Dec. 23, 1924. 1,520,291

W. HAHNEMANN

TRANSMITTING AND RECEIVING DEVICE FOR SUBMARINE SOUND WAVES

Filed March 24, 1921

Fig. 1.

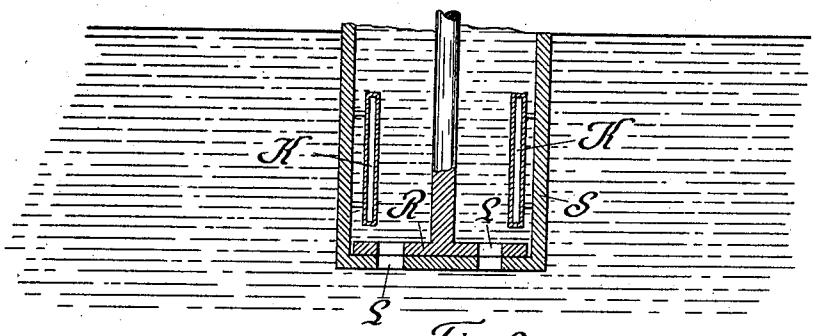


Fig. 2

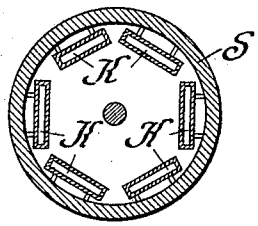
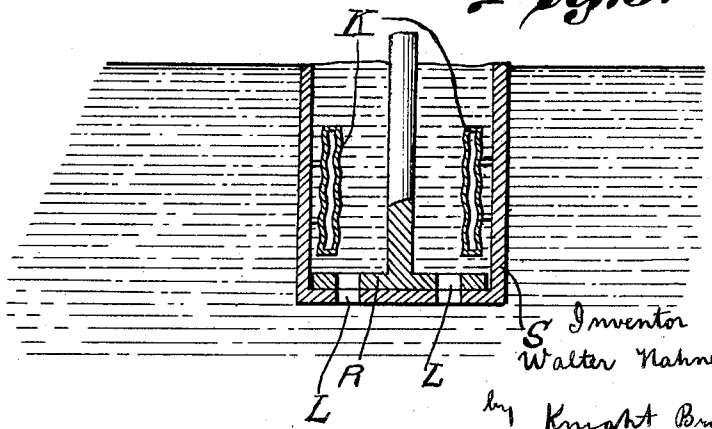


Fig. 3.



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UNITED STATES PATENT OFFICE.

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TRANSMITTING AND RECEIVING DEVICE FOR SUBMARINE SOUND WAVES.

Application filed March 24, 1921. Serial No. 455,320.

To all whom it may concern:

Be it known that I, WALTER HAHNEMANN, citizen of the German Republic, residing at Kitzeberg, near Kiel, province of Schleswig-Holstein, State of Prussia, Germany, have invented certain new and useful Improvements in and Relating to Transmitting and Receiving Devices for Submarine Sound Waves, of which the following is a specification.

In hydraulic submarine sound transmitting and receiving arrangements of whatever form of construction,—such for example, as sirens, whistles, and hydraulic automatic interrupters,—the production of sound in the surrounding medium is based directly or indirectly upon the emanation of a volume of liquid from a container under pressure, the liquid emanating from the container into the surrounding water or into another container which is in contact or in communication with the surrounding water. In such case the sound energy produced in the surrounding water is determined by, or is at least dependent upon the quantity of water emanating per period.

The transmitters and receivers heretofore known in the art and based on the hydraulic principle have the disadvantage that the delivery of large quantities of water per period becomes impossible, because owing to the incompressibility of the liquid in the container under pressure, a very great drop in pressure occurs in the container even when the volume of the liquid is only slightly reduced; thus a strong suction effect is produced in the container which opposes the further emanation of liquid therefrom. On the other hand, in the case of transmitters or receivers in which the emanated quantity of liquid is directed in turn into a limited volume of liquid, a very high counter-pressure is produced in the latter even at the entry of less than the full quantity of the emanated liquid. Similar difficulties occur everywhere in submarine sound transmitters or receivers operated hydraulically, in which several liquid containers of limited size are employed.

Attempts have been made to remove these disadvantages by providing air cushions or the like in the containers (for instance, in the containers from which the sound producing quantities of water emanate or in containers which are connected with them), the air or the like in these cushions serving as a compressible medium. These air cushions should preferably be disposed at a distance of less than one-half the wave length of the frequency used, from the point at which the sound producing volume of water emanates or enters as the case may be.

The advantage of this arrangement, as compared with the pressure-equalizing tanks frequently used in hydraulic submarine senders or receivers, resides in the fact that the sound pressure magnitudes are directly influenced at the point at which the sound is produced. If the air cushions were disposed further than one-half of a wave length from a point of sound production, such as is the case in other well-known arrangements, the production of the full pressure is already completed at the point of sound production before the pressure wave has reached the point at which it is cushioned by the compressible medium.

It has been found that in many cases the object aimed at, namely, an efficient control of the sound pressure field in regard to its pressure magnitudes, is not sufficiently attained because the location of the compressible medium with relation to the point of sound production is an unfavourable one. If, for instance, the buffer chambers filled with compressible material are so arranged that they have only a small surface common with the radiation field to be controlled, or that they have only a small acting surface, then with a given oscillating mass very high velocities of those quantities of water which are to oscillate on the small surfaces of the buffer chambers must be produced. Such accelerations can hardly be obtained in practice.

A feature of the invention consists in so shaping the buffers that with a given volume they have a large surface.

In the accompanying drawing constructional examples of the invention are shown as applied to a submarine sound signalling device of the siren type, in the interior of which device the sound pressure field is to be reduced. R indicates the rotor, S the stator, and LL the sound openings of the siren. For cushioning the wave stroke in the interior of the siren piston, air cushions KK are arranged, which, according to the

invention, are constructed in the form of exceedingly flat boxes made of thin sheet metal.

In the drawing, Figure 1 shows a vertical section through a siren provided with a common form of the buffer comprised in the invention; Figure 2 shows a horizontal section through the same; and Figure 3 shows a vertical section, similar to Figure 1, of a siren provided with another form of the buffer comprised in the invention.

The specific details of the flat air cushions or buffers are not of importance for the invention. They can, for example, be crinkled, as shown in Figure 3. It is only important that the arrangement should be as flat as possible and lamellar.

In principle, the invention is not limited to the use of gases as the cushioning medium. Instead of these, more or less solid or plastic materials of higher compressibility than water can be used, which materials are brought into a flat extended form such as india rubber sheets or the like; also porous materials containing air, such as earthenware cells, can be used to advantage if they have a sufficiently extensive surface; but homogeneous materials of high compressibility are to be preferred, because with these the active surface and the total volume can be calculated more exactly. Similarly the invention is not limited to any particular form of hydraulic sound signalling apparatus, but extends to all submarine sound apparatus in which buffer or cushioning chambers are used for modifying the sound pressure field. The invention is particularly used with advantage where it is desired to produce oscillations of relative large amplitude in the liquid by direct excitation with an electromagnet, without the necessity of employing levers or special oscillatory structures in conjunction with the diaphragm.

I claim:

1. A submarine sound communication plant, comprising in combination, sound communication apparatus, and a liquid-pressure cushioning element arranged in the sound propagating liquid at a point adjacent said apparatus, the surface of said cushioning element being large in comparison with its volume.

2. A submarine sound communication plant, comprising in combination, sound communication apparatus, and a gas-filled cushion arranged in the sound propagating liquid at a point adjacent said apparatus, the surface of said cushion being large in comparison with its volume.

3. A submarine sound communication plant, comprising in combination, sound communication apparatus, and a liquid-pressure cushioning element arranged in the sound propagating liquid at a point from said apparatus not greater than one-half the wave length of the sound waves produced.

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

WALTER HAHNEMANN.

Witnesses:
AENEAS MARXER,
EMIL LÜTT.