

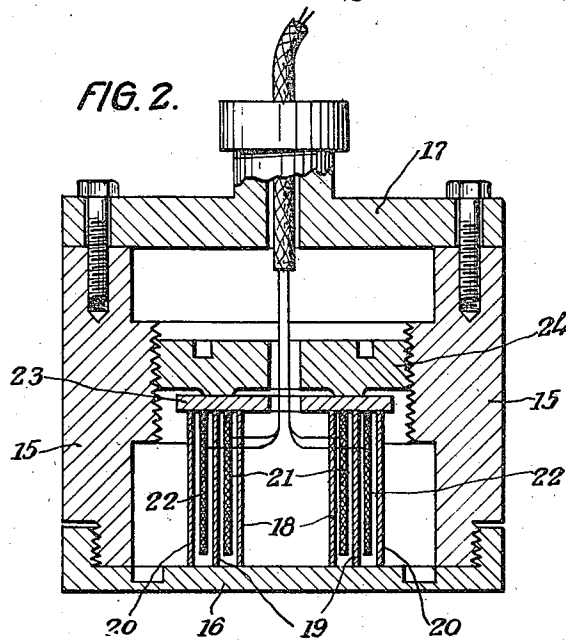
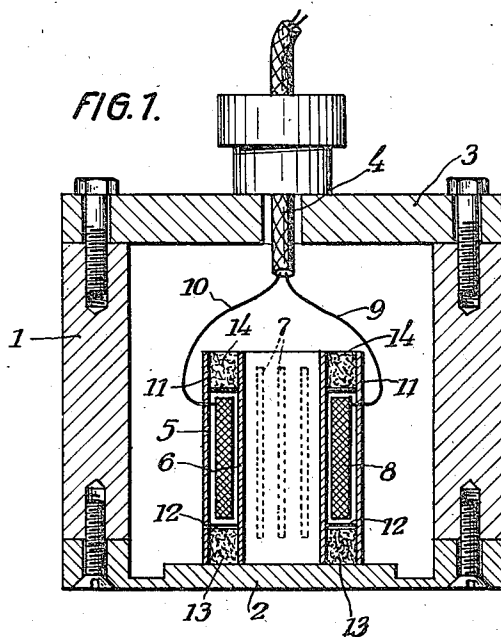
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VIBRATORY SYSTEM FOR THE TRANSMISSION AND RECEPTION OF SOUND WAVES

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VIBRATORY SYSTEM FOR THE TRANSMISSION AND RECEPTION OF SOUND WAVES

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5 Claims. (Cl. 177—386)

It has already been proposed to use in the construction of magnetostrictive vibratory system tubular members made of a magnetostrictive material, which are connected to diaphragms or terminal masses. In the hitherto known constructional forms either a single tube was used or several tubes were mounted next to one another on a common plate. This construction has this disadvantage among others, that it is difficult to obtain magnetic circuits which extend almost completely in the magnetostrictive material. When only a single tube is used, the magnetic circuit can only be completed through yokes, or slots have to be cut in the tubes and the bridge-shaped parts thus formed separately wound. If a plurality of tubes be used, a fairly large number must be employed, as, with the use of only two or three tubular bodies, an unsymmetrical structure of the vibratory body results and the distribution of the flux entails difficulty.

According to the present invention in a vibratory system for the transmission and reception of sound waves with two or more longitudinally vibrating, tubular magnetostriction vibrators, the ends of which are connected to a diaphragm, more particularly a piston diaphragm or a terminal mass, the tubular vibrators are disposed concentrically with respect to one another and enclose between their walls one or more cylindrical coils in such a manner that their axes coincide with the tube axes. With this arrangement it becomes possible to cause the magnetic flux to extend over the greater part of its path in the magnetostrictive material. If the circuit is to be completed it is only necessary to interpose in the space between the walls of the concentric tubes above and below the cylindrical coil rings of this magnetostrictive material. This constructional form of the vibratory system has the further advantage, that it allows of a ready adaptation to the circular construction of the diaphragm. A further advantage is that the vibratory system has great rigidity to buckling.

Preferably the diameter of the tubes will be made equal to or greater than half the diameter of the piston diaphragm connected with them, in order as far as possible to prevent non-sinusoidal vibrations. The vibratory system may be so constructed that the tubular vibrator is connected with one of its ends rigidly to the piston diaphragm and with its other end either vibrates freely or is loaded by a mass. A constructional form may also be used with advantage, in which the end lying opposite the piston diaphragm is connected with the casing as the abutment, either

under pressure or not. The connection of the vibratory system with the diaphragm may also be established in the same way. The tubular vibrator will then be interposed in a stressed state between the middle part of the piston diaphragm and the oppositely disposed part of the casing wall, but so as to be capable of being easily removed at any time.

The invention is illustrated by way of example in the accompanying drawing, in which,

Fig. 1 shows a vibratory system with a tubular vibrator standing freely on the diaphragm and

Fig. 2 another constructional form in which the tubular vibrator is connected at the inner end with the casing.

In Fig. 1 of the drawing 1 is a cylindrical casing which is closed at one end by a piston diaphragm 2, while at the other end a closing cover 3 having a cable 4 with a bushing is provided. On the piston diaphragm 2 is fixed a magnetostriction tubular vibrator which consists of two concentric tubes 5 and 6. These tubes are made of sheet nickel having a thickness of about 0.5 mm. and are rigidly fixed by soldering to the thickened middle part of the piston diaphragm 2. The walls of the tubes are preferably provided with longitudinal slots 7, for preventing as far as possible the formation of eddy currents. Between the walls of the tubes 5 and 6 a cylindrical coil 8 is arranged. The leads 9 and 10 to the cylindrical coil are taken through slots in the outer tube. For establishing a good magnetic circuit narrow rings 11 and 12 of magnetic material are inserted above and below the coils so as just to make contact with the walls of the two tubes. These rings have radial slots for preventing eddy current losses. Pads 13 and 14 of spongy rubber which are pushed lightly between the tubes prevent the rings from falling out or moving within the space between the tube walls. The longitudinal slots in the tubes are preferably extended beyond the place where the cylinders 11 and 12 establish a magnetic circuit, as will be seen from the drawing. The free end of the tubular vibrator may be rigidly connected with terminal masses for varying the damping and tuning of the vibratory system.

In Fig. 2 a similar vibratory system is shown. The casing is formed by a cylindrical part 15, a piston diaphragm 16 and a closing cover 17. On the piston diaphragm 16 is mounted a magnetostriction tubular vibrator consisting of three concentric tubes 18, 19 and 20. Between the three tubes are disposed two cylindrical coils 21 and 22 in the same manner as in Fig. 1, which are con-

5 nected in series or parallel. At one end of the tubes a ring-shaped mass 23 is soldered on, to which the coils 21 and 22 are so connected as to extend freely between the walls of the tubes. In the casing above this ring-shaped mass 23 a threaded ring 24 is provided, by which the tubular vibrator can be pressed against the thickened middle part of the piston diaphragm 16.

10 In another constructional form the tubes of magnetostrictive material are rigidly soldered to the piston diaphragm and by means of the threaded ring 24 pressure is exerted on to the other end, so that the piston diaphragm 16 is given a certain initial stressing and in this way the vibrator is rigidly connected to the casing.

15 The vibratory system can be used both as a transmitter and as a receiver for the production of and the reception of sound oscillations, more particularly in water. When used as a receiver, the piston diaphragm should have as small a mass as possible. As, however, in view of the requisite stiffness the thickness of the diaphragm mass may not go below a definite dimension, it is of importance to keep the weight which is added through the magnetostriction vibrator mounted on it as low as possible. This is ensured by the construction according to the invention, for it is possible to make the tubular vibrator in this form extremely light. A further result of the form of the vibrator is, that the piston diaphragm is supported in such a manner, that undesired forms of vibration of the diaphragm are as far as possible eliminated.

What I claim is:

35 1. A magnetostrictive transmitting and receiving device comprising a casing having a diaphragm at one end thereof, a plurality of cylinders mounted concentrically on said diaphragm with their axes at right angles to the radiating 40 surface of the diaphragm, an abutment member and a plate upon which the abutment member bears, a plurality of coils mounted on said plate and means for adjusting said abutment member longitudinally of said casing, said coils being positioned to lie concentric with the cylinders 45 mounted on said diaphragm.

2. A magnetostrictive transmitting and receiving device comprising a casing having a diaphragm at one end thereof, a plurality of concentric cylinders mounted on said diaphragm with their axes at right angles to the radiating surface of the diaphragm, a plate carrying a plurality of coils adapted to be positioned parallel to the cylinders and means threading into said casing and bearing on said plate whereby the coils remain concentrically positioned with respect to said cylinders and the desired pressure is placed on said diaphragm through said cylinders.

3. A magnetostrictive transmitting and receiving device comprising a cylindrical casing having a diaphragm at one end thereof, a plurality of concentric rings positioned concentrically within said casing on said diaphragm with their axes at right angles to the radiating surface of the diaphragm, a plate, means adjustably positioned for bearing upon said plate, and a plurality of coils positioned to occupy the space between successive cylinders, said coils being mounted on said plate.

4. Means for transmitting and receiving high frequency compressional waves comprising a cylindrical casing having a piston diaphragm at one end, a plurality of cylinders, a plurality of concentric coil means positioned between said cylinders and securing said coils in position respectively between said cylinders.

5. Means for transmitting and receiving high frequency compressional waves comprising a casing having a diaphragm at one end, a plurality of concentric cylinders of magnetostrictive material mounted upon said diaphragm, a plate bearing upon the ends of said cylinders and having mounted and positioned thereon a plurality of concentric coils, the coils occupying positions one between each of said cylinders, and a member threading within the casing and bearing upon said plate exerting pressure upon said cylinders through said plate.

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CERTIFICATE OF CORRECTION.

Patent No. 2,153,571.

April 11, 1939.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 29, claim 4, for the words "coil means" read coils; line 30, before "securing" insert means; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of May, A. D. 1939.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.