Jan. 2, 1923. 1,440,596.

J. H. HAMMOND, JR.

SUBMARINE MINE.

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Fig. 1

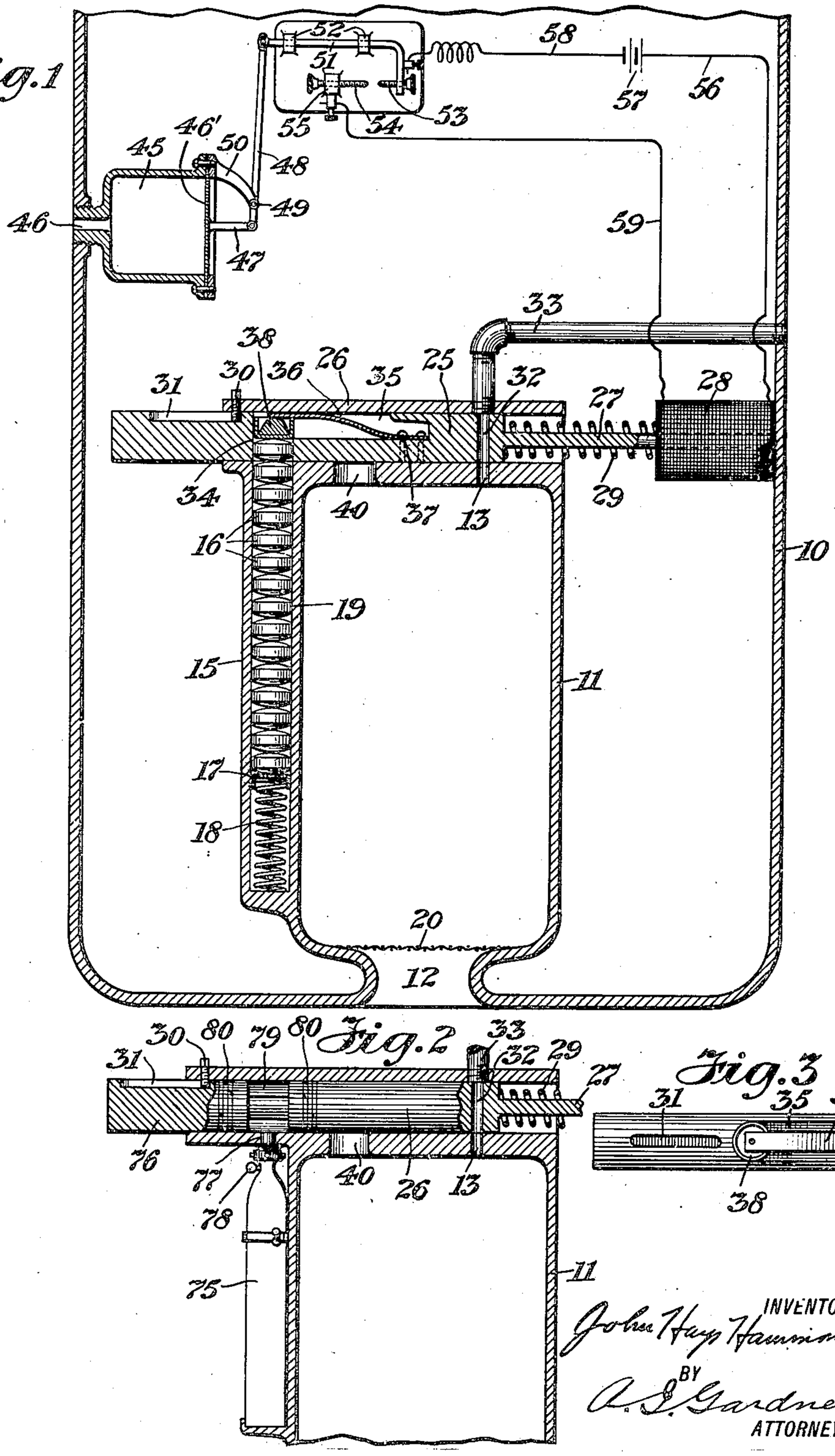
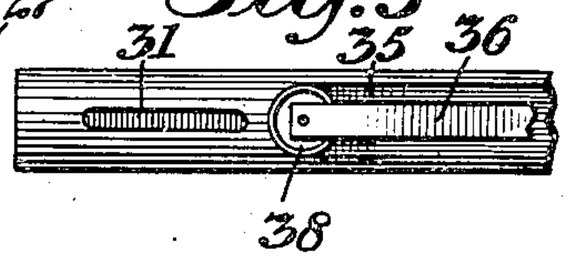


Fig. 2

Fig. 3



INVENTOR

John Hays Hammond Jr

BY

A. L. Gardner.

ATTORNEY

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

SUBMARINE MINE.

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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 the city of Gloucester, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Submarine Mines, of which the following is a specification.

Some of the objects of this invention are to provide a submarine mine of simple and inexpensive construction, which, when submerged, will maintain a substantially constant predetermined depth, and which, after a predetermined time, will sink to the ground beneath the water; to provide in a submarine mine improved means for regulating the depth of submergence of the mine; and to provide other improvements as will appear hereinafter.

In the accompanying drawings, Fig. 1 is a fragmentary vertical longitudinal central section of a submarine mine constructed in accordance with this invention; Fig. 2 is a fragmentary vertical longitudinal central section, showing a modified form of the same; and Fig. 3, a fragmentary top plan view of a detail of the form of mine shown in Fig. 1.

Referring to the drawings, one embodiment of this invention comprises a submarine mine, including an outer casing 10, which may be cylindrical in form or of any other suitable form and which contains in its upper portion (not shown) any well known or suitable explosive material and mechanism for exploding the same when struck by a vessel.

For maintaining the mine at a predetermined distance below the surface of the water when submerged the lower portion of the casing 10, is provided with an internal chamber or casing 11, coaxial with the outer casing 10, and arranged to communicate with the water surrounding the outer casing 10, through a passage 12, leading from the lower end of the internal casing 11, through the lower end of the external casing 10, and also through a port 13, leading through the upper end of the inner casing 11, and which is arranged to be automatically opened and closed as will appear hereinafter. The inner casing 11, is entirely sealed against the admission of a fluid except through the passage 12, and the port 13.

The parts of the mine are so proportioned and arranged that when the mine is placed in the water vertically with the opening 12 facing downwardly, the mine will gradually sink, the water flowing gradually in to the internal casing 11 through the opening 12, and forcing the contained air out through the port 13, and to prevent the mine from sinking more than to a predetermined depth a vertical cylindrical magazine 15, is secured to one side of the inner casing 11. Within this magazine are arranged a vertical series of discs 16, of calcium carbide or any other material or materials which will unite with water to produce a gas, and these discs are pressed upwardly by a cap 17, arranged beneath the lowermost disc and which is normally pressed upwardly by a spiral spring 18, arranged in the lower end of the magazine 15. Each of these discs 16, may be of substantially the same diameter as the internal diameter of the magazine 15, or each disc may be slightly smaller in diameter than the internal diameter of the magazine and may be snugly enclosed in a thin capsule or coating 19, fitting loosely in the magazine and made of gelatine or any other material which is slowly soluble in water. By this coating the discs are protected while in the magazine from any moisture which might leak into the magazine, and the formation of gas by a disc when placed in the inner casing 11, occurs gradually and consequently sudden and excessive upward movement of the mine under the action of this gas is avoided. A perforated screen 20 extends across the opening 12 to prevent the discs 16 from falling into the opening 12.

For transferring the discs 16, from time to time, from the magazine 15, to the interior of the inner casing 11, and for simultaneously closing the port 13 leading from the inner casing 11, a horizontal reciprocatory valve 25, is provided which is arranged to reciprocate snugly in a casing 26, provided therefore upon the upper end of the inner casing 11. This valve is provided at one end with a horizontal cylindrical extension 27, forming the core of a solenoid 28, which is rigidly secured within and to the outer casing 10. The valve 25 is normally pressed outwardly away from the solenoid 28, and into its normal position shown in Fig. 1, by a spiral spring 29 surrounding the extension 27. The valve is held against rotation and the

longitudinal movement of the valve is limited by means of a pin 30, which is threaded through the valve casing 26, and engaged in a keyway 31, extending longitudinally of the valve. The valve 25, is provided with a transverse vertical port 32 which, when the valve is in its normal or outermost position, registers at its lower end with the port 13 of the inner casing, and at its upper end with the lower end of a pipe 33, which extends upwardly from the valve casing 26, and opens outwardly through the outer casing 10, thus permitting communication between the upper end of the inner casing 11 and the space surrounding the outer casing.

The valve 25, is also provided with a circular aperture 34, which is of substantially the same diameter as the internal diameter of the magazine 15, and which, when the valve is in its normal position, registers with the upper end of the magazine 15. The valve 25, is also provided upon its upper side with a longitudinal recess 35, in which is arranged a leaf spring 36, one end of which is rigidly secured to the valve as at 37, and the other end of which is provided with a downwardly facing cylindrical plunger 38, secured thereto which is arranged to reciprocate snugly in the aperture 34, provided in the valve, the leaf spring being under an initial tension tending to force its free end and the plunger 38, downwardly.

The spiral spring 18 and the leaf spring 36 are so proportioned and arranged that the upward pressure of the spiral spring against the discs 16 exceeds at all times the downward pressure of the leaf spring, and consequently when the valve is in its normal or outermost position the spiral spring 18 presses the whole series of discs 16 upwardly, thus forcing the uppermost disc into the aperture 34 in the valve against the downward pressure of the plunger 38, and forcing the upper side of the free end of the leaf spring against the upper portion of the inner surface of the valve casing 26. The construction and arrangement is such that when the uppermost disc 16 or capsule is in this position its under surface will be flush with the lower surface of the valve 25, and when the valve is moved inwardly the uppermost disc 16 will be carried inwardly by the valve, while the next lower disc will remain stationary.

For automatically energizing the solenoid 28, when the mine has reached a predetermined depth, to move the valve 25, inwardly or towards the solenoid 28, to close the port 13, and to transfer the uppermost disc 19, into registration with a circular aperture 40, provided therefor in the upper end of the inner casing 11, a pressure cylinder 45, is fixedly arranged within the outer casing 10, and above the inner casing 11, and communicates with the water surrounding the mine through an aperture 46, provided therefor. The inner end of this pressure cylinder 45 is closed by a flexible diaphragm 46′, to the central portion of which is secured one end of a lug 47, to the other end of which is pivotally connected one end of a lever 48, which is arranged to oscillate about a fixed axis on a horizontal pivot 49, intermediate of the ends of the lever 48, and carried by a bracket 50, rigid with the pressure cylinder 45. Arranged to be reciprocated in a fixed path by the free end of the lever 48, is a slider 51, which travels in fixed guides 52, and which carries at one end an electrical contact 53, which is threaded through and adjustable longitudinally with respect to the slider 51. Arranged in alinement with the reciprocatory contact 53, is a normally stationary electrical contact 54, which is adjustably threaded through a fixed support 55. One end of the solenoid 28, is connected through a wire 56, a battery 57, and wire 58, with the reciprocatory contact 53, and the other end of the solenoid 28, is connected by a wire 59, with the stationary contact 54.

By this arrangement the contacts 53 and 54 may be so adjusted that when the pressure upon the inner surface of the diaphragm 46′ reaches a predetermined amount, due to the mine having reached a predetermined depth below the surface of the water, the reciprocatory contact 53, will be brought into engagement with the stationary contact 54, and the solenoid 28, accordingly energized and the valve 25 drawn inwardly, thus transferring one of the discs 16, from the top of the magazine to a position in alinement with the aperture 40, whereupon the disc will be forced through the aperture by the action of the leaf spring 36, and drop into the water in the inner casing 11, whereupon the capsule or coating 19 (if any) surrounding the disc will be dissolved, thus gradually exposing the surface of the disc and consequently gradually producing a predetermined volume of gas which will displace some or all of the water from the inner casing 10 through the outlet 12, and will cause the mine to rise gradually accordingly.

When the mine reaches a predetermined depth in this upward movement, the pressure upon the diaphragm 46 will be reduced to the point where any further upward movement will cause the contacts 53 and 54 to be separated, whereupon the circuit through the solenoid 28 will be broken and the valve 25 will be forced outwardly under the action of the spiral spring 29, thus opening the port 13, and allowing the gas to escape gradually from the inner casing 11, whereupon the mine will again descend gradually until the pressure of the water upon the diaphragm 46′ is sufficient to close the

contacts 53 and 54, whereupon the operation of transferring a disc 16 to the inner casing 11, will be repeated. This cycle of operations will be repeated until all of the discs 16 have been exhausted from the magazine 15, thus maintaining the mine approximately at a predetermined depth for a predetermined period, and then permitting the mine to sink to and remain upon the ground beneath the water, where the mine will not be a menace to navigation.

In the modified form of this invention shown in Fig. 2, the construction is the same as hereinbefore described with the exception that instead of the hereinbefore described magazine 15, containing discs 16, there is provided a tank or receptacle 75, which contains air under considerable pressure, and instead of the hereinbefore described valve 25, there is provided a horizontal reciprocatory valve 76 which is actuated as hereinbefore described, but which is arranged to automatically transfer predetermined volumes of compressed air consecutively from the tank 75 and to permit the same to expand through the aperture 40, and into the inner casing 11. The tank 75 is detachably connected to the inner casing 11, and normally communicates through an outlet 77, controlled by a valve 78, with an annular passage 79, between the valve 76 and its casing 26, formed by an annular recess in the valve 76. The valve 76, which is preferably cylindrical is provided upon each side of the annular recess 79 with any suitable rings 80, to prevent leakage of the compressed air from the tank 75.

In this modified form of this invention, when the mine reaches a predetermined depth, the diaphragm 46′ acts to close the contacts 53 and 54, to move the valve inwardly from the position shown in Fig. 2, to a position where the annular recess 78 will register with the aperture 40, thus closing the port 13, and transferring a predetermined volume of compressed air from the tank 75, to a position where it will be permitted to expand into the interior of the inner casing 11, and to displace a volume of water greatly in excess of the cubic contents of the annular passage 78, owing to the high pressure of the air in the tank 75, whereupon the mine will be caused to rise gradually until the pressure upon the diaphragm is sufficiently diminished to release the valve 76, thus opening the port 13, and permitting the air to be exhausted from the inner casing 11, as hereinbefore described, this cycle of operations being repeated as long as sufficient compressed air remains in the tank 75, after which the mine will be permitted to sink and remain permanently upon the ground beneath the water.

Having thus fully described this invention, I claim:

1. In a submarine mine, the combination with means providing a compartment provided with an opening and a port arranged to communicate with the surrounding water when the mine is submerged, of a receptacle for storing matter, a magnetic shiftable matter transfer valve, a hydrostat, electro-magnetic means controlled by the action of said hydrostat for shifting said valve to close said port and effecting the transfer of matter from said receptacle to said compartment causing the displacement of the water, therefrom.

2. In a submarine mine, the combination with means providing a compartment provided with an opening and a passage leading from said compartment to the surrounding water when the mine is submerged of a receptacle for storing matter, means including a matter transfer magnetic valve element having an opening therethrough normally constituted in said passage, electro-magnetic means controlled by the pressure of said water for shifting said valve element to disestablish said passage and to effect the transfer of matter to said compartment to cause the displacement of water therefrom.

3. In a submarine mine, the combination of means providing a compartment provided with an opening, a passage leading from said compartment to the surrounding water when the mine is submerged, an aperture in said compartment, means providing a storage receptacle, means including a matter transfer magnetic valve element having an opening therethrough normally constituted in said passage, a hydrostat, electro-magnetic means controlled by the action of said hydrostat for moving said valve in one direction and for holding the same to effect a transfer of matter from said receptacle to said compartment through said aperture and to simultaneously disestablish said passage permitting and causing the displacement of water from said compartment.

4. In a submarine mine, the combination of means providing a compartment provided with an opening, a passage leading from said compartment to the surrounding water when the mine is submerged, an aperture in said compartment, means providing a storage receptacle, means including a matter transfer magnetic valve element having an opening therethrough normally constituted in said passage, a hydrostat, electro-magnetic means controlled by the action of said hydrostat for moving said valve in one direction and for holding the same to effect a transfer of matter from said receptacle to said compartment through said aperture and to simultaneously disestablish said passage permitting and causing the displacement of water from said compartment, said hydrostat serving to actuate said electro-magnetic means when the mine has reached a certain

depth to release said valve element so that it may assume its normal matter receiving position.

5. Depth regulating instrumentalities for a submarine mine having a compartment, a passage leading from said compartment to the exterior of said mine and a valve casing, said depth regulating instrumentalities including means providing a storage receptacle for matter in communication with said valve casing, a matter transfer slide valve having a solenoid core, and means for energizing said solenoid core to cause said valve to slide to disestablish said passage and for effecting the translation of matter from said receptacle to said compartment.

6. Depth regulating instrumentalities for a submarine mine having a compartment, a passage leading from said compartment to the exterior of said mine and a valve casing, said depth regulating instrumentalities including means providing a storage receptacle for matter in communication with said valve casing, a matter transfer slide valve having a solenoid core, and means for energizing said solenoid core to cause said valve to slide to disestablish said passage and for effecting the translation of matter from said receptacle to said compartment, said second-mentioned means functioning to deenergize said solenoid core at a predetermined time and means for automatically returning said valve to its normal position after such deenergization.

7. In a submarine device, the combination with means providing a compartment communicating with the surrounding water when said device is submerged, of means providing a storage receptacle, matter arranged in said receptacle which will unite with water to produce a gas, and means operative to transfer successive portions of said matter from said receptacle into said compartment to cause the displacement of water therein.

8. In a submarine device, the combination with means providing a compartment communicating with the surrounding water when said device is submerged, of means providing a storage receptacle, matter arranged in said receptacle which will unite with water to produce a gas, and means controlled by the pressure of said water and operative to transfer successive portions of said matter from said receptacle into said compartment to cause the displacement of water therein.

9. In a submarine device, the combination with means providing a compartment communicating with the surrounding water when said device is submerged, of means providing a magazine, a plurality of calcium carbide elements arranged in said magazine, and means operative to transfer said elements successively from said magazine into said compartment to cause the generation of a gas in said compartment.

10. In a submarine device, the combination with means providing a compartment communicating with the surrounding water when said device is submerged, of means providing a magazine, a plurality of calcium carbide elements arranged in said magazine, and means controlled by the pressure of said water and operative to transfer said elements successively from said magazine into said compartment to cause the generation of a gas in said compartment.

11. In a submarine device, the combination with means providing a compartment communicating with the surrounding water when said device is submerged, of means providing a magazine, a plurality of elements arranged in said magazine and composed of material which when acted upon by water will produce a gas, a coating of material slowly soluble in water surrounding each of said elements, and means operative to transfer said elements successively from said magazine into said compartment.

12. In a submarine device, the combination with means providing a compartment provided with a port arranged to communicate with the surrounding water when the device is submerged, and provided with an aperture, of means providing a storage receptacle, a valve casing connecting said compartment and said receptacle, and a valve movable in said valve casing, said valve being provided with an opening and being movable to cause said opening to communicate with said receptacle and to simultaneously open said port, and said valve being movable to cause said opening to communicate with said aperture and at the same time to close said receptacle and said port.

13. In a submarine device, the combination with means providing a compartment provided with a port arranged to communicate with the surrounding water when the device is submerged, and provided with an aperture, of means providing a storage receptacle, a valve casing connecting said compartment and said receptacle, a valve movable in said valve casing, said valve being provided with an opening and being movable to cause said opening to communicate with said receptacle and to simultaneously open said port, and said valve being movable to cause said opening to communicate with said aperture and at the same time to close said receptacle and said port, an electromagnet arranged to actuate said valve, and means controlled by the pressure of the water surrounding said device for energizing said electromagnet.

14. In a submarine mine, the combination with means providing a compartment having an aperture and a passage leading from said compartment to the exterior of said

mine, of means providing a storage receptacle, a plurality of elements which when united with water generate a gas in said receptacle, a valve casing connecting said compartment and said receptacle, a valve having a solenoid core movable in said casing, said valve having an opening therethrough at one end in registration with the open upper end of said receptacle, a second opening through said valve at the other end constituted in said passage when the valve is in its normal position, means arranged in said storage receptacle for pushing one of said elements into the first-mentioned opening in the valve, means for energizing said solenoid core to cause said valve to slide, causing the disestablishment of said passage, and means carried by said valve for pushing the element carried in the valve into said compartment through the aperture therein.

15. In a submarine mine, the combination with means providing a compartment provided with an opening and a port arranged to communicate with the surrounding water when the mine is submerged and provided with a receptacle for storing matter, of a transverse valve, a hydrostat, means controlled by the action of said hydrostat for shifting said valve to close said port and bodily transfer a quantity of said matter from said receptacle to said compartment thus causing a displacement of water from said compartment.

16. In a submarine mine, the combination with means providing a compartment provided with an opening and a port arranged to communicate with the surrounding water when the mine is submerged, a receptacle for storing matter, a shiftable transfer valve adapted to bodily move a quantity of said matter from said receptacle to said compartment, a hydrostat, and means controlled by the action of said hydrostat for shifting the said valve to transfer matter from said receptacle to said compartment.

Signed at New York, in the county of New York and State of New York, this 24th day of September, A. D. 1915.

JOHN HAYS HAMMOND, Jr.

Witnesses:
ROBERT D. HANNA,
JAMES S. CAMPBELL.