Jan. 6, 1948. C. CHILOWSKY **2,434,143**

SUPERSONIC SIGNAL TRANSMITTER AND RECEIVER

Original Filed April 17, 1943

Fig. 1.

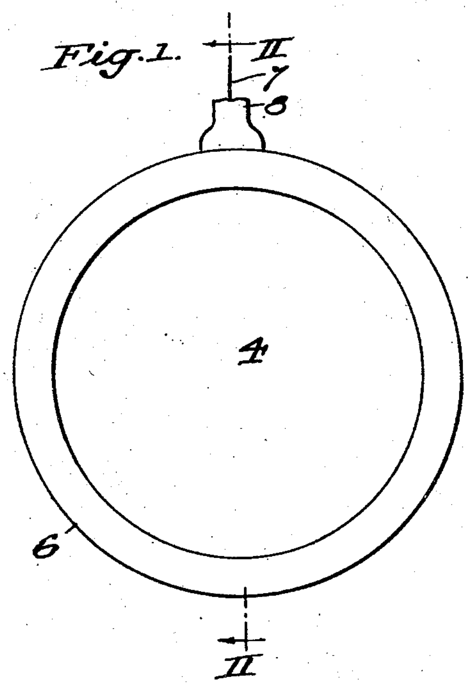


Fig. 2.

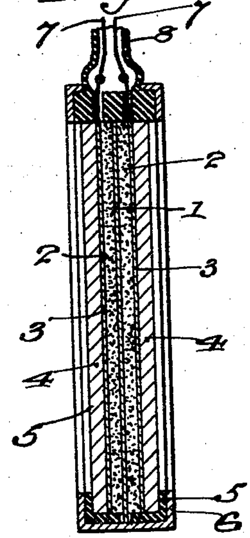
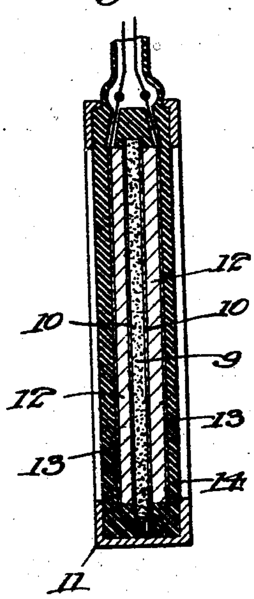


Fig. 3.



INVENTOR.
Constantin Chilowsky
BY
Brown & Seward
ATTORNEYS

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SUPERSONIC SIGNAL TRANSMITTER AND RECEIVER

Constantin Chilowsky, New York, N. Y.

Original application April 17, 1943, Serial No. 483,514, now Patent No. 2,420,864, dated May 20, 1947. Divided and this application September 25, 1943, Serial No. 503,785

3 Claims. (Cl. 177—386)

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This invention relates to a submarine signaling device and particularly to such a device which may have large linear dimensions and which includes, as an active element, a sheet or plate of piezoelectric plastic material described in application Serial No. 483,514, filed April 17, 1943, now Patent No. 2,420,864, May 20, 1947, of which application this is a division.

An object of the invention is to provide such a device for the reception and emission of supersonic waves which includes one or more sheets or plates of piezoelectric plastic material which may be substantially larger than the piezoelectric elements heretofore known and used.

A further object consists in providing certain improvements in the form, construction and arrangement of the parts whereby the above named and other objects may effectively be attained.

As described in said application Serial No. 483,514, it is proposed to incorporate in a suitable plastic material a quantity of piezoelectric substance in the form of fine particles evenly distributed in the plastic material, thus forming a composite mass which retains a certain degree of elasticity. In order that this product may, as a whole, exhibit useful piezoelectric characteristics, the crystals of the imbedded piezoelectric substance are oriented in substantially the same direction with respect to their electrical axes, so that the compression and expansion of the composite material will cause the appearance on the faces of the crystal particles of uniformly oriented opposite electric charges. As a result the material will be electrically polarized in one or the other direction according to the sign of the compression and opposite electric charges will appear on opposite surfaces of a lamination in this material. Conversely, of course, when a sheet, plate or lamination of the material is placed in an electrical field of suitable high alternating frequency it will respond with high frequency vibrations. For obtaining the most pronounced effect, the saturation of the plastic material with the uniformly oriented piezoelectric crystals should be substantially as dense as possible. The orientation of the crystal particles may be produced either in the course of the preparation of the material or after its otherwise complete fabrication, as set forth in the application above referred to.

A practical embodiment of the invention is shown in the accompanying drawings in which

Fig. 1 represents a face view of a signaling device;

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Fig. 2 represents a vertical section taken along the line II—II of Fig. 1, and

Fig. 3 represents a corresponding vertical section of a modified form of the device.

Referring to the drawings, it will be understood that the apparatus shown is intended for the emission and reception of supersonic waves and utilizes the piezoelectric plastic material described above; the apparatus being preferably of large linear dimensions and operative in two opposite directions. In this device a metallic plate 1 is placed in the middle between two layers of ultra-sound reflecting material 2 which may be, for instance, solid foams of plastic material. Next to the reflecting layers 2 are placed thin sheets of metal 3 and next to these sheets are layers of piezoelectric plastic material 4; all said layers and sheets being intimately connected, as by cementing. The assembly of parts just described is surrounded at its periphery by a ring of insulating material 5 within a metallic reinforcing ring 6 and the plate 1 is grounded to the ring 6 so that it will be maintained at zero potential. Protective coverings of ultra-sound transparent material (metal foil for instance) may be provided for the exposed surfaces of the layers 4, if desired. The metal sheets 3 are connected, respectively, to the lead wires 7 which are encased within a watertight housing or cable 8; the wires 7 being associated with a suitable source of alternating potential for signal emission, or with suitable signal translating apparatus for signal reception. The middle sheet 1, at zero potential, forms an electrical separation between the two operating halves of the device, and the outer surfaces of the layers 4, whether covered or uncovered, are also at zero potential.

In the modified form of apparatus shown in Fig. 3, a layer of reflecting material 9 is placed in the middle, between metallic sheets 10 which are grounded to the outer metallic ring 11. The layers of piezoelectric plastic material 12 are placed next to the metal sheets 10, and metallic sheets or electrodes 13 are provided on the outer surfaces of the layers 12. The whole assembly, except the ring 11, is contained within an insulating case 14, the flat walls of which are transparent to ultra-sound. The sheets or electrodes 13 are connected to suitable electrical apparatus for emission or reception, as previously described.

Because the piezoelectric plastic material may be manufactured in any desired size or shape, it is possible to make ultra-sound detecting devices of the type exemplified herein in sizes and shapes which have heretofore been impossible, and such devices, even up to one meter or more in diameter, will be able to withstand vibrations and high pressures without damage while proving far more effective for signal transmission and reception than the small quartz crystal devices used heretofore.

It will be understood that various changes may be made in the construction, form and arrangement of the several parts without departing from the spirit and scope of my invention and hence I do not intend to be limited to the particular embodiment herein shown and described, but what I claim is:

1. A supersonic signal transmitter and receiver comprising, a metallic backing sheet, a sheet of ultra-sound reflecting material adjacent said backing sheet, a layer of piezoelectric plastic material having one surface facing said reflecting material and the other surface facing the direction of transmission and reception of supersonic signals, and an insulated electrode on one of said surfaces, the backing sheet being positioned between the reflecting material and the piezoelectric plastic material, and the electrode being covered by a layer of ultra-sound transparent insulating material.

2. A supersonic signal transmitter and receiver comprising, a sheet of ultra-sound reflecting material, metallic backing sheets on both surfaces of said reflecting sheet, layers of piezoelectric plastic material adjacent said backing sheets, electrodes on the face of each layer of plastic material opposite to the backing sheets, and layers of ultra sound transparent insulating material covering said electrodes.

3. A supersonic signal transmitter and receiver

adapted for operation simultaneously in two opposite directions comprising, two metallic backing sheets, a sheet of ultra-sound reflecting material between said backing sheets, layers of piezoelectric plastic material on the sides of said backing sheets opposite from the reflecting material, whereby each backing sheet is positioned between the reflecting material and a respective layer of piezoelectric plastic material, each of said layers having one surface facing said reflecting material and the other surface facing a direction of transmission and reception of supersonic signals, and having an insulated electrode on one of said surfaces covered by a layer of ultra-sound transparent insulating material.

CONSTANTIN CHILOWSKY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,105,010	Sawyer	Jan. 11, 1938
1,788,405	Nicolson	Jan. 13, 1931
1,830,328	Nicolson	Nov. 3, 1931
2,283,285	Pohlman	May 19, 1942
2,233,992	Wyckoff	Mar. 4, 1941
2,009,451	Kunze	July 30, 1935
2,086,891	Bachmann et al.	July 13, 1937
1,471,547	Chilowsky et al.	Oct. 23, 1923

FOREIGN PATENTS

Number	Country	Date
476,506	Germany	May 22, 1929