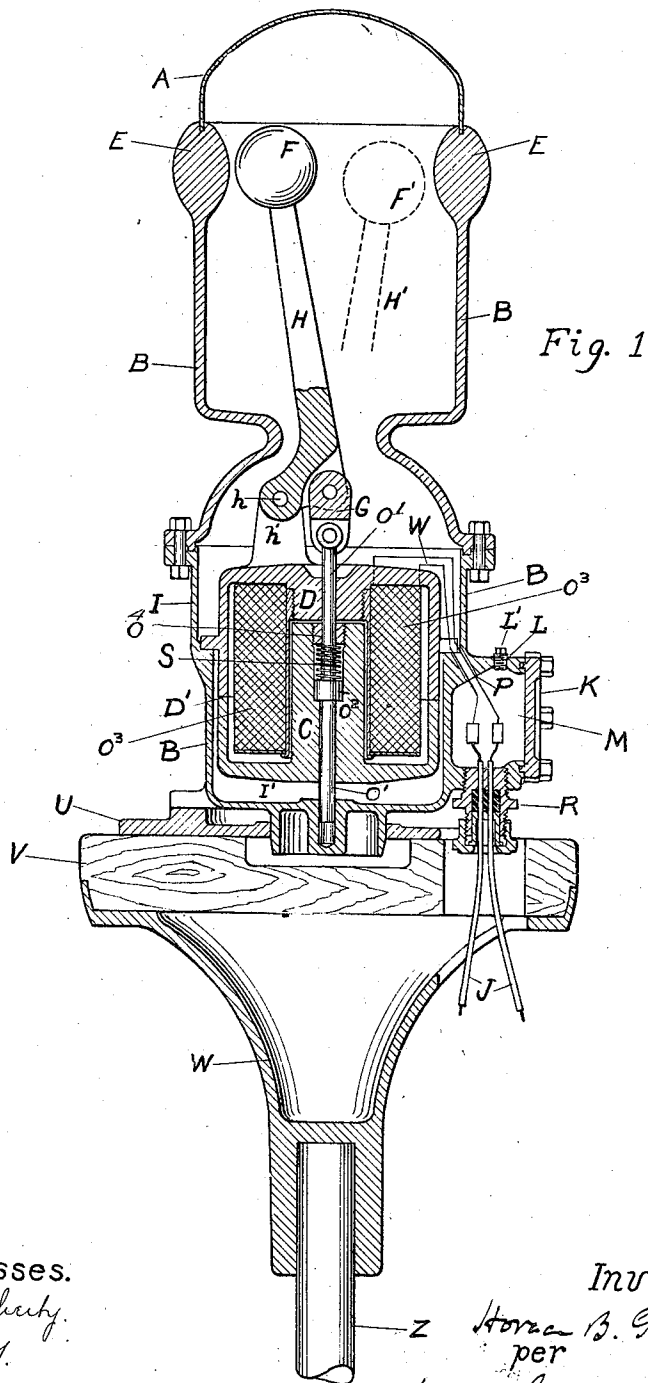


935,750.

4 SHEETS—SHEET 1.



Witnesses:
M. E. Flaherty
M. V. Foley

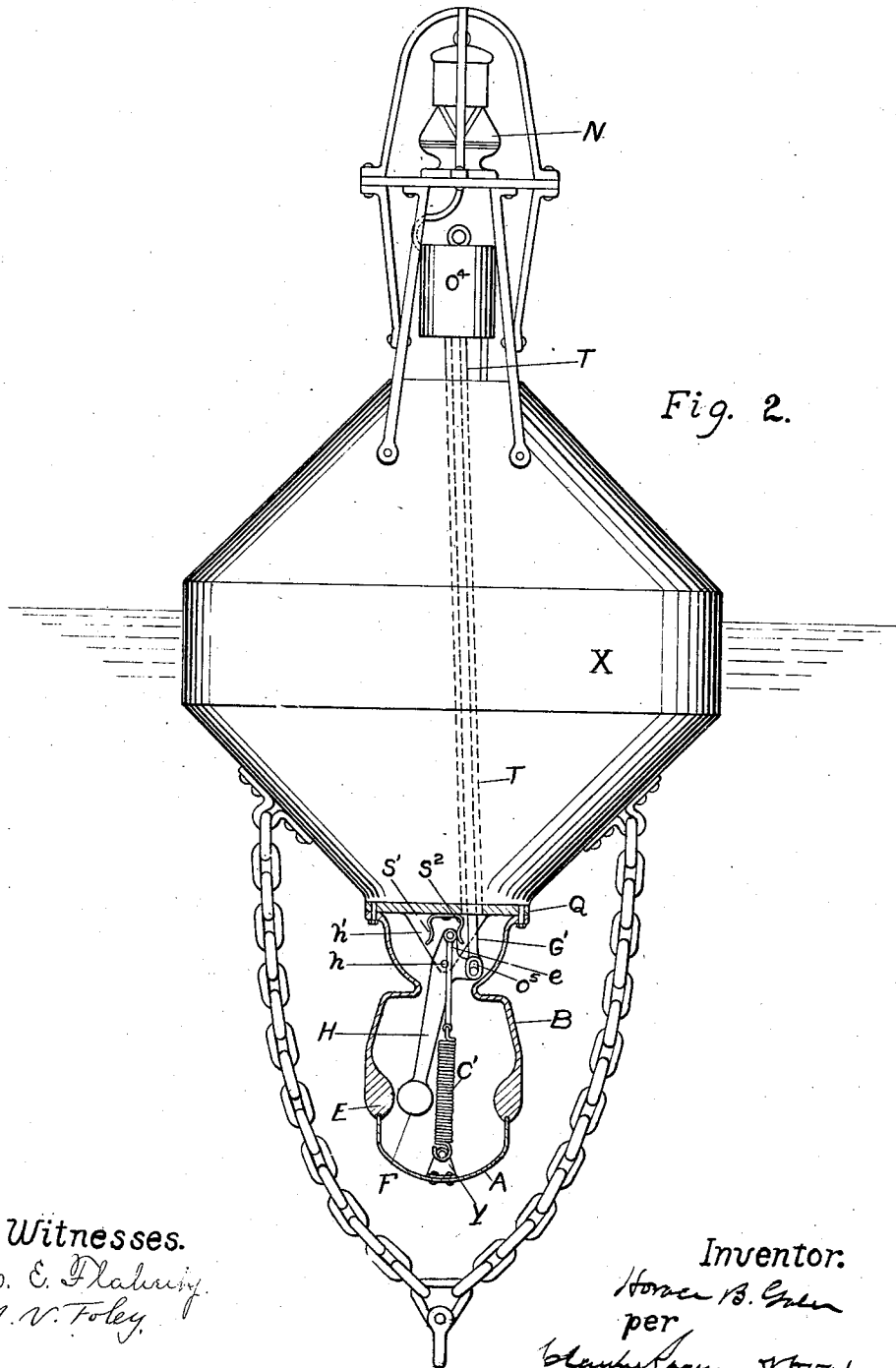
Inventor:

-z Horace B. Gann
per
Charles Raymond & Co.
Attorneys.

H. B. GALE.
 DEVICE FOR PRODUCING SOUND SIGNALS IN WATER.
 APPLICATION FILED MAR. 5, 1908.

935,750.

Patented Oct. 5, 1909.
 4 SHEETS—SHEET 2.



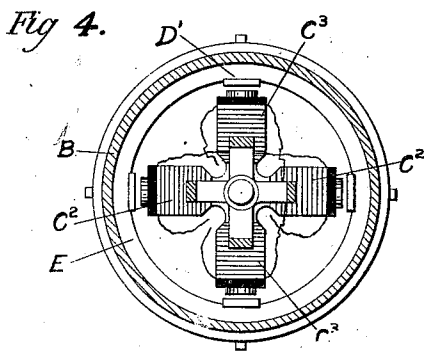
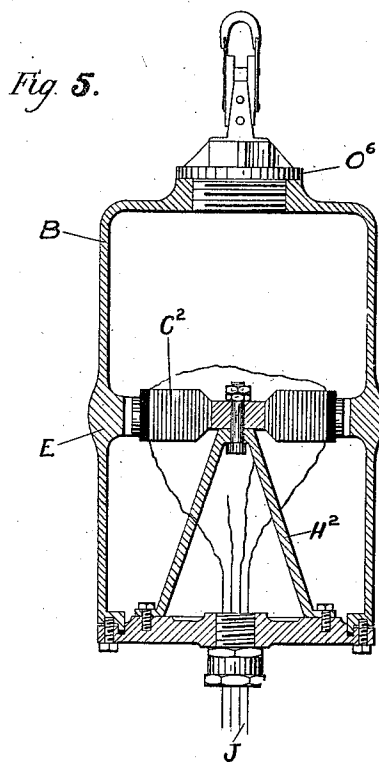
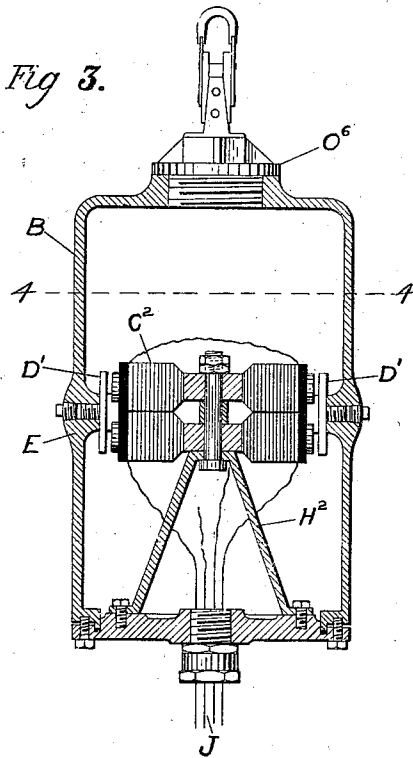
Witnesses.
 H. E. Flaherty
 M. V. Foley

Inventor.
 Horace B. Gale
 per
 Charles J. [unclear]
 Attorney

H. B. GALE.
 DEVICE FOR PRODUCING SOUND SIGNALS IN WATER.
 APPLICATION FILED MAR. 5, 1908.

935,750.

Patented Oct. 5, 1909.
 4 SHEETS—SHEET 3.



Witnesses.
 M. E. Flaherty
 M. V. Foley

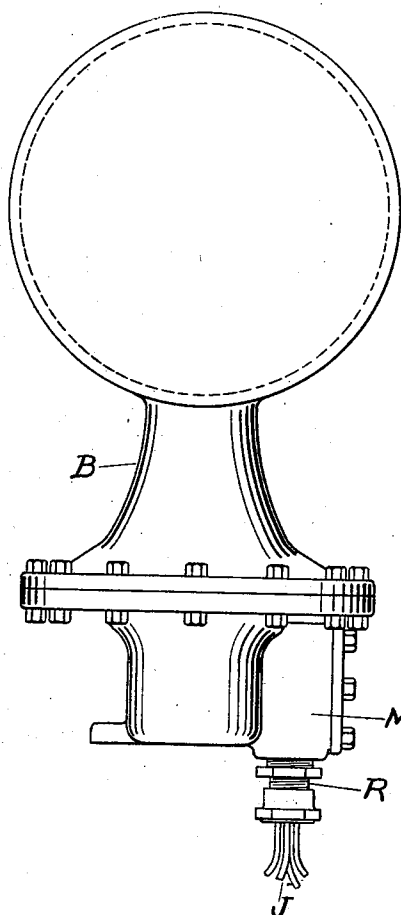
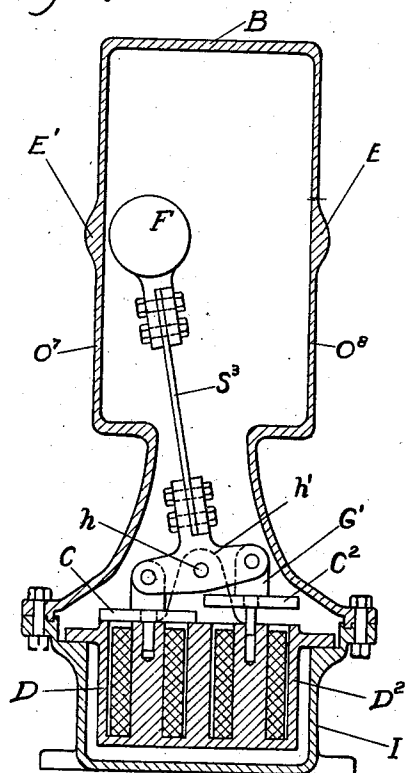
Inventor.
 Horace B. Gale
 per
 Charles Kaye and Thomas
 Attorneys.

APPLICATION FILED MAR. 5, 1906.

Patented Oct. 5, 1909.

4 SHEETS--SHEET 4.

Fig. 7.



M. E. Flaherty
M. V. Foley

Horace B. Gann
 per
 Branch & Fay *Attorneys.*

UNITED STATES PATENT OFFICE.

HORACE B. GALE, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO SUBMARINE SIGNAL COMPANY, OF WATERVILLE, MAINE, A CORPORATION OF MAINE

DEVICE FOR PRODUCING SOUND-SIGNALS IN WATER.

935,750.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed March 5, 1906. Serial No. 304,407.

To all whom it may concern:

Be it known that I, HORACE B. GALE, a citizen of the United States, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Devices for Producing Sound-Signals in Water, and do hereby declare the following, when read in connection with the accompanying drawings, to be such a full, clear, and exact disclosure thereof as will enable others skilled in the art to which my invention relates to make and use the same.

It has been ascertained by experiment that in a signaling device for submarine purposes, the vibrating body to be the most efficient should be in direct contact with the water, in order that the sound waves may be produced in the medium by which they are to be conducted, and loss of energy in their passage from one medium to another thereby avoided. It is, however, a decided practical advantage that the apparatus for exciting the vibrations of the resonant body should, itself, be protected from direct immersion or contact with the water. Especially is this true of electrical apparatus, which is peculiarly liable to injury by salt water. In case a hammer is used to excite the vibration of the resonant body, it is found also that immersion of the hammer in water tends to offer considerable resistance to its rapid motion. Another objection to the admission of water to the operating parts is that an ever-present film of water prevents a clean contact of striker and sounder. Again, unless the water be excluded the mechanism is liable to corrosion, marine growths and interference from floating obstructions which seriously interfere with its operation.

Having these and other points in mind, one object of my invention is the production of a submarine sounding device in which the vibrating body is in direct contact with the water for delivering thereto vibrations of great energy, and in which the operating parts are entirely protected from the water.

Another object of my invention is the production of a submarine sounding device wherein the operating mechanism cannot be obstructed by or in any way be subject to the effects of the presence of water, and which has no moving parts which have to be packed to prevent the admission of water.

Another object of my invention is the pro-

duction of efficient operating means especially adapted to my particular sounding device for actuating the same with great energy.

Other objects of my invention will presently appear upon reference to the description thereof in connection with the drawings, wherein—

Figure 1 is an elevation, mainly in section, of a sounding device embodying my invention. Fig. 2 is a view illustrating the operation of my device in connection with a buoy or other floating structure, the operating mechanism in this instance being slightly different from that shown in Fig. 1. Fig. 3 represents a sectional view illustrating another modification of the operating devices, and Fig. 4 a sectional view taken on the line 4—4 of Fig. 3. Fig. 5 is a sectional view illustrating another embodiment of my invention. Fig. 6 is a vertical section, and Fig. 7 an elevation illustrating another form of my invention.

Referring specifically to the drawings, B represents a closed case, preferably, though not necessarily, entirely metallic, serving the double function of resonant case or sounder and a receptacle for operating means.

E is a thicker portion of the case which serves as the vibrator, and which, in Figs. 1, 2, 3, 4, and 5, takes the form of a heavy ring which may be either integral with the rest of the case as shown, or of separate construction and attached thereto. It may project either on the inside or on the outside of the case, or on both sides thereof, as shown in Figs. 1, 3, 4, and 5.

In Figs. 1 and 2, one end of the case B is formed by a cap A, which may be of thinner metal than the rest of the case. This construction is mainly for convenience in manufacture—the body of the case being cast in one piece, and the cap attached (for example, by calking and soldering) so as to make a permanent water-tight joint—in effect, making the cap one piece with the body of the case.

Various devices for exciting the vibration of the sounder may be used in my invention, and I do not confine myself to any particular device for this purpose.

Fig. 1 illustrates the type of exciter which I now prefer, comprising a hammer F adapted to strike the ring E and an electromagnet D with a movable armature C for actuating

the hammer F. The magnet D is energized by passing an electric current through the coil O³ surrounding the forks of the magnet D and armature C.

5 The source of electrical power may be submerged in the sea or may be located upon shore or upon a vessel or other floating structure and is connected to the sounding device by the cable J. The striker is in this instance shown as mounted on one arm of the bell crank lever H, which lever is pivoted on the journals *h* on a lug *h*¹ located for convenience on the top of the magnet D. The shorter arm of the lever is pivotally connected with the link G which, in its turn, is shown as pivotally connected to the rod O¹ having a collar O², which rests upon the armature C of the magnet D. A helical spring S rests upon the collar O² and between it and the collar O⁴ for the purpose below described.

I have shown the case B, Fig. 1, as having formed thereon a junction box M. The cable J is firmly attached to this box at the opening R by means of its sheath and any suitable locking means. The box is provided with an opening and a removable cover K therefor. The terminal wires W of the electric operating means presently to be described are laid through the opening P into the junction box. The line wires of the electric supply cable J pass into the junction box at the opening R and are securely connected to the wires W within the box. This done, the cover K of the box is tightly secured in place. An opening L is shown in the top of the junction box M, and a plug L¹ provided for said opening. Through this opening, after the electric connections are complete and the cover in place, I pour a waterproof insulating compound until the box M is filled, thus sealing and making perfectly water-tight the joints at which the cable and wires enter the same. The plug L¹ is then secured in place.

The operation of the actuating mechanism is as follows: When the magnet D is not energized the weight of the armature C and its connecting parts cause the hammer F and the arm H to assume the position shown in the dotted lines at F¹ and H¹. Upon the passage of current through the coil O³ for the sounding of a signal the armature C is drawn up, throwing the striker into the position shown in full lines in the drawings (see Fig. 1). The momentum of the moving parts, however, carries the striker slightly beyond this position and into contact with the ring E, thus delivering a blow which sets the ring into vibration which vibrations are repeated in the water and the predetermined signal given. The helical springs though temporarily yielding under the momentum of the moving parts quickly forces the rod O slightly down again and

causes the striker to recede from its position of contact with the ring E to the position shown in the full lines of the drawing, thus preventing such contact of the striker and ring as would dampen the vibrations. Upon interruption of the current the striker again falls back into the position indicated by the dotted lines, the armature simultaneously dropping to the bottom of the case B, and the apparatus is ready for another stroke.

In Fig. 2 I have illustrated a modification of my invention so far as the operating means is concerned. This figure shows my invention as in operative connection with a gas buoy of the type usually employed in the light-house service. This buoy I have represented by X. It is charged with gas under pressure, which supplies in the usual manner a lamp N supported upon a frame work above the buoy. The gas as it passes from the reservoir within the buoy to the lamp N may be caused to operate suitable mechanism inclosed in the case O⁴ to actuate a reciprocating rod G¹. This rod is shown as passing through a tube T into a mechanism case or sounder of the character heretofore described, which is attached to the bottom of the buoy below the water.

I have not shown the mechanism for operating the rod G¹ as it forms no part of my present invention. It may, however, be of the type shown and described in United States Patent No. 637,925, for operating bells in the air. In this instance, the operating mechanism in the case B is as follows: The striker F is mounted upon the long arm of the bell crank lever H pivoted as heretofore described at the point *h* upon a lug *h*¹ on the bottom plate Q. To the short arm of the lever the reciprocating rod G¹ is connected and at the point of connection is provided with an elongated slot O⁵, whereby the reciprocating rod and the arm of the lever have relative movement for the purposes to be presently described. A spring C¹ is attached to an extension of the arm H beyond the pivotal point. The other end of the spring C¹ is attached at the point Y to the part A of the casting B. Two leaf springs S¹, S², are shown mounted on the plate Q to prevent by their contact with the extension of the arm H, the striker F from remaining in contact with the ring E after being thrown against the same.

The striker F is thrown against the ring E by the spring C¹. The apparatus being in the position shown in Fig. 2, the rod G¹ on being forced upward will rotate the arm H about the pivot H¹ to throw the striker F to the right. The point *e* will be simultaneously carried to the left and when the arm H has passed slightly beyond the vertical position the spring C¹ will throw the striker F quickly toward the right and against the ring E, the slot in the lower end of the rod

G¹ permitting this free motion of the pin on the arm H. The striker F being now thrown over to the right hand side of the case will, upon downward movement of the rod G¹, be carried toward the left and after it has passed slightly beyond the vertical position on the left hand side will be thrown by the spring C¹ quickly to the left, again striking the ring E and being returned by the leaf spring S² to the position shown in the drawing.

In Figs. 3 and 5 I have shown a lug or ring O⁰ attached to and forming part of the case for suspending the apparatus in the water.

In Figs. 3, 4, and 5, the means for exciting the vibration of the resonant body consists of electro magnets O⁷ which cause the case B to vibrate by means of magnetic lines of force in the manner set forth as applied to vibrating a bell in United States Patent No. 636,519, to Gray & Mundy, and which, therefore, need not be further described.

In Figs. 1, 2, 3, 4, and 5, I have shown my invention embodied in an apparatus in which the sounder is in the form of a ring which forms part of the casing containing the striking mechanism. I do not, however, mean to limit my invention to the form of sounder shown, as in certain cases a plate or diaphragm may be used as the sounder, my invention being limited only by the necessity that a vibrating body shall be in contact with the water and the vibrating mechanism be protected from the water and at the same time be arranged to impart the necessary vibrations directly to the vibrating body. Such a modification of the resonant case B is shown in Figs. 6 and 7, in which the thickened portion E is in the form of bosses in the center of the round diaphragms O⁸ and O⁹, respectively. By constructing these diaphragms so that each will give a different sound, the utility of the signaling means may be increased.

In Figs. 6 and 7 a pair of magnets D and D² are shown, which may be energized alternately, attracting alternately the armatures C and C², causing the hammer F to strike alternate blows on the two diaphragms O⁸ and O⁹.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent is:—

1. In an apparatus for producing sound signals in water, the combination of a sounding body having a portion of its surface adapted to be exposed to contact with water, and a portion thereof shielded therefrom, and means inclosed therein acting directly upon said body to originate sound vibrations therein capable of transmission through the water.

2. In an apparatus for producing sound vibrations in water; the combination of a

closed sounding body adapted to be immersed in water, means inclosed in the body acting directly thereon to originate sound vibrations therein and adapted to cause said body to impart sound vibrations to the surrounding water, and means for operating said inclosed means from a point outside the body, as set forth.

3. In an apparatus for producing sound vibrations in water, the combination of a closed sounding body immersed in water, a striker adapted to strike against the inner surface thereof to cause the vibration of said body, means for operating said striker inclosed in said body and means for causing the actuating of said striking operating means from a point outside the casing, as described.

4. In an apparatus for producing sound vibrations in water, the combination of a closed metallic vibratory body, a striker inclosed in the said body and adapted to strike upon the inside surface thereof, and electrical mechanism, also inclosed in said body, for actuating the said striker, and a cable or insulated wire attached to the said body and entering the same through a sealed opening whereby electrical power may be conveyed inside the body for operating the striker, whereby sound signals will be originated capable of being transmitted through the water in which the body is immersed.

5. In an apparatus for producing sound vibrations in water comprising a closed cylindrical metallic case, having a thickened portion, a striker inclosed in the said case and adapted to strike said thickened portion, an electrical mechanism for actuating the striker, and a cable or insulated wire entering the case through a sealed opening whereby electrical impulses may be conveyed inside the case for operating the striker to originate and transmit sound signals, substantially as set forth.

6. A water-tight submerged case, a portion of which is capable of exciting sound vibrations in water in contact with it, and means inclosed within the case whereby the vibrating portion of said case may be set in motion to originate and transmit signals, as described.

7. A submerged water-tight case capable of vibration and of transmitting sound vibrations to water in which such case is submerged, and means inclosed within said case whereby sound vibrations may be set up in said case, as described.

8. A water-tight case having two or more faces each capable of transmitting sound vibrations to water and each attuned differently from the other, said case being adapted to be submerged in water, said case being provided with means inclosed therein whereby such vibrations may be excited, in combination with means located outside the case

whereby said exciting means may be operated.

9. A submerged water-tight sound-producing case, a striking means inclosed within said case, means inclosed within the case for operating said striker to cause it to engage the internal wall of said case, the portion of the wall so engaged being thicker than the

rest of the said wall whereby sound vibrations capable of utilization as submarine sound signals may be originated.

HORACE B. GALE.

In presence of:—

M. E. FLAHERTY,

M. V. FOLEY.