Sept. 4, 1951 E. E. MOTT 2,566,850

ELECTROACOUSTIC TRANSDUCER

Filed Oct. 19, 1946

FIG. 1

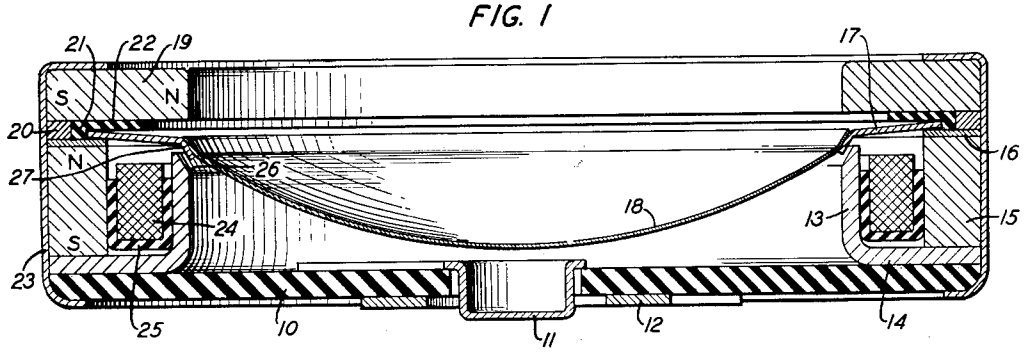


FIG. 2

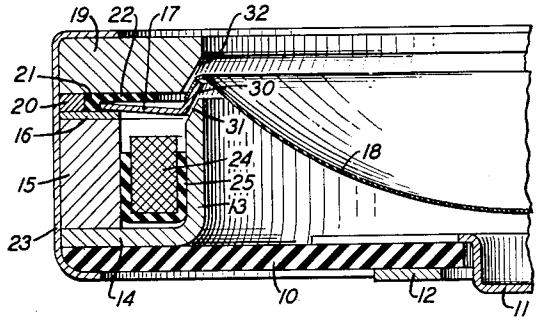
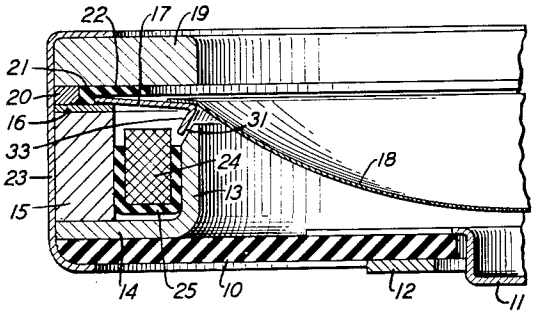


FIG. 3



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UNITED STATES PATENT OFFICE

2,566,850

ELECTROACOUSTIC TRANSDUCER

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Application October 19, 1946, Serial No. 704,485

1 Claim. (Cl. 175—339)

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This invention relates to electroacoustic transducers and more particularly to ring armature transducers, such as disclosed in Patent 2,249,160, granted July 15, 1941, to Edward E. Mott, especially suitable for use as and in loudspeakers.

In electroacoustic transducers, the power which can be translated is dependent upon the amplitude of diaphragm vibration. Translation of high power with a device having a diaphragm of convenient size entails large amplitude diaphragm displacement. In transducers of the ring armature type and of presently known constructions, considerations of efficiency, particularly from the standpoint of the magnetic circuit, dictate the use of a small air-gap between the free or unsupported marginal portion of the armature. Thus, in such constructions, because of the considerations noted, the maximum permissible amplitude of armature vibration may be limited and, accordingly, the amplitude of diaphragm displacement likewise may be limited.

One object of this invention is to increase the maximum permissible amplitude of armature vibration in ring armature type electroacoustic transducers without degradation of the magnetic efficiency, whereby an increase in the maximum power translated is realized.

Another object of this invention is to decrease the static force upon the diaphragm in a ring armature transducer, whereby the mechanical stiffness of the vibratory system is decreased.

In accordance with one feature of this invention, in an electroacoustic transducer of the type disclosed in the patent above-identified, the ring armature and inner pole-piece are so constructed and arranged that the armature may execute large amplitude vibrations without danger of contact thereof with the pole-piece.

More specifically, in accordance with one feature of this invention, in such a transducer, the armature and inner pole-piece are provided with juxtaposed portions inclined to the direction of armature displacement. These portions may be positioned in close proximity, thereby to provide a low reluctance air-gap, but because of the disposition thereof relative to the direction of vibration of the armature, large amplitude vibrations are attainable.

The invention and the above-noted and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a view in cross-section of an electroacoustic transducer illustrative of one embodiment of this invention; and

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Figs. 2 and 3 are fragmentary sectional views of transducers illustrative of other embodiments of this invention.

Referring now to the drawing, the transducer illustrated in Fig. 1 comprises a plate 10, for example of insulating material, having a pair of contacts or terminals 11 and 12 affixed thereto. Mounted upon the plate 10 is a magnetic structure including a pole-piece having a cylindrical portion 13 and an annular flange 14 which is seated upon the plate. The magnetic structure includes also a cylindrical, axially magnetized magnet 15 coaxial with the cylindrical pole-piece portion 13, seated upon the flange 14 and secured thereto, as by soldering.

Seated upon the magnet 15 is an annular, magnetic spacer 16 upon which the peripheral portion of an annular magnetic armature 17 rests. The armature carries a dished non-magnetic diaphragm member 18, the periphery of which is secured to the inner marginal part of the armature, as by a suitable cement.

An auxiliary magnet 19 overlies the armature 17 and extends over the magnet 15 and pole-piece portion 13. As indicated in Fig. 1, the auxiliary magnet is magnetized radially so that its poles are of opposite polarity with respect to that of the magnet 15 and pole-piece tip in juxtaposition thereto. Advantageously, the auxiliary magnet is of less strength than the main magnet 15. The auxiliary magnet rests against a magnetic annulus 20, which provides a low reluctance path between the two magnets, and an insulating spacer 21 having an annular flange portion 22 overlying the armature.

The plate 10, magnet structure, spacers and auxiliary magnet are held securely in assembled relation by a metallic band or sleeve 23, the edges of which are crimped over the plate and auxiliary magnet.

An annular signal coil 24 is mounted between the magnet 15 and pole-piece 13, is insulated therefrom by an insulating member 25 and has its ends connected to the terminals 11 and 12.

The pole extremity of the cylindrical pole-piece 13 is tapered to provide a frusto-conical pole face as indicated at 26. The inner marginal portion 27 of the armature is bent or inclined to conform to the inclined pole face 26 to provide an air-gap of uniform length inclined relative to the direction of armature and diaphragm vibration, i. e., vertical in Fig. 1. Because of the construction and arrangement of the pole face 26 and armature portion 27, it will be appreciated that the air-gap therebetween can be made quite short, yet the armature may execute large ampli-

tude vibrations without contact between the armature and the pole-piece 13. Also, it will be appreciated that because of the inclination of the portion 27 and pole face 26, the static magnetic force effective upon the armature is relatively small whereby the stiffness of the vibrating system, i. e. the armature and diaphragm unit, also is relatively small. Thus, efficient translation may be attained. Additionally, because of the low stiffness of the vibratory system, a low resonance frequency for this system may be obtained.

The transducer illustrated in Fig. 2 is of construction similar to that shown in Fig. 1 and described hereinabove. However, the armature 17 is provided with an upwardly extending, inclined annular or frusto-conical portion 30 conforming to and uniformly spaced from the inclined pole face 31 of the pole-piece 13. Also, the auxiliary magnet 19 is provided with an annular inclined face 32 conforming to and uniformly spaced from the armature portion 30, whereby a small air-gap therebetween may be employed and, thus, high magnetic efficiency obtained.

The embodiment of this invention illustrated in Fig. 3 is similar to that shown in Figs. 1 and 2. However, in this embodiment, the annular or frusto-conical armature portion 33, which conforms to and is spaced uniformly from the pole face 31, is inclined at an angle less than a right angle with respect to the body of the armature.

Reference is made of the application Serial No. 704,483 filed October 19, 1946, of Edward E. Mott wherein a related invention is disclosed and claimed.

Although specific embodiments of this invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claim.

What is claimed is:

An electroacoustic transducer comprising a magnetic structure including cylindrical inner and outer pole members, the inner member having an outer frusto-conical pole face at one end thereof, an annular magnetic armature of width small in comparison to its diameter, said armature having a flat body portion extending from said outer member toward said inner member and having a frusto-conical inner marginal portion extending upwardly from said body portion, said frusto-conical pole face and said frusto-conical marginal portion being in juxtaposition and conforming to each other, means on said outer pole member defining an annular fulcrum support for said armature adjacent its periphery and coaxial therewith, and an annular magnetic member overlying said armature and extending from said outer pole member toward said inner member, said magnetic member having a frusto-conical face in juxtaposition and conforming to said frusto-conical inner portion of said armature.

EDWARD E. MOTT.

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