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MEANS FOR THE INTERCHANGE OF ELECTRICAL
AND ACOUSTICAL ENERGY
Original Filed Aug. 6, 1942

2,473,835

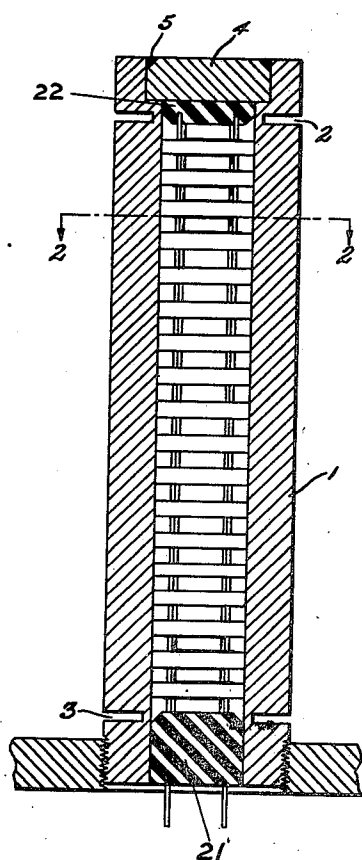


FIG. 1

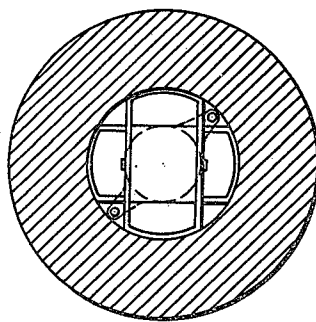


FIG. 2.

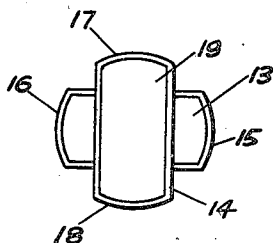


FIG. 3.

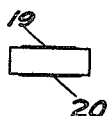


FIG. 4.

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MEANS FOR THE INTERCHANGE OF ELECTRICAL AND ACOUSTICAL ENERGY

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Original application August 6, 1942, Serial No. 453,909. Divided and this application March 17, 1948, Serial No. 15,391

5 Claims. (Cl. 177-386)

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The present application is a division of application Serial No. 453,909, filed August 6, 1942.

The present invention relates to a submarine signaling device and more particularly to a system which might be used either for sending or receiving.

The present invention is particularly useful for sending and receiving in a given plane normal to the axis of the unit itself, for the unit in the present form may be used in an elongated form in a direction at right angles to the direction of radiation.

The present invention may be applied to magnetostriction devices or to devices energized by other means, as, for instance, piezoelectric crystals. In the form of the apparatus when energized by piezoelectric means, a central core of crystals is provided which, when energized by alternating current, produces radial vibrations in an elongated shell which may be transmitted to the water or the other sound propagating medium.

Without further description of the merits and advantages of the present invention which will be more completely understood and appreciated from the description in the specification below, the invention will now be described in connection with the drawings showing the embodiment of the invention in which Fig. 1 shows a sectional elevation of a form of apparatus using piezoelectric crystals; Fig. 2 is a section on line 2-2 of Fig. 1; and Figs. 3 and 4 show detail arrangements of the crystal and the electrodes of the device of Fig. 1.

In the invention there is provided a cylindrical shell 1 which should preferably have a thickness less than the order of a one-quarter wave length of the wave which is to be propagated radially through the shell. As a matter of fact, shells thinner than this may in most cases preferably be used. At each end of the cylinder there is provided circumferential grooves 2 and 3 so as to permit the vibrational section between the two grooves free radial vibration without any clamping effect due to the end of the casing. As indicated in Fig. 1, one end of the casing may be closed by a plug member 4 welded to the cylinder around its edge as indicated at 5.

Piezoelectric crystals 13 and 14, arranged alternately at right angles to each other as shown in Fig. 3, are arranged in a stack in the cylindrical shell 1. The end surfaces 15, 16, 17 and 18 of the crystals are accurately cut to fit the cylindrical contour of the shell. The crystals 13 and 14 are elongated and laid crosswise along diame-

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ters of the circular section of the cylinder at right angles to each other. The edges 15 and 16 of the crystal 13 bear against the inner wall of the cylinder and are cemented to it with some suitable cement and similarly the edges 17 and 18 of the crystal 14. The crystals are provided with electrodes 19 and 20 on their elongated faces, the electrode 20 on the underside of the crystal making electrical contact with the electrode on the crystal arranged crosswise to it. These crystals may be held in place by rubber or insulating plugs 21 at the bottom and 22 at the top of the unit.

In the crystal structure, electrical potentials produced across the electrodes will produce longitudinal vibrations in the crystal acting upon the cylindrical walls and therefore produce radial vibration of the cylindrical elements. The structure may be tuned and resonance may be established by choosing the material thickness and dimension of the cylinder in connection with the use of the piezoelectric crystal elements. Various types of crystals may be employed but it is preferable to use in this connection a piezoelectric crystal of great activity such as Rochelle salt.

Having now described my invention, I claim:

1. Means for the interchange of electrical and acoustical energy comprising a hollow cylindrical element the outer surface of which serves to radiate and receive compressional wave energy, a plurality of crystals arranged alternately crosswise to each other forming crosses with the ends of the crystals bearing against the walls of the cylinder in positions substantially 90 degrees from each other, said crystals being piezoelectric elements with electrodes positioned on the surfaces of the crystals in planes normal to the axis of the cylinder.

2. Means for the interchange of electrical and acoustical energy comprising a hollow cylindrical element, a stack of piezoelectric crystals having their electrical surfaces substantially at right angles to the axis of the crystals and having their compressional ends bearing against the inner walls of the cylinder, said crystals being divided into groups in interleaved relation with the crystals of one group extending at an angle to those of another group.

3. Means for the interchange of electrical and acoustical energy comprising a hollow cylindrical element, a stack of piezoelectric crystals having their electrical surfaces substantially at right angles to the axis of the crystals and having their compressional ends bearing against the inner walls of the cylinder, said compressional ends

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being cemented to the inner walls of said cylinder, said crystals being divided into groups in interleaved relation with the crystals of one group extending at an angle to those of another group.

4. A compressional wave translating device comprising two groups of similar elongated piezoelectric crystals mounted in spaced superposed relation with corresponding dimensions of said crystals in parallel planes, the crystals of said groups being arranged alternately with the crystals of one group extending at an angle to the crystals of the other group.

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5. A compressional wave translating device comprising a plurality of elongated, piezoelectric crystals mounted in superposed parallel relation, said plurality of crystals being divided into groups in interleaved relation with the crystals of one group extending at an angle to those of another group.

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No references cited.