. Upon energization of the electromagnet 31, the reed 32 is moved, carrying with it the terminal 34, thereby to complete the circuit at the terminal 38, thus energizing the electromagnet 37.

Positioned in suitable proximity to the electromagnet 37 is a switch 39 pivoted at 40 and controlled by a suitable retarding device or dash pot. Herein the switch 39 is connected by an insulated rod 41 to a plunger 42 mounted in a suitable casing or cylinder 43 and having therein a coiled spring 44. The casing 43 may contain some suitable liquid or other material which will retard the movement of the piston 42. I have herein represented the opposite ends of the casing as connected by a by-pass 45, through which the liquid is driven by movement of the piston 42. Normally the spring 44 tends to hold the switch 39 in the position indicated and in contact with a terminal 46 of the conductor 23. Upon suitable prolonged energization of the electromagnet 37 the switch 39 will be attracted and move the piston 42 to the right, viewing the drawing, so as to break contact at the terminal 46 and render the exploding mechanism of the mine non-potential to explode the same as the result of the impact of a vessel against the mine.

The movement of the plunger 42 is so retarded by the presence of the liquid within the casing 43 that a materially prolonged energization of the electromagnet 31 is necessary to effect the complete withdrawal of the switch 39 from the terminal 46. The de-energization of the electromagnet 37, therefore, does not permit the instantaneous return of the switch 39 into contact with the terminal 46, and does not render the mine instantly potential upon cessation of the sound waves to which the device 25 and reed 32 are responsive. A friendly vessel, after having controlled the mine for safe passing, is thus permitted to have opportunity to clear the mine before it becomes again potential to explode on impact. The full movement of the switch 39 away from the terminal 46 is accomplished by the emission of sufficiently prolonged impulses from the friendly ship.

It will thus be apparent that so long as the proper impulse is emitted from a friendly ship, the switch 39 remains out of contact with the terminal 46 thus rendering the mine non-potential to explode upon impact. The cessation of said impulse permits the coil spring 44 to act and to draw the switch 39 again into contact with the terminal 46 thus rendering the mine non-potential to explode upon impact. A friendly ship being aware of the approach of an enemy will, in the practice of my invention, cease the emission of the proper impulse, thereby rendering the mine potential with respect to the approaching enemy's ship.

The system thus far described is controlled to render it safe for friendly ships by submarine sound signals. As an additional precaution, and to guard against an enemy solving the secret of rendering itself immune from explosion by contact with such a mine as described, my invention contemplates the use also of a box 50 (see Figs. 2, 3, and 9,) provided with a diaphragm face 51, the whole adapted to be suitably suspended in the liquid-filled tank 25 referred to, or other-

wise suitably supported so that its diaphragm shall be responsive to impulses differing it may be, from those to which the microphone 27 (Fig. 1) is responsive. When the diaphragm 51 receives the vibrations to which it is made responsive its vibrations will cause the contact 52 mounted thereon to close the circuit through the fixed contact 53 in or on the said tank, which circuit (see Fig. 3) includes the battery 54 and magnet 55.

The armature lever 56, which is placed in the circuit 23, 14, referred to in Fig. 1, as an additional control therefor, constitutes a switch which, upon proper energizing of its magnet, will be moved to break said circuit in a manner similar to that in which it is broken by the switch of armature lever 39, it thus requiring both said levers to be moved by their respective magnets to break the detonator circuit and render the mine safe for a friendly ship.

The adjustment of the microphonic circuit of Fig. 1 and that of the circuit of Figs. 2 and 3 are such that it will require vibrations or periodic sound waves of different periodicity to render them effective to close their respective circuits. For example, the adjustment of the dash pot (Fig. 1) may be such that after the microphonic circuit has been closed proper sound waves may be transmitted to close the further circuit through the diaphragm reeds 52, 53 (Fig. 2), rendering the cooperation of the two essential to proper control of the mine by a friendly hand.

Obviously, either one might be used to the exclusion of the other, but the conjoint use of the two as shown in Fig. 9 complicates the problem to be solved by a hostile ship before the mine could be rendered safe for passage of such ship thereover.

In Fig. 4 I have illustrated diagrammatically a plurality of receiving tanks 25, the microphonically or diaphragmatically controlled contacts of which are arranged in parallel, as indicated, whereby with the respective tanks or receivers distributed uniformly about the mine it will be possible to reach it with substantial directness from any side of the mine, thus effecting a more certain result or protection than might be possible if a single receiver only were employed at one side of the mine and more sensitively responsive from that side than from any other.

Referring now to Figs. 5 and 6, I have illustrated an embodiment of my invention wherein instead of a single receiving tank 25 responsive to impulses or vibrations of a given periodicity I have employed a plurality of tanks 25^a and 25^b, containing vibratory reed contacts electrically arranged in series circuit through the battery, said reeds having different predetermined vibratory periodicities. To energize these reeds to cause them respectively to cooperate in closing the circuit therethrough it is necessary to transmit sound waves having the different and specific frequencies called for by their respective adjustments. Consequently, the operation of but one reed will be insufficient to break the detonator circuit.

Another method of obtaining selectivity by the use of different frequencies is shown in Fig. 6.

The mine is equipped with two fluid-containing tanks 25^c, 25^d containing vibratory reed contacts as before.

These vibratory reed contacts have different specific frequencies and must be energized by wave trains of different frequencies.

Normally the armature 60 of the relay 61 rests on either the right-hand or left-hand contacts 62, 63. Assuming the armature 60 to be in its left-hand position, if the reed in the tank 25^d be energized it will close the circuit through the contact 62 and the magnet 64, which latter will draw the armature away from the contact 62, breaking the circuit thereat and closing it at the contact 63.

With the armature in position against the contact 63, if the reed in the tank 25^c be energized it will close the circuit through said contact 63 and the magnet 65 and thereby return said armature to its original position, and by proper adjustment of the reeds vibrations of predetermined different periodicity may, through the respective reeds in the tanks 25^c and 25^d cause the armature to vibrate between the contacts 62, 63, whereas vibration of the reed in either tank without the other would merely hold said armature in one or the other of its extreme positions.

The free end of the armature lies between two contacts 66, 67, in circuit with a magnet 68 and the battery 69, which circuit also includes the end of said armature 60, which is made as a contact member for the purpose.

The armature of the magnet 68 is, or is attached to, a reed 70, controlling a circuit through the battery 71 and magnet 72. This reed armature 70 will not respond to a single impulse through its magnet but will respond to impulses of the required frequency, consequently vibration of the armature 60 will cause the reed 70 to be drawn to its magnet, break the circuit through its magnet 72, and, by releasing its armature, break the detonator circuit to render the mine safe as before.

It will be observed that the means described permits a mine to be transported and

stored with safety and rendered operative only when it has been planted in desired position. When so planted, it is operative to accomplish its work of destruction upon contact therewith by any ship or object by which it is intended to be operated.

A friendly ship or hand may, however, render the mine temporarily inoperative by the use of predetermined sound waves or impulses in the medium, usually a liquid, in which the mine is submerged or placed, and this means for rendering the mine temporarily inoperative may be made so complicated by the use of vibrations or impulses of different periodicity, or otherwise differentiated one from another, as to make it practically impossible for an enemy to discover that particular combination of vibrations or impulses necessary to render the mine so inoperative.

While the mine described is normally operative and rendered temporarily inoperative by predetermined impulses or combinations of impulses, obviously the reverse might be employed, as in Fig. 7; that is to say, the mine might be normally inoperative and rendered for the time being operative by sending out proper impulses or combinations of impulses.

In the system shown in Fig. 7 the hereinbefore described vibratile member 20 is arranged to control a circuit containing a battery 24, the detonator 5, and the normally open switch 56, which is arranged to be moved into engagement with the contact 46 to close the circuit through the detonator and to explode the mine upon energization of the magnet 55. The magnet 55 is in a normally open circuit including the battery 54 and the box 50. The box 50 shown enlarged and in section in Fig. 2 contains the hereinbefore described diaphragm 51 and the hereinbefore described normally spaced contacts 52 and 53 which control the circuit through battery 54 and magnet 55. When the diaphragm 51 receives the vibrations to which it is made responsive it will cause the contact 52 mounted thereon to close the circuit through the fixed contact 53, the battery 54 and electro-magnet 55, thus drawing the armature or switch 56 into engagement with the contact 46 and thus rendering the circuit through the detonator 5 and battery 24 potential to explode the mine whenever the vibratile member 20 is swung into engagement with either of the fixed contacts 16 or 17, as by the impact of a vessel against the mine.

The two types, under favorable conditions, might be advantageously used together.

Under conditions where there is no great tide movement, and where the ships which have positioned the mines could readily remember the location of the mines, it would be advantageous to place them in separate fields, the first field comprising mines of the normally inoperative type, another field comprising mines of the normally operative type. The enemy could be led to a position between the two.

If a simulated retreat is made by the ships employing the mines, the enemy would follow them through the first field without detonation but, upon reaching the second field they would detonate the mines and lose the ships. Warned by the explosion of these mines and the resulting disaster to their advance ships, the remainder of the fleet would undoubtedly turn back and, upon reaching the other field, the ships which had positioned the mines, by emitting the proper signals could then cause said other mine field to become operative for the destruction of the ships passing thereover.

The employment of a mine of the type described herein for use in naval warfare should enable the user thereof to employ different strategic methods to cause the enemy's flotilla to move into the mine field.

Where the combination of impulses is employed it is, of course, necessary to the proper functioning of the devices that the enemy should not discover the multiple frequencies required. Inasmuch as it is possible to set up forced oscillations in any vibratory element by the employment of highly damped shock excitation, it is important to use a vibratory element having a peaked resonance curve. In order to produce such a vibrating element in the form of a reed it is desirable that said reed shall have considerable stiffness. Such an attribute requires that there shall be a considerable amount of received energy to effectively make or break local circuits. Inasmuch as the amount of received energy is proportional to the distance of the receiving mechanism from the transmitter, it will be seen that the stiffer the reed the shorter the distance that it will be possible to control the same. It may therefore be preferable to employ two or more reeds having a large difference of periodicity, each of these reeds having a considerably flatter resonance curve and being considerably more sensitive. If the said frequencies are far enough apart it would be impossible for the enemy to force vibrations in both reed systems.

In Fig. 8 of the drawings I have illustrated the desirable effect in transmitting directive sound signals so that the enemy may not be apprised of the proximity of the ship using said signals. I have shown the enemy's ship at x, the sound-transmitting ship at y, and the mines at z, z^1, z^2. The direction of the sound signals may be limited to a more or less cone-like formation, as shown, so that mines directly in the path of

the vessel will be controlled by said sound waves, but vessels located in other positions with regard thereto will not receive said signals.

In the modified system shown in Fig. 9 the hereinbefore described circuit 14, 23, including the battery 24 and the detonator 5, is arranged to be controlled by the vibratile member 20 as hereinbefore described, and also by the two switches 39 and 56, the first switch 39 being controlled as hereinbefore described by an electro-magnet 37 arranged in a normally open circuit containing the battery 36 and controlled as hereinbefore described by the microphone 27, and the second switch 56 being controlled by the electro-magnet 55 arranged in a normally open circuit containing the battery 54 and controlled by the hereinbefore described movable parts arranged in the box 50 shown in detail in Fig. 2. As shown in Fig. 9, the two electro-magnets 37 and 55 are in normally open circuits and consequently the switches 39 and 56 are normally held in engagement with their respective contacts, thus rendering the circuit through the battery 24 and the detonator 5 normally potential to explode the mine upon impact, and in order to render the circuit through the battery 24 and the detonator 5 non-potential to explode the mine upon impact it is necessary to have both switches 39 and 56 simultaneously open, and this may be accomplished only by having the microphone 27 and the diaphragm 51 in the box 50 simultaneously energized by two suitable series of received impulses, as hereinbefore described.

Any form of transmitter may be employed to set up the necessary vibrations or impulses but a Fessenden oscillator I have found to be very efficient because a very powerful sound wave producer.

A plurality of false signals should, for the best results, be sent out so that the true periodicity of the receivers could not be ascertained by the enemy in listening.

The reeds and diaphragms should be most carefully insulated from the body portions of the mines, so that local forced vibrations would not affect the receivers. A reed when used should be stiff and with a sharp resonance curve. Inasmuch as the received energy at one hundred feet would be very large, it is possible to create a reed contact system which is not affected by the forcing effects of other sound signals of large power but of different periodicity.

Thus the enemy must know the exact period of the mine to render it inoperative, and to ascertain this period would be a matter of the greatest difficulty because of the concealment of the true operating vibrations by false vibrations.

Throughout the description, I have referred to ships, but it is evident that the invention is applicable with respect to any body or bodies with which the mine may be brought into contact.

My invention may be practiced with respect to devices or mechanisms other than floating mines. I have disclosed a preferred embodiment of floating mine with which my invention is preferably practiced.

The word "impulse" as used in the claims is intended to include any change of whatever character in the condition of the medium in which the impulse takes place that is susceptible of producing action for the control of the mine. The word "signal" also as used in the claims is intended to comprehend any one or more impulse or impulses that furnish a means of producing desired temporary or permanent control or action of or in connection with the mine.

While my invention is especially useful in connection with marine or submarine mines, it is obvious that in many respects it is equally applicable to mines for other than marine uses, so that my invention is not restricted in these respects to either of them.

Having thus described one illustrative embodiment of my invention and the best mode known to me for carrying the same into effect, I desire it to be understood that although specific terms are employed they are used in a generic and descriptive sense, and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims:

1. A submarine mine provided with signal-responsive controlling means and exploding means automatically operated upon removal of said mine from the water.

2. A submarine mine provided with signal-responsive self-restoring, detonating means normally inoperative and means automatically to render the said detonating means operative upon immersion in the water.

3. A marine mine having a device responsive to submarine signals, and an electric circuit controlled thereby to render the mine ineffective during the transmission of said submarine signals.

4. A marine mine provided with a member responsive to submarine signals, an electric circuit controlled thereby, and a sensitive member controlled by said circuit for rendering said mine ineffective during the transmission of said signals.

5. A marine mine provided with a device responsive to submarine signals and an electric circuit controlled thereby, a reed tuned to the frequency of said signals, and means controlled by said reed to render the mine ineffective during the transmission of said signals.

6. A marine mine provided with means for exploding the same upon impact, and means responsive only to impulses of predetermined characteristics transmitted through space for rendering said mine ineffective during the transmission of said impulses.

7. A marine mine having self-restoring means to explode the same upon impact, and selective means controlled from a distance for rendering said impact-operated means ineffective.

8. A marine mine having self-restoring means to explode the same upon impact, and a device responsive to sound waves to render said impact-operated means ineffective.

9. A marine mine having self-restoring means to explode the same upon impact, and a device responsive to submarine sound signals to render said impact-operated means temporarily ineffective.

10. A marine mine having means to explode the same upon impact, a device responsive to submarine signals and cooperating with said impact exploding means to control the potentiality thereof, an electric circuit controlled by said device, a switch adapted to be opened by said circuit, and means to retard the opening of said switch.

11. A marine mine having an electric circuit adapted to be closed upon impact, thereby to explode the mine, a device responsive to submarine signals, and means controlled by said device to interrupt said circuit.

12. A marine mine having an electric circuit adapted to be closed upon impact, thereby to explode the mine, a device responsive to submarine signals, means controlled by said device to interrupt said circuit, and means to retard the opening of said circuit.

13. A marine mine having an electric circuit to be closed upon impact, thereby to explode the mine, a device responsive to submarine signals, a circuit controlled thereby, and a switch controlled by said last-mentioned circuit to interrupt the impact-operated circuit.

14. The combination with a mine having detonating means, of means arranged to cause the energization of said detonating means as the result of an extraneous cause, and means responsive only to energy having a predetermined periodicity to render said second mentioned means ineffective.

15. A submarine mine provided with exploding means automatically operative upon the removal of said mine from the water, said exploding means comprising means providing a compartment adapted to contain water, a float arranged in said compartment, and detonating means controlled by said float.

16. A submarine mine provided with exploding means automatically operative upon the removal of said mine from the water, said exploding means comprising a float carried by said mine and detonating means controlled by said float.

17. A mine having a device responsive only to radiant energy having a given periodicity, and means controlled by said device for rendering said mine ineffective while said device is responding to said radiant energy.

18. A mine having a device responsive to vibrate in unison with signals of a predetermined periodicity, and means controlled by said device to render said mine ineffective during the transmission of said signals.

19. A mine provided with a device responsive to vibrate in unison with signals of a predetermined frequency, a reed tuned to said frequency, and means controlled by said reed to render said mine ineffective during the transmission of said signals.

20. The combination with a mine, of means automatically operative to explode said mine as a result of a sudden displacement of said mine, and means responsive only to impulses having a given characteristic for rendering said mine ineffective while said impulses are being received.

21. The combination with a mine, of means automatically operative to explode said mine as a result of a sudden displacement of said mine, and means responsive only to impulses having a given characteristic for rendering said mine ineffective while said impulses are being received, said first mentioned means being automatically restored to a potential condition upon the cessation of said impulses.

22. A mine provided with means for exploding the same, as a result of a sudden displacement of said mine, and means responsive to radiant energy for rendering said first-mentioned means either potential or non-potential to cause said mine to be exploded upon impact.

23. A mine having means to explode the same upon impact, and means selectively responsive to radiant energy having a predetermined periodicity to render said first mentioned means ineffective.

24. A mine having means to explode the same upon impact, and means selectively responsive to radiant energy in the form of compressional waves having a predetermined frequency for rendering the said first mentioned means ineffective.

25. A submarine mine having means to explode the same upon impact, and means selectively responsive to submarine compressional waves having a predetermined frequency for rendering said first mentioned means ineffective.

26. A submarine mine having means to explode the same upon impact, and means

lectively responsive to sound waves hav-
g a predetermined frequency for render-
g said first mentioned means ineffective.
27. A mine provided with means for ex-
oding the same as a result of the sudden
splacement of said mine, a plurality of
ments selectively responsive respectively
a plurality of series of radiant impulses
ving different frequencies respectively,
d means controlled by said elements for
rendering said first-mentioned means either potential or non-potential to cause said mine to be exploded upon impact.

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

JOHN HAYS HAMMOND, JR.

Witnesses:

F. J. BEHR,

IRVING U. TOWNSEND.