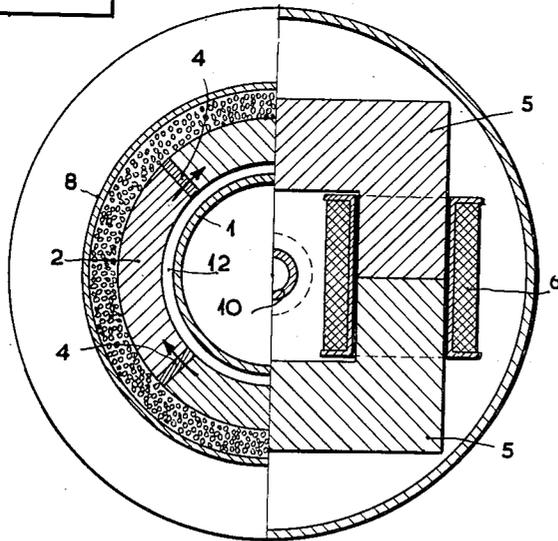
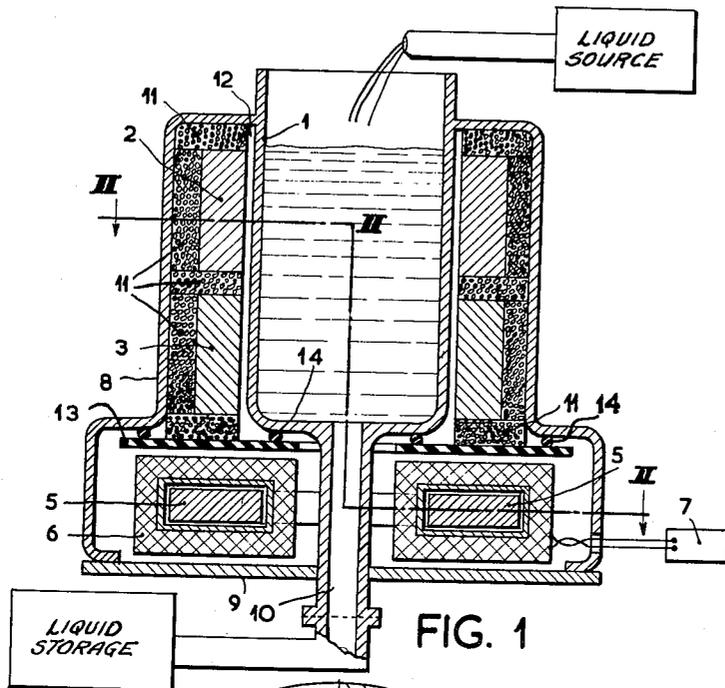


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ULTRASONIC IRRADIATING DEVICE

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## ULTRASONIC IRRADIATING DEVICE

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The present invention relates to an ultrasonic irradiating device. More particularly, the invention relates to an ultrasonic irradiating device comprising a vessel which is set into vibration in radial directions for the ultrasonic treatment of liquids or matter in liquids. During this treatment, either variations in the properties of the liquids may be obtained, or liquids may be used which exert a purifying action upon immersed objects to be cleaned. The term "ultrasonic" is to be understood in this case to mean also audible frequencies upwards of 10 kc./s.

According to the invention, the wall of the vessel may consist of piezomagnetic material. The wall is surrounded by at least one piezomagnetic ferrite ring which in turn is surrounded by an extension of the wall of the vessel on one side thereof. The extension of the wall surrounds the primary winding of the supply transformer and is connected to the other side of the vessel, thereby forming a single closed secondary winding, of which the wall of the vessel forms part. A liquid, which is preferably degassed, is provided between the wall of the vessel and the ferrite ring as a medium for the transmission of the vibration from said rings to said vessel.

The device of the present invention, which is formed as an integral unit, is simple and compact due to the absence of a separate secondary winding provided on the ferrite ring and has a very high electro-acoustic efficiency. In addition, the supply transformer is wholly surrounded and protected by the secondary winding.

In order that the invention may be readily carried into effect, one embodiment will now be described, by way of example, with reference to the accompanying drawing, in which:

FIG. 1 shows a longitudinal section, and

FIG. 2 shows cross-sections taken along the lines II-II of FIG. 1.

A cylindrical vessel 1, which may consist of piezomagnetic material, is surrounded by two superposed piezomagnetic ferrite rings 2 and 3, each comprising four segments. Thin ferromagnetic discs 4, comprising, for example, Ferroxdure, are positioned between the segments of the ferrite rings 2 and 3. The discs 4 are four segments. Suitable ferrite materials for making the rings 2 and 3 of the ultrasonic transducer, are well known and are described, for example, in the article "Ferrocube Material for Piezomagnetic Vibrators," by the present inventor, published in the Philips Technical Review, volume 18, No. 10, March 1957, pages 285 et seq. The segments of the rings are pre-polarized in the direction of the arrows by means of discs 4 of suitable permanent magnet material for example, of Ferroxdure such as described in the publication "Ferroxdure, a Class of New Permanent Magnet Materials" by J. J. Went et al., Philips Technical Review, volume 13, pages 194-208, 1951/52. Below the vessel 1, there is provided a transformer core 5 of non-piezomagnetic or soft piezomagnetic ferrite material having a primary winding 6. The primary winding 6 comprises two parts and is connected to an electrical signal energy generator 7 operating at an ultrasonic frequency.

The upper side of the vessel 1 is provided with a cylindrical extension 8 which surrounds the rings 2 and

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3 and surrounds the primary winding 6. The extension 8 is connected, via a base plate 9 and a port on 10 to the lower side of the vessel 1, thereby forming a single turn secondary winding. The rings 2 and 3 are resiliently suspended in the cylindrical extension 8 in liquid-tight sponge rubber or sponge-plastic rings 11. A degassed liquid, possibly under pressure, is provided in a space 12 between the rings 2, 3 and the vessel 1. Reference numerals 13 and 14 indicate a sealing plate and sealing rings for the liquid. The plate 13 and rings 14 consist of electric insulating material.

The rings 2 and 3 are set into vibration by the magnetic field induced therein by the single turn secondary winding which surrounds the rings and is formed by the wall of the container 1, the extension 10 thereof, the base plate 9 and the extension port on 8. Current is induced in the said secondary winding by the primary winding 6 and the transformer core 5 which as shown, is common to the primary winding 6 and to the single turn secondary winding.

The vibration produced in the rings 2 and 3 by reason of the piezomagnetic properties thereof is transmitted via the liquid in the space 12 to the vessel 1 which contains either the liquid to be treated or the object to be treated, immersed in a liquid. No vibration energy is lost in an outward radial direction due to the insulating action of the rings 11. As shown, the portion 10 is in the form of a tube, and a continuous flow of liquid can be treated by providing the upper side of the vessel 1 with a supply tube as shown.

What is claimed is:

1. In an ultrasonic irradiating device comprising an electrically conductive vessel adapted to hold a liquid, a piezomagnetic ferrite ring positioned substantially coaxially around the said vessel, said ring being coupled to said vessel for transmitting vibrations thereto, a primary transformer winding and input means for electrical energy generating means operating at an ultrasonic frequency for energizing said primary winding, means for inducing piezomagnetic vibrations in said ring comprising a secondary transformer winding, said secondary winding comprising said vessel and an extending portion thereof and being positioned substantially surrounding said ring and in inductive proximity to the said ring and to said primary winding, and forming a housing with and around the said vessel.

2. In an ultrasonic irradiating device comprising an electrically conductive vessel adapted to hold a liquid, a piezomagnetic ferrite ring positioned substantially coaxially around said vessel for providing substantially radially directed vibrations in the said vessel, fluid means between said vessel and said ring for transmitting vibrations therebetween, a primary transformer winding and input means for electrical energy generating means operating at an ultrasonic frequency for energizing said primary winding, means for vibrating said ring in substantially radial directions comprising a secondary transformer winding, said secondary winding comprising said vessel and an extending portion thereof and being positioned substantially surrounding said ring and in inductive proximity to the said ring and to said primary winding, and forming a housing with and around the said vessel, and resilient material positioned in said housing between said ring and said extending portion for suspending the said ring.

3. In an ultrasonic irradiating device comprising an electrically conductive vessel adapted to hold a liquid, a primary transformer winding and input means for an electrical energy source operating at an ultrasonic frequency for energizing said primary winding, a piezomagnetic ferrite ring positioned substantially coaxially around said vessel and being coupled thereto for trans-

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mitting substantially radially directed vibrations to the said vessel, said ring comprising four segments having ferromagnetic discs interposed therebetween, means for vibrating said ring in substantially radial directions comprising a secondary transformer winding, said secondary winding comprising said vessel and an extending portion thereof and being positioned substantially surrounding said ring and in inductive proximity to the said ring and to said primary winding, and forming a housing with and around the said vessel.

4. In an ultrasonic irradiating device comprising an electrically conductive vessel of piezomagnetic material adapted to hold a liquid, means for supplying liquid to said vessel, means for deriving liquid from said vessel, a primary transformer winding and input means for electrical energy generating means operating at an ultrasonic frequency for energizing said primary winding, a piezomagnetic ferrite ring positioned substantially coaxially around said vessel for providing substantially

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radially directed vibrations in the said vessel, said ring comprising four segments having ferromagnetic discs interposed therebetween, fluid means between said vessel and said ring for transmitting vibrations therebetween, means for vibrating said ring in substantially radial directions comprising a secondary transformer winding, said secondary winding comprising said vessel and an extending portion thereof and being positioned substantially surrounding said ring and in inductive proximity to the said ring and to said primary winding, and forming a housing with and around the said vessel, and resilient material positioned in said housing between said ring and said extending portion for suspending the said ring.

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