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D. LEIBOWITZ ET AL

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SEGMENTED FERRITE SONAR TRANSDUCER WITH PERMANENT MAGNET BIAS

Filed Sept. 3, 1963

FIG. 2

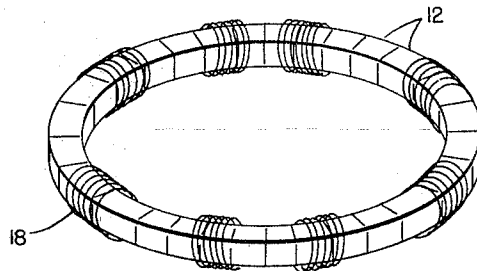


FIG. 1

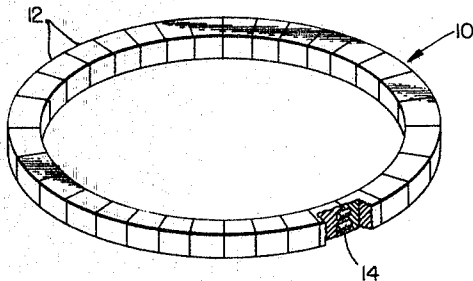


FIG. 3

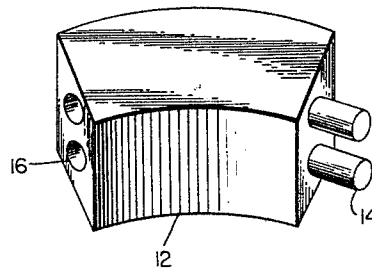
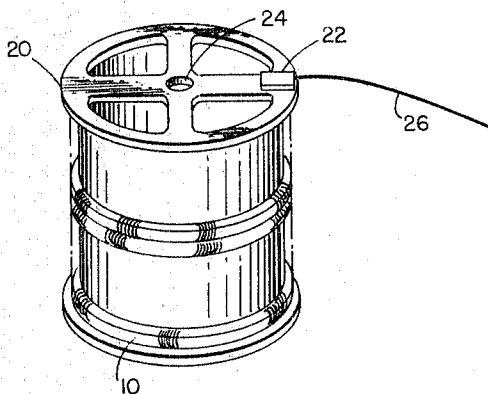


FIG. 4



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Secretary of the Navy

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4 Claims. (Cl. 340-10)

The present invention relates to sonar transducers and more particularly to segmented sonar transducers having a permanent magnet bias.

In the practical application of transducers, polarization has previously been produced by electromagnetic means. With such a polarization, the field coils used were bulky which in itself, made the device bulky and difficult to handle. While permanent magnets have been used to eliminate the limitations of the electromagnetic means, the units themselves are still large and bulky since the arrangement and placement of the magnets in the device are generally inside of the transducer housing and in order to accommodate a proper magnet arrangement, the housing itself must be made large and bulky.

This invention relates to a magnetostrictive electro-acoustic transducer in which the polarizing field is established by mounting permanent magnets inside of ferrite rings thereby making the device lighter and easier to handle and eliminates the need for water proofing.

An object of the present invention is the provision of providing an omni-directional segmented toroidal ferrite sonar transducer having a high coupling coefficient and high efficiency.

Another object is to provide a segmented ring ferrite transducer having permanent magnet inserts.

A further object of the invention is the provision of ferrite transducer which requires no additional direct current power supply.

A further object of the present invention is the provision of a method of forming a transducer ring from segmented members.

A final object of the present invention is the provision of a transducer made entirely of ferrite rings thereby eliminating the corrosive effects of water.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the annexed drawings, which illustrate a preferred embodiment and wherein:

FIG. 1 is an isometric view of one complete segmented ferrite ring showing a broken away section at the magnet insert area.

FIG. 2 is an isometric view of the segmented ferrite ring shown in FIG. 1, having representative windings.

FIG. 3 is an isometric view of one segment of the cemented ferrite ring shown in FIGS. 1 and 2.

FIG. 4 is an isometric view showing several segmented ferrite rings forming the preferred transducer.

Briefly, the invention entails placing permanent magnets, which act as a D.C. bias source, in segments of a ferrite ring forming a transducer thereby eliminating the requirement of an additional D.C. source.

Referring now to the drawings in detail, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a transducer ring 10 which is formed from a number of segments or blocks 12 as shown in FIG. 3.

Initially blocks 12, which are formed from an N-51 ferrite material, are fitted with magnets 14 which are grain oriented so as to give the maximum field strength and coercive force. Each block 12 is accurately machined with the ends being ground at an angle accurate to

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five minutes of arc, so that upon assembly an accurate ring 10 is formed. After the magnets 14 are assembled in blocks 12, the blocks and magnets are magnetized in the pole pieces of a large electromagnet. The blocks having the magnets therein are now assembled into a ring 10, with the magnets 14 fitting into holes 16 of an adjacent block until the complete accurate ring is formed. A cement such as Epon V or araldite, placed on Teflon or drafting cloth, is used to cement the blocks together, however any type of cement material which can readily be used with N-51 ferrite can be used. The completed ring is now cured for the proper curing cycle of the adhesive used.

FIG. 2 shows the assembled ring 10, having A.C. windings 13. Though these windings are shown as raised above the ring surface, for clarification purposes, they are generally wound adjacent the ring surface.

FIG. 4 shows ring 10 mounted on a drum 20, with the drum having an A.C. power connection 22 mounted thereon. Drum 22 may be of any material, but is preferably made of metal. Aperture 24 is used as a means of raising and lowering the transducer in and out of water, and cable 26 is a transmission line for the A.C. power supply from the water surface when the device is in use. Though only three rings are shown mounted on drum 20, during operation the rings 10 would completely cover the face of drum 20, with the windings of each individual ring connected to connector 22 the latter of which is adapted to be connected to an A.C. power supply (not shown).

In operation, an A.C. power supply operating at approximately 2800 c.p.s. and approximately one wave length long is supplied to each ring 10, by cable 26 through connector 22. Since there is a constant D.C. source applied on the rings at all times by the permanent magnet inserts, the material is said to be polarized. Upon applying an A.C. power source to the rings, the rings will contract in and out as is expected of a transducer, and therefore supply acoustic motion to the water. It can readily be seen, that the magnets add to the alternating current and thereby contract and expand the field. As has been described, the device needs no additional A.C. source, since it is always D.C. biased, is 85-88% efficient, and may be submerged without additional protection for the housing.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that with the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A transducer ring for forming a permanently biased immersible transducer comprising:

a plurality of arcuate ferrite members having radial side faces with a pair of bores formed in each of said side faces;

a permanent magnet substantially conforming to the cross-sectional dimension of said bores being positioned in each of the bores on one side face of each of said members and being of such length as to protrude from the side face so as to be receivable within the bores on the radial face of an adjacently positioned arcuate member; and

said plurality of members being positioned with their radial faces in abutting relation to form a rigid transducer ring.

2. The device as defined in claim 1, wherein:

the side faces of the arcuate members are accurately ground to an angle of such dimensions not to exceed a tolerance of 5 minutes of an arc to provide optimum fit between said arcuate members in forming the transducer ring; and

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said pair of permanent magnets in each of said arcuate members is geometrically positioned relative to each other to provide maximum field strength and coercive force.

3. The device as defined in claim 1, further including: 5
 cementing means located between the abutting side faces of said arcuate members so as to provide added rigidity and sealing protection to the transducer ring; and
 a plurality of wire windings located at intervals along 10
 the circumferential perimeter of the ring for applying energizing potential thereto.
 4. A plurality of rings defined in claim 3 and further including: 15
 a cylindrical housing having said plurality of rings mounted thereon in co-axial relationship; and
 electrical power supply terminal means mounted on said housing and being connected to each of said windings to apply operating potential thereto when

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said terminal means is energized from an electrical power source.

References Cited by the Examiner

UNITED STATES PATENTS

2,444,967	3/1936	Turner	340—11
2,475,321	7/1949	Horn	29—155.6 X
2,535,025	12/1950	Shoenberg	29—155.6 X
2,745,084	8/1956	Bundy	340—11
2,795,709	6/1957	Camp	
2,836,881	6/1958	Pollock	29—155.6 X
2,947,890	8/1960	Harris et al.	
2,958,918	11/1960	MacMillan	46—25 X
3,126,617	3/1964	Blume	29—155.6
3,163,922	1/1965	Brailowsky	29—155.6
3,177,382	4/1965	Green	340—10 X

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