(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 251 599**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 87305474.6

(51) Int. Cl.⁴: H04R 17/00

(22) Date of filing: 19.06.87

(30) Priority: 19.06.86 GB 8614940

(43) Date of publication of application:
07.01.88 Bulletin 88/01

(84) Designated Contracting States:
BE CH DE ES FR GR IT LI NL SE

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(54) Acoustic transducer.

(57) An acoustic transducer I comprises a piezoelectric material 4 having a linear shape and which is arranged in the form of a flat spiral within a body 2 of encapsulant material. The piezoelectric material may be a polyvinylidine fluoride coaxial cable and this thus can allow the construction of a high performance planar hydrophone at relatively low cost.

EP 0 251 599 A2

ACOUSTIC TRANSDUCER

This invention relates to an acoustic transducer. It relates particularly to a transducer body capable of being used in a passive sonar system.

In the design of a transducer body for a passive sonar system there is a requirement to provide a useful transducer surface having a comparatively large area, for example an area of fifteen centimetres square. The required thickness of this body is expected to be quite small, for example 0.025m. There are various ways in which such a large area might be constructed but a major constraint is generally the cost of the final transducer body. One way in which the cost might be reduced would be to reduce the area of active material used in each transducer. However, to reduce the area of active material can frequently produce unwelcome side effects in that the overall perfomance of the transducer is degraded.

We have now discovered an alternative construction which can allow the manufacture of a relatively low cost transducer body to be carried out without having a serious loss in the expected performance of the body.

According to the invention, there is provided an acoustic transducer comprising a piezoelectric material having a linear shape and which is arranged in the form of a flat spiral within a body of encapsulant material.

Preferably, the piezoelectric material is a polyvinylidene fluoride plastics material in the form of a coaxial cable, a piezoelectric rubber composition or an optical fibre.

The spiral shape may have a pitch which is varied at different positions around the circumference of the spiral so that the sensitivity of the resulting transducer will be varied in its response to signals coming from different directions. The choice of encapsulant material used to form the transducer body can also be varied as necessary to produce a required acoustic sensitivity in the finished transducer.

The invention also comprises a large area planar hydrophone having an array of acoustic transducers as just described.

By way of example, a particular embodiment of the invention will now be described with reference to the accompanying drawing, the single Figure of which shows a plan view of a acoustic transducer.

As shown in the Figure, the acoustic transducer 1 comprises a length of a piezoelectric material 4 which is arranged in the form of a flat spiral shape. The piezoelectric material 4 was a polyvinylidene fluoride coaxial cable. The spiral shape is supported in a body 2 of encapsulant material. The dimensions of the body 2 were 0.025 metres thick by fifteen centimetres square.

One end of the length of material forming the transducer is brought out of the encapsulant body 2 at a terminal 3. The terminal 3 allows the transducer 1 to be readily connected to the other components of a passive sonar system so that the transducer output can be utilized.

In operation, when the acoustic transducer 1 is mounted on the hull surface of a marine vessel and connected in a passive sonar system, the transducer will be able to pick up sounds and pressure variations from the environment for processing in the system. A number of the transducers 1 may be mounted side-by-side like tiles on a wall to provide a large area hydrophone which will have a high sensitivity to the incoming signals.

Where it is required that the acoustic transducer be made more sensitive to sound coming from one direction rather than from a different direction, a transducer may be constructed in which during the winding of the spiral shape the pitch of the spiral is varied at particular positions round the circumference. This then will act to vary the sensitivity of the resulting transducer across its face so that, after encapsulation, the same variation will be apparent in the completed transducer body. This provision can have a beneficial effect on the beamforming performance of large arrays.

The sensitivity of a hydrophone is additionally dependent on the physical properties of the encapsulation material. The careful choice of encapsulation material therefore can give one a further control over the acoustic sensitivity of the resulting hydrophone.

The acoustic transducer of the invention was found to enable the construction of a high performance large area planar hydrophone at a comparatively low cost. The transducer was also able to be easily tailored to produce specific performance characteristics.

The foregoing description of an embodiment of the invention has been given by way of example only and a number of modifications may be made without departing from the scope of the invention as defined in the appended claims. For instance, instead of the length of piezoelectric material being a polyvinylidene fluoride coaxial cable, this could be of some other suitable material such as a piezoelectric rubber or an optical fibre material.

Claims

1. An acoustic transducer comprising a piezoelectric material having a linear shape and which is arranged in the form of a flat spiral within a body of encapsulant material.

2. A transducer as claimed in Claim 1, in which the piezoelectric material is a polyvinylidene fluoride plastics material, a piezoelectric rubber composition or an optical fibre material.

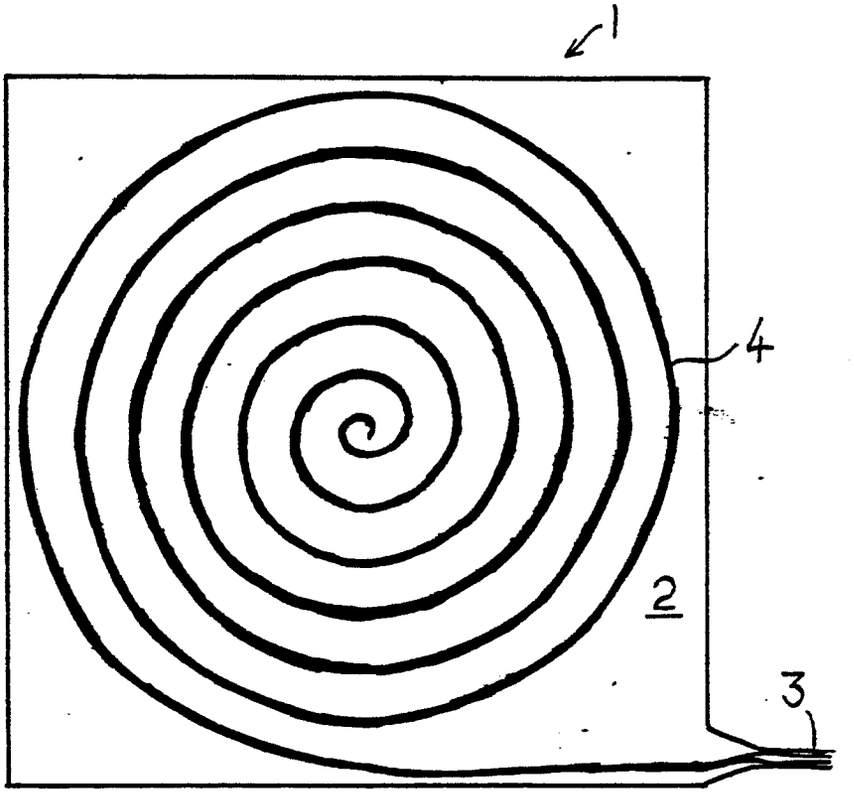
3. A transducer as claimed in Claim 1 or 2, in which the piezoelectric material is in the form of a coaxial cable.

4. A transducer as claimed in any one of Claims 1 to 3, in which the spiral shape has a pitch which includes a variation at different positions around the circumference to give the resulting transducer different sensitivities to signals from different directions.

5. A transducer as claimed in any one of Claims 1 to 4, in which the material of the encapsulant body is selected to provide a control over the acoustic sensitivity of the finished transducer.

6. An acoustic transducer substantially as hereinbefore described with reference to the accompanying drawing.

7. A hydrophone comprising an array of transducers as claimed in any one of Claims 1 to 6.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