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SOUND TRANSLATING DEVICE

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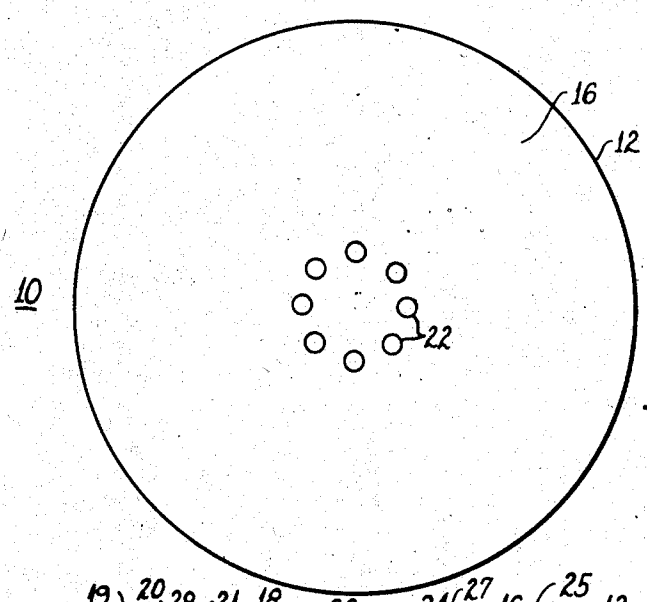

Fig. 1

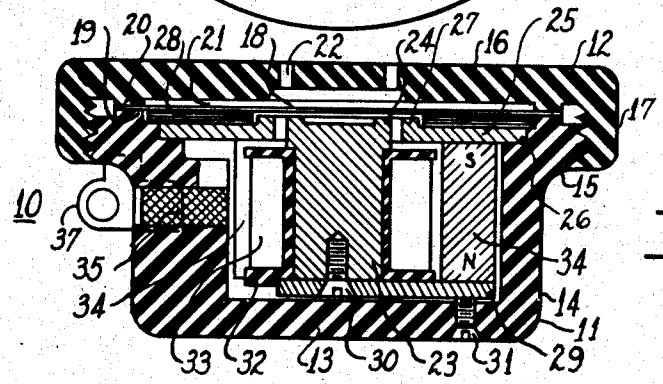

Fig. 2

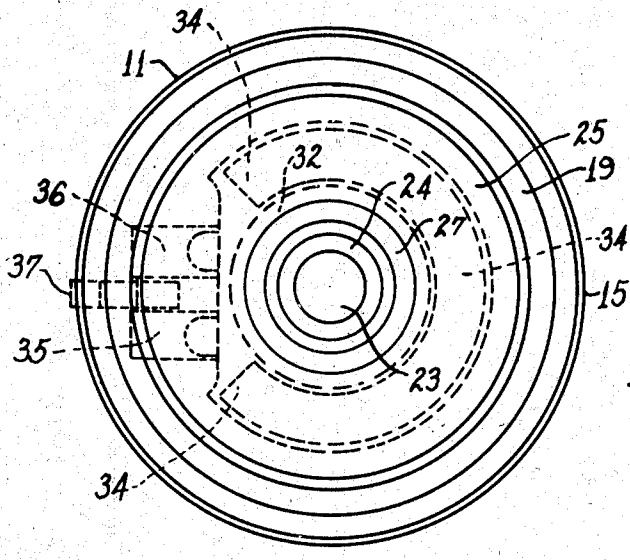

Fig. 3

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SOUND TRANSLATING DEVICE

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3 Claims. (Cl. 179—114)

The present invention relates to sound translating devices and more particularly to receivers for telephone instruments.

It is the principal object of the present invention to provide an improved sound translating device of the type mentioned, which is of rugged and compact construction and which is highly efficient in operation.

Another object of the invention is to provide in a sound translating device, an improved magnetic circuit which is extremely short and of considerable cross-sectional area.

The objects set forth above are attained in accordance with the present invention by providing a sound translating device comprising a cylindrical cup-shaped casing, an annular cap secured to the open end of the casing and an annular vibratory magnetic diaphragm mounted adjacent its peripheral edge between the open end of the casing and the cap. Also, the device comprises a cylindrical magnetic core element disposed substantially centrally within the casing and having a pole face presented to the diaphragm, a first ring-shaped magnetic field element disposed adjacent the open end of the casing below the diaphragm and surrounding the core element in spaced relation therewith, the first field element having a pole face presented to the diaphragm, and a second magnetic field element disposed adjacent the bottom wall of the casing and magnetically connected to the core element. Further the device comprises a winding disposed in the casing and surrounding the core element, a substantially C-shaped permanent magnet disposed in the casing and partially surrounding the winding, the permanent magnet being positioned between the first field element and the second field element and presenting opposite poles thereto, and a terminal block carried by the side wall of the casing and projecting inwardly into the open side of the C-shaped permanent magnet. More particularly, the core element carries an outwardly projecting annular ledge presenting an annular pole face to an annular central portion of the diaphragm remote from the peripheral edge thereof; and the first field element carries an outwardly projecting annular ledge arranged in surrounding close spaced relation with the annular ledge carried by the core element and presenting an annular pole face to an annular portion of the diaphragm in surrounding close relation with the annular central portion thereof, whereby the principal magnetic flux traversing the core element and the field element traverses, in addition to the annular central and annular surrounding portions of the diaphragm, only the annular intervening portion of the diaphragm disposed between the annular central and annular surrounding portions thereof.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which Figure 1 is a plan view of a sound translating device embodying the present invention; Fig. 2 is a transverse sectional view of the device shown in Fig. 1; and Fig. 3 is a plan view of the device shown in Figs. 1 and 2, illustrating the relative positions of the elements housed in the casing thereof when the cap, the diaphragm and the stack of damping material incorporated therein are removed.

Referring now more particularly to the drawing, there is shown a sound translating device 10 in the form of a receiver for a telephone instrument and embodying the present invention. The device 10 comprises a cylindrical cup-shaped casing 11 and an annular cap 12, whereby the device as a whole has a thin cylindrical configuration. Both the casing 11 and the cap 12 are formed of insulating material, preferably Bakelite. The casing 11 comprises a bottom wall 13, an upstanding cylindrical side wall 14 and an outwardly flared annular rim 15; while the cap 12 comprises a flat top wall 16 and a downwardly turned cylindrical rim 17. The rim 17 of the cap 12 in internally threaded to receive external threads provided on the rim 15 of the casing 11.

An annular magnetic vibratory diaphragm 18 is arranged between the open end of the casing 11 and the cap 12, the peripheral edge of the diaphragm 18 being clamped between two cooperating annular ledges 19 and 20 respectively carried by the rim 15 of the casing 11 and the top wall 16 of the cap 12. A shallow annular recess is provided in the top wall 16 of the cap 12 in order to provide a shallow chamber 21 adjacent the front side of the diaphragm 18, the chamber 21 communicating with the exterior by way of a plurality of restricted openings 22 disposed in the top wall 16 of the cap 12.

A substantially cylindrical magnetic core element 23 is centrally disposed within the casing 11 and is provided with an outwardly projecting annular ledge 24 presenting an annular pole face to an annular central portion of the diaphragm 18 remote from the peripheral edge thereof. A

substantially ring-shaped magnetic field element 25 is disposed in the open end of the casing 11, the field element 25 being seated in an annular recess 26 cut in the interior face of the rim 15 of the casing 11. The field element 25 is arranged in surrounding close spaced relation with the core element 23 and carries an outwardly projecting annular ledge 27 arranged in surrounding close spaced relation with the annular ledge 24 carried by the core element 23 and presenting an annular pole face to an annular portion of the diaphragm 18 disposed in surrounding close relation with the annular central portion thereof. An annular stack 28 of sheets of damping material is disposed between the diaphragm 18 and the field element 25 and positioned between the annular ledge 19 carried by the rim 15 of the casing 11 and the annular ledge 27 carried by the field element 25. Preferably, the annular stack of sheets of damping material comprises a number of layers or sheets of soft paper effective to damp the vibration of the diaphragm 18 at its natural frequency of vibration, thereby to minimize distortion of the response of the device 10.

The lower end of the core element 23 is secured to a semiannular magnetic field element 29 by a magnetic screw 30. The field element 29 is disposed adjacent the bottom wall 13 of the casing 11, the position of the field element 29 with reference to the bottom wall 13 of the casing 11 being adjustable by an arrangement including a screw 31 threaded into a tapped hole provided in the bottom wall 13 of the casing 11. An insulating winding spool 32 is mounted on the core element 23 in surrounding relation therewith and carries a surrounding winding 33. Preferably, the winding spool 32 is formed of Bakelite.

A substantially C-shaped permanent magnet 34 is disposed within the casing 11 in surrounding relation with respect to the winding 33 and between the field element 25 and the field element 29, the permanent magnet 34 being positioned between the winding 33 and the cylindrical side wall 14 of the casing 11 and in spaced relation with respect thereto. The permanent magnet 34 is magnetized longitudinally of the center line of the core element 23, whereby a semiannular north pole thereof is presented to the field element 29 and a semiannular south pole thereof is presented to the field element 25. Preferably, the permanent magnet 34 is formed of Alnico; while the core element 23 and the field elements 25 and 29 are formed of Allegheny Electric Metal.

In view of the above description of the construction and arrangement of the core element 23, the permanent magnet 34 and the field elements 25 and 29, it will be understood that the device 10 comprises a series magnetic circuit extending from the north pole of the permanent magnet 34 by way of the field element 29, the core element 23, the annular ledge 24 carried by the core element 23, the annular central portion of the diaphragm 18, the annular intervening portion of the diaphragm 18 disposed between the annular central portion and the annular surrounding portion thereof, the annular surrounding portion of the diaphragm 18, the annular ledge 27 carried by the field element 25, and the field element 25 to the south pole of the permanent magnet 34. Thus, it will be understood that the magnetic flux traversing the annular ledges 24 and 27 respectively carried by the core element 23 and the field element 25 is confined to an annular section of the diaphragm 18 disposed between the center and the marginal edge thereof. This arrangement is very advantageous in view of the fact that the magnetic flux path is of relatively large cross-sectional area but is confined to a relatively narrow annular section of the diaphragm 18, thereby to minimize the reluctance of the magnetic path introduced by the diaphragm 18 and to enhance the response of the diaphragm 18 over the operating frequency band.

Further, the device comprises a terminal block including two electrical terminal elements 35 and 36 and a supporting element 37, the terminal block being carried by the side wall 14 of the casing 11 and projecting inwardly into the open side of the C-shaped permanent magnet 34. More particularly, the electrical terminal elements 35 and 36 are embedded in two spaced-apart openings formed in the side wall 14 of the casing 11; while the supporting element 37 is embedded in a recess disposed intermediate the two spaced-apart openings and formed in the side wall 14 of the casing 11. Preferably, the exterior walls of the terminal elements 35 and 36 are knurled; while the supporting element 37 comprises a section having a substantially L-shape, thereby positively to insure anchoring of the electrical terminal elements 35 and 36 and the supporting element 37 in the side wall 14 of the casing 11. Preferably, the electrical terminal elements 35 and 36 and the supporting element 37 are hot-pressed into the respective openings and recess formed in the side wall 14 of the casing 11 after the casing 11 has been molded and before it has been allowed to set. Finally, the electrical terminal elements 35 and 36 are respectively connected to the opposite ends, not shown, of the winding 33, thereby to afford a connection between the winding 33 and an exterior telephone circuit, not shown.

This arrangement of the terminal block carried by the side wall 14 of the casing 11 is very advantageous in view of the fact that it materially contributes toward compactness as the terminal block occupies only the space within the casing 11 disposed between the opposite ends of the substantially C-shaped permanent magnet 34.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A sound translating device comprising a longitudinally extending cylindrical cup-shaped casing, a laterally extending vibratory diaphragm mounted adjacent its marginal edge in the open end of said casing, a longitudinally extending core element disposed substantially centrally within said casing and having a pole face presented to said diaphragm, a laterally extending first field element disposed adjacent the open end of said casing in substantially parallel close spaced relation with respect to said diaphragm and surrounding said core element in close spaced relation therewith, said first field element having a pole face presented to said diaphragm, a laterally extending second field element disposed adjacent the bottom end of said casing and magnetically connected to said core element, a winding disposed in said casing and surrounding

said core element, said winding being positioned between said first field element and said second field element, and a semiannular permanent magnet disposed in said casing and at least partially surrounding said winding, said permanent magnet being positioned between said first field element and said second field element and presenting opposite longitudinally spaced-apart poles thereto.

2. A sound translating device comprising a longitudinally extending cylindrical cup-shaped casing, a laterally extending vibratory diaphragm mounted adjacent its marginal edge in the open end of said casing, a longitudinally extending core element disposed substantially centrally within said casing and having a pole face presented to said diaphragm, a laterally extending field element disposed adjacent the open end of said casing in substantially parallel spaced relation with respect to said diaphragm and surrounding said core element in close spaced relation therewith, said field element being positioned below and closely adjacent said diaphragm and having a longitudinally projecting ledge presenting a pole face to said diaphragm, an annular stack of sheets of damping material disposed between said diaphragm and said field element, a winding disposed in said casing and surrounding said core element, and semi-annular permanent magnet disposed in said casing and at least partially surrounding said winding, said permament magnet being coupled both to said core element and said field element and presenting opposite poles thereto.

3. A sound translating device comprising a longitudinally extending cylindrical cup-shaped casing, a laterally extending vibratory diaphragm mounted adjacent its marginal edge in the open end of said casing, a longitudinally extending core element disposed substantially centrally within said casing and having a pole face presented to said diaphragm, a laterally extending first field element disposed adjacent the open end of said casing in substantially parallel close spaced relation with respect to said diaphragm and surrounding said core element in close spaced relation therewith, said first field element having a pole face presented to said diaphragm, a laterally extending second field element disposed adjacent the bottom end of said casing and magnetically connected to said core element, a winding disposed in said casing and surrounding said core element, said winding being positioned between said first field element and said second field element, a substantially C-shaped permanent magnet disposed in said casing and partially surrounding said winding, said permanent magnet being positioned between said first element and said second field element and presenting opposite longitudinally spaced-apart poles thereto, and a terminal block carried by the side wall of said casing and projecting laterally into the open side of said C-shaped permanent magnet.

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