H. HECHT.

MEMBRANOUS OR DIAPHRAGM TRANSMITTER FOR SUBMARINE SOUND SIGNALS.

APPLICATION FILED JULY 7, 1913.

1,097,859. Patented May 26, 1914.

Fig. 1.

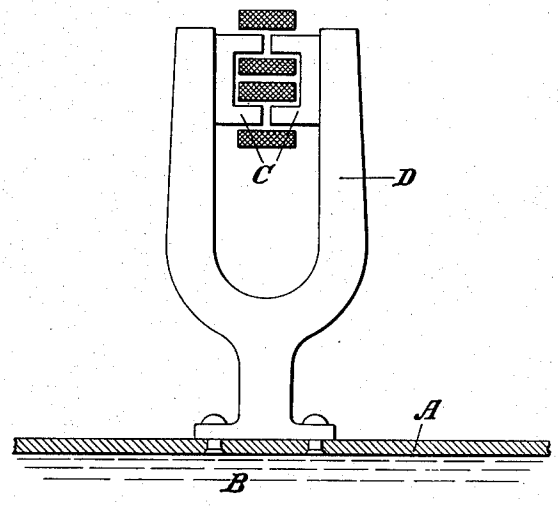
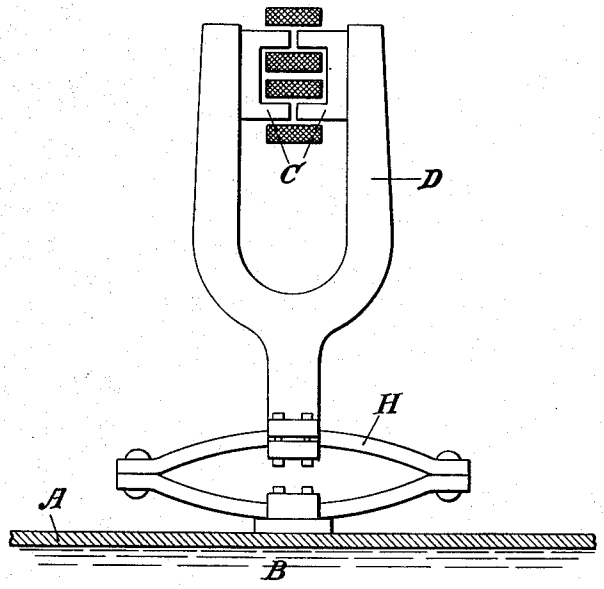


Fig. 2.



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UNITED STATES PATENT OFFICE.

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MEMBRANOUS OR DIAPHRAGM TRANSMITTER FOR SUBMARINE SOUND-SIGNALS.

1,097,859. Specification of Letters Patent. Patented May 26, 1914.

Application filed July 7, 1913. Serial No. 777,753.

To all whom it may concern:

Be it known that I, HEINRICH HECHT, Dr. Phil., engineer, a subject of the King of Prussia, and resident of 65 Feld street, Kiel, Germany, (whose post-office address is 65 Feld street, Kiel, Germany,) have invented certain new and useful Improvements in Membranous or Diaphragm Transmitters for Submarine Sound-Signals, of which the following is a specification.

The invention relates to a membranous or diaphragm transmitter for submarine sound signals that is to say a device for producing sound vibrations in the side of a hollow body that impinges on the water, for example the outer skin of a ship or of a buoy. Attempts have been made to solve this problem by directly coupling the ship's side or a membrane inserted therein with the armature of an electromagnet, that is excited by alternating current. In connection herewith the difficulty has arisen that it has been found to be impossible to transform large outputs of power into vibratory energy. The very slight compressibility of water causes even very large acoustic effects to have only very small amplitudes. Thus in order to excite a large mass of water effectively, very great forces are necessary correspondingly to the very small amplitude distances and as the permeability of the electromagnet iron employed only allows of a relatively slight saturation in the case of high frequency of vibration, the available forces can only be increased by simultaneously increasing or enlarging the masses of iron employed in connection wherewith all internal losses increase in equal degree, so that the degree of effectiveness attained, no matter what dimensions may be adopted, is always far below the most moderate requirements of efficiency and economy. This difficulty could be obviated by causing the energizer, for example an electromagnet to act on the end of a lever and coupling the point of the radiator or of the ship's side that is to be energized with a suitably short arm of the lever. As however in view of the small amplitudes, for the production of which it serves, a rigid lever arrangement is difficult or impossible, this form of execution can in general never be perfectly carried out.

The invention consists in introducing between the energizer or the apparatus that transforms the imparted energy into acoustic vibrations, and the radiator or the membrane that conveys the vibrations to the surrounding water, a system with very pronounced self-vibration and attuning it so that the frequency of its self-vibration coincides as nearly as possible with that of the impressed vibration. At the same time the form and the dimensions of the transmission system may likewise be such that it contains points, the amplitudes of which are in the required ratio to the amplitudes imparted to another point, as for example the longitudinal vibrations in the stem of a tuning fork to the transverse vibrations of its prongs or the transverse vibrations of the tuning fork in different places in the prongs. The system may however be so dimensioned that a lower ratio is produced between the amplitudes at the point of action of the energizer and that of the radiator and that the required amplitude ratio is obtained by means of a suitably loose coupling between the transmission device and the side of the ship.

In the accompanying drawing Figure 1 represents a diagrammatic view of one form of the invention: Fig. 2 is a similar view of a slightly modified form.

In both figures A is the side of the ship or a side impinging on the water B, and forming the radiator, C is the energizer, which is shown for example as a pair of electromagnets.

D is the transmission device.

In the form shown in Fig. 1 the transmission device, between the energizer C and the radiator A constitutes a body which has as slight a self-damping action as possible, preferably a tuning fork D is used, and which is so dimensioned that its own periodicity of vibration comes nearest to the required musical pitch and that the requisite ratio is assured between the valves of the amplitudes occurring in the prongs and in the stem. The stem of the tuning fork D is attached to the side A and between the prongs of the fork D the pair of electromagnets C is arranged. If the pair of electromagnets be energized, the tuning fork D is vibrated and the vibrations are transmitted in the requisite ratio to the side A and thence to the adjoining water B.

The form illustrated in Fig. 2 differs from that in Fig. 1 in that between the stem of the tuning fork and the membrane A a spring H is inserted. Thus between the stem and the membrane there is a further

amplitude ratio and the tuning fork therefore does not need to be so dimensioned as to give the full sum of the required transmission.

What I claim and desire to secure by Letters Patent is:—

1. A transmitter for submarine sound signals comprising means for producing vibrations, a body impinging on the water and adapted to act as a membrane or diaphragm and solid or rigid transmission means introduced between the vibration producing means, and the membrane or diaphragm, and attuned to the periodicity of the vibration producing means.

2. A transmitter for submarine sound signals comprising a transmission element, a vibration producer arranged to act on the transmission element at points which have great amplitudes of oscillation, and a hollow body impinging on the water and acting as a membrane or diaphragm, and connected with points of the transmission element which have small amplitudes of oscillation.

3. A transmitter for submarine sound signals comprising means for producing vibrations, a body impinging on the water and adapted to act as a membrane or diaphragm and transmission means introduced between the vibration producing means and the membrane or diaphragm consisting of a vibrating tuning fork or tongue that is as free as possible of damping action, and is coupled with the vibration producing means in proximity to a vibration center, and with the membrane or radiator in proximity to a vibration node.

4. A transmitter for submarine sound signals comprising an energizer, a radiator, a transmission element and flexible non-damping intermediate parts, springs adapted to connect the transmission element with the energizer and the radiator in proximity to vibration centers or nodes.

In testimony whereof I affix my signature, in presence of two witnesses.

DR. HEINRICH HECHT.

Witnesses:
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