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⑤④ **Mounting of sonic devices.**

⑤⑦ A sonic transducer (16) is mounted in its individual sealed casing (10) so that it is protected against the entry of water. A transducer head (18) is in good sonar coupling with the face (14) of the casing through the medium of a layer (24) of silicone gel. The sonic device in the form of the sonic transducer in its casing can be mounted as a unit in a bore in a stave (30) for carrying an array of sonic devices. Each device is protected in its individual casing against the entry of water so that a surrounding sealed casing for the assembly of transducers in the stave is not necessary.

MOUNTING OF SONIC DEVICES  
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This invention relates to the mounting of sonic devices by which term is meant transducers for the transmission and/or reception of sound energy.

5 The invention is related to the invention the subject of British Patent Specification No.8521950 filed 4th September 1985 and a copy of the specification and drawings of that application is annexed to this specification as part of the  
10 disclosure.

The introduction to that specification explains how sonic devices have been mounted in an array by mounting them individually in apertures in a metallic stave which holds them in the correct spaced  
15 relationship. The invention forming the subject of that application was an alternative to such a method of mounting, according to which an array of sonic devices were individually located in a block of foam which was mounted in turn in a sealed container which constituted  
20 an alternative to the prior art stave with its individually mechanically mounted sonic devices.

According to the present invention a means is provided for mounting each sonic device in the stave in an improved manner which is simple and cheap and yet  
25 perfectly effective in preventing moisture reaching the transducer. Transducers mounted in the stave as disclosed in British Specification No.8521950 have been found to fail due to the entry of moisture in contact with the transducer.

30 The present invention contemplates the provision of a stave having an array of sonic devices mounted in a novel way and also the use of an individual assembly including a sonic device for use in a stave as a

replacement for a prior art sonic device which has failed.

According to one aspect of the present invention a sonic device includes an assembly of a sonar transducer and a head and the assembly is mounted within its individual sealed casing with the head in good sonar coupling with a face of the casing.

The said face of the casing is conveniently a flat face and may be the face of an end cap secured and bonded to one end of an otherwise open-ended cylinder.

There may be an intermediate layer, perhaps a solid or a fluid layer, between the face of the casing and the head and that layer might be of silicone gel or of castor oil, for example. What is needed is a material which provides good acoustic coupling between the two faces and preferably also good sealing against moisture.

The remainder of the space around the transducer element and the casing may be filled with a foamed plastics material.

The casing itself will conveniently be formed for location in a corresponding bore in a mounting stave and the casing could be of moulded and/or machined plastics material which is strong, non-corrosive and not very absorbent of sonic energy.

According to another aspect of the invention a stave carrying an array of sonic devices has at least one of those devices in accordance with the aspect of the invention defined above which device is located in a bore in the stave by means locating it longitudinally of, and transversely to, the axis of the transducer. Conveniently the casing of the sonic device can be a fit in one end of the bore and can be secured by a surrounding clamp at the other end of the bore.

According to another aspect of the invention an

the end of the body 12.

The remaining space between the transducer 16 and the casing 10 is filled with a foamed plastics material, e.g. Bibbithane Isofoam 510, to the level indicated at 26.

The assembly is manufactured by locating the face cap 14 on the transducer head 18 of the transducer 16 after coating either or both with a layer of silicone gel 24; assembling the body 12 with the face cap 14 and bonding or sealing the two together; mounting the assembled casing 10 and element 16 in a foam moulding tool; accurately locating the transducer 16 in position within the casing 10, for example, by means of grub screws incorporated in the tool; and introducing the plastics foam material into casing 10, capping the casing to prevent the escape of foam.

The plastics foam may be poured or injected into the casing. With the foam material specified above, injection or pouring, and curing, can take place at room temperature.

A lead 28 providing electrical connection with the ceramic stack 20 is sealed in the casing and held by means of a glanded end cap (not shown) closing the upper end of the casing 10.

The casing 10, although made of thermoplastics material in the embodiment described, may instead be fabricated of other material provided that the material is non-corroding in water, not heavily absorbent of sonic energy and not corrosive in combination with the material of the stave. The casing 10 may also be fabricated from parts made of different materials. The sonic device is mounted upon a stave 30, which may carry a plurality of such devices, as described in the discussion of prior art in the preamble of British patent specification No.8521950.

assembly of sonic devices on a stave is repaired by replacing a faulty device by a device as defined in accordance with one aspect of the invention above.

5 The invention includes the step of forming the casing of a sonic device as defined so as to conform with the dimensions of a bore in a stave in which the sonic device is to be mounted.

10 The invention may be carried into practice in various ways, and one embodiment will now be described by way of example with reference to the accompanying drawings, in which the single figure is a sectional view of a sonic device according to the invention mounted in a mounting stave.

15 A generally cylindrical casing 10 is fabricated from a body 12 and a face cap 14. The casing material is preferably a thermoplastic polyester with good mechanical strength and minimal absorbance of sonic energy, e.g. VALOS (RTM - General Electric Company USA) thermoplastic polymer. The casing is made by moulding  
20 or machining or by a combination of the two processes.

The face cap 14 is bonded, screwed or ultrasonically sealed to the body 12. It may be of the same material as the casing.

25 A conventional sonic device in the form of a sonar transducer 16, mounted within the casing 10, comprises an assembly of a head 18, a ceramic stack 20, and a balancing mass 22. The head 18 is a close fit within the cap 14, and a layer of silicone gel 24, interposed between the face of head 18 and the inner surface of  
30 face cap 14, provides good acoustic coupling and prevents the ingress of foam into the region between the face of the head 18 and the inner surface of the face cap 14. The gel 24 may extend around the edge of the head 18 past the joint between the body 12 and the  
35 cap 14 and into the annular gap between the head and

The end part 32 of the casing 10 is an interference or tight fit within a transverse bore 33 in the stave 30. Clamps 34 located on the stave engage an annular groove formed around the casing adjacent the cap 14 and accurately locate the casing within the bore, both perpendicularly to, and along the axis of, the bore.

The construction described provides a sonic device which requires no complex mechanical mounting structure for the transducer 16, and yet achieves sealing against the ingress of water. Devices according to the invention are lighter, simple and cheaper than equivalent prior art devices, but can replace such devices in existing systems, provided the body 12 is designed to fit the bore and clamps on the stave; or is machined to fit.

Castor oil is one possible alternative to silicone gel as a sealant/acoustic coupler between the cap 14 and the transducer head 18; other solid or fluid materials may also be satisfactory.

The foam may, or may not, be impregnated with castor oil as described in specification No.8521950.

The foam 26 and/or the gel 24 effectively seal the interior of the casing from entry of sea water.

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## CLAIMS

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1. A sonic device (16) including an assembly of a sonar transducer (20) and a head (18) characterised in that the assembly is mounted within its individual sealed casing (10) with the head (18) in good sonar coupling with a face (14) of the casing.  
5.
2. A device as claimed in claim 1 in which the said face of the casing is the face of an end cap (14) secured and bonded to one end of an otherwise open-ended cylinder (12).  
10.
3. A device as claimed in either of the preceding claims including an intermediate layer (24) between the face of the casing and the head providing good acoustic coupling between the two faces.  
15.
4. A device as claimed in claim 3 in which the intermediate layer (24) constitutes a moisture seal between the head and the face of the casing.  
20.
5. A device as claimed in any of the preceding claims in which the remainder of the space within the casing around the assembly contains a filler (26) for example a foamed plastics material.  
25.
6. A device as claimed in any of the preceding claims in which the casing (10) is formed for location in a corresponding bore in a mounting stave (30).
30. 7. A device as claimed in any of the preceding claims in which the casing is moulded and/or machined from a strong non-corrosive material which is not very absorbent of sonic energy.

8. A stave (30) carrying an array of sonic devices at least one of which is a device as claimed in any of the preceding claims.
5. 9. A stave as claimed in claim 8 in which the said device is located in a bore in the stave by means (34) locating it longitudinally of, and transversely to, the axis of the transducer.
10. 10. A stave as claimed in claim 9 in which the casing of the said sonic device is a fit in one end of the bore and is secured by a clamp (34) at the other end of the bore.
15. 11. A method of repairing an assembly of sonic devices on a stave (30) in which a faulty sonic device is replaced by a device as claimed in any of claims 1 to 7.
20. 12. A method as claimed in claim 11 including the step of forming the casing of the replacement sonic device so as to conform with the dimensions of a bore and/or fittings by which the replacement device is to be
25. mounted in the stave.

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