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HYDROPHONE MEMBERS

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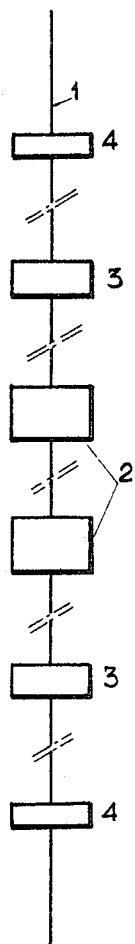


Fig. 1

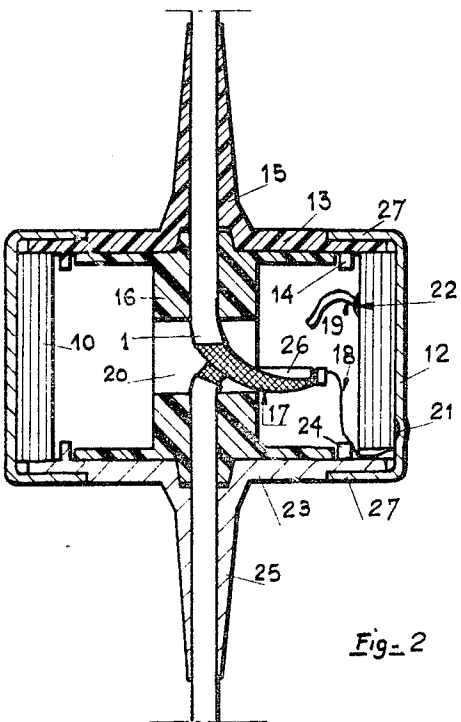


Fig. 2

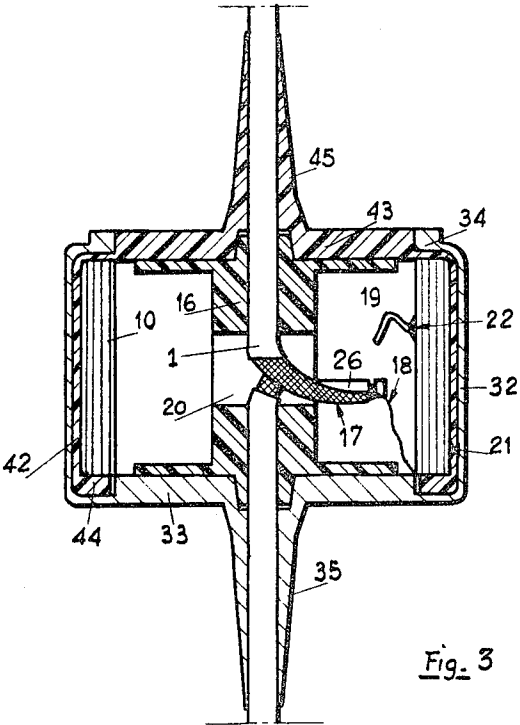


Fig. 3

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Guy Maës, Neuilly-sur-Seine, France, assignor to
L'Electronique Appliquée, Paris, France

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923,762, Patent 1,355,675
3 Claims. (Cl. 340—10)

The present invention concerns improvements in or relating to hydrophone members specially adapted to be used in submarine listening microphone arrangements of the so-called anti-echo kind, i.e. hydrophone arrangements comprising a plurality of members so dimensioned and relatively supported that they do not present any substantial response to the echoes on the bottom and surface of the sea of the noises they are intended to pick off.

In the accompanying set of drawings, FIGURE 1 is a diagrammatical view showing an arrangement of six hydrophones;

FIGURE 2 is a sectional view of one hydrophone in accordance with the present invention;

FIGURE 3 is a sectional view of a modified form of the hydrophone shown in FIGURE 2.

As an illustrative example of such anti-echo arrangements, FIG. 1 shows a diagrammatic view of one of such devices comprising for instance six hydrophone members distributed in three pairs of identical members in each pair, referred as 2, 3 and 4 along an hydrophone cable 1 from which they depend and from which they are supported. The distribution is such that it substantially follows the so-called Tchebyscheff law so that the radiation diagram of the arrangement does not present any substantial secondary lobes but only a main lobe symmetrical with respect to the mid-plane orthogonal to the arrangement. Hydrophone members 2 are dimensioned for the higher weight and hydrophone members 4, for the lower weight in the arrangement, the weight of hydrophone members 3 being intermediate between those of members 2 and 4. Consequently the directivity of pick-off radiation diagram will be maximum in the said plane.

It is an object of the invention to provide a structure of an hydrophone member wherein the weight can be easily determined by the sole choice of the height of the piezo-electric cylindrical part incorporated therein as a converter from sound to electrical signal pick-up.

A further object of the invention is to so provide such structure that the response is substantially constant over the whole height of the piezo-electric cylinder.

A further object of the invention is to so provide such a structure that its mechanical and acoustical arrangement is particularly simple and efficient for the sought purposes.

According to the invention, a piezo-electric hydrophone member for anti-echo submarine listening arrangements is mainly characterized by the combination of a piezo-electric hollow cylinder the height of which is adjusted for the response efficiency coefficient thereof, a pair of plastic material plates applied on the opposite edges of said cylinder, a stretcher within said cylinder and not in contact with it for supporting said plates, at least one annular sheath tightly applied over the external surface of the said cylinder and two axial sleeves extending from said plates in an outward direction and watertightly separating the input and output cable portions which are connected to the piezo-electric cylinder terminals within the so provided watertight inner volume of said cylinder.

With reference to the accompanying drawings, two

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illustrative embodiments of such a member are respectively shown in FIGS. 2 and 3 in cross-section views. In these figures the piezo-electric cylinder 10 is of a height provided for defining the "weight" of the member, that is to say, as inferred above, the amount of the response efficiency coefficient of the member to any pick-off noise. The inner stretcher 16 is in two parts or at least is provided with a hollowed intermediary portion as shown at 20 for splicing the cable 1 and making therefrom electrical connections such as 17 to the electrode terminals 21 and 22 on the outer and inner faces of the cylinder 10 through leads 18 and 19. The electrode terminals may be made by metallizing of said faces and the leads 18 and 19 may be soldered to said terminals at one end thereof and at wires of the cable 1 at the other end thereof. The stretcher 16 has preferably the shape of a spool with two end flanges each of a smaller diameter than the inner diameter of the cylinder 10. When the spool is provided in two parts, it may be used for affixing the cable passing through the member so as to avoid undue traction stretch thereon.

With special reference to FIG. 2 over the flanges of the spool 16 are applied two circular plates 13 and 23 of a plastic material such as rubber or the like, extension sleeves 15 and 25 of which constitute sheaths for the incoming and outgoing portions of the cable 1. The watertightness of the member is thus obtained at such places and further, in cooperation with the stretcher spool 16, they will contribute to damp the traction pulls during the use of the arrangement in the water. The cylinder 10 is pressed between the plates 13 and 23 and consequently does not make contact with the flanges of the spool 16; consequently further, the incident pressure waves on the upper and lower faces of the member are not transmitted by said flanges to the cylinder 10. When required, further, circular ribs, 14 and 24 are provided in the plates 13 and 23 for better defining in the arrangement the position of the piezo-electric cylinder 10 though said ribs do not come into contact with the upper and lower ends of said cylinder. A flexible cylindrical sheath 12 provided with annular flanges 27 encase the cylinder 10, being applied over its external face and the flanges 27 apply over outer portions of the plates 13 and 23, thus maintaining the sheath in its position over the cylinder 10 and ensuring watertightness of the cylinder inner volume at such places. Said sheath may be made of rubber or similar plastic material. Being tightly applied to the outer wall of the piezo-electric cylinder 10, all pressure elastic waves are translated without appreciable weakening to said cylinder.

As a modification shown in FIG. 3, the sheathing of the outer wall of the cylinder 10 is made from extensions of the end plates between which the cylinder is maintained. The lower plate 33, also provided with its cable sleeve 35, extends in a tubular wall portion 32 ending in an annular flange 34. The upper plate 43, provided with its cable sleeve 45, extends in another tubular wall 42 ending in an annular flange 44. The relative dimensioning is such that on the first part, the tubular wall 42 tightly applies over the outer lateral wall of 10 and the flange 44 applies under the end annular face of said cylinder 10. Once the stretcher 16 introduced within the cylinder and the connections made between said cylinder and the cable, the other sheath 32 of end plate 33 is then passed over the sheath 42 so that said sheaths are in tight application one over the other and over the lateral wall of the cylinder 10. The laterally incident pressure waves will not be appreciably attenuated as in the arrangement of FIG. 2. The ribs such as 14 and 24 may be dispensed with, due to the positioning of the cylinder automatically obtained from flange 44 and end plate 43.

What is claimed is:

1. A piezoelectric hydrophone for anti-echo submarine listening comprising in combination:

(a) a hollow cylinder of piezoelectric material having inner and outer electrodes thereon;

(b) a rigid hollow spool-shaped member positioned coaxially within said cylinder and spaced radially inwardly thereof, the flanges of said spool lying in substantially the same planes as the end faces of said cylinder, said spool further including a central transverse bore therethrough;

(c) a pair of substantially disk-shaped apertured elastomeric members overlying opposite ends of said spool and said cylinder, and including outwardly axially-extending tubular portions concentric with said apertures and cylindrical portions enclosing said cylinder in water-tight relation and terminating in radially inwardly extending flanges;

(d) and an electrical cable extending through said disk-shaped members and said spool and connected to said electrodes through said transverse bore.

2. A hydrophone as defined by claim 1 in which said disk-shaped members each include an annular rib on the facing surfaces thereof, the outer diameter of said rib being less than the internal diameter of said cylinder and the inner diameter of said rib being greater than the external diameter of the flanges of said spool shaped member.

3. A hydrophone as defined by claim 1 in which said spool shaped member is formed in two parts which pinch said cable therebetween.

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CHESTER L. JUSTUS, *Primary Examiner.*

G. M. FISHER, *Assistant Examiner.*