Jan. 9, 1951 C. S. ANDERSEN 2,537,253

ELECTRODYNAMIC TELEPHONE RECEIVER

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Fig. 1.

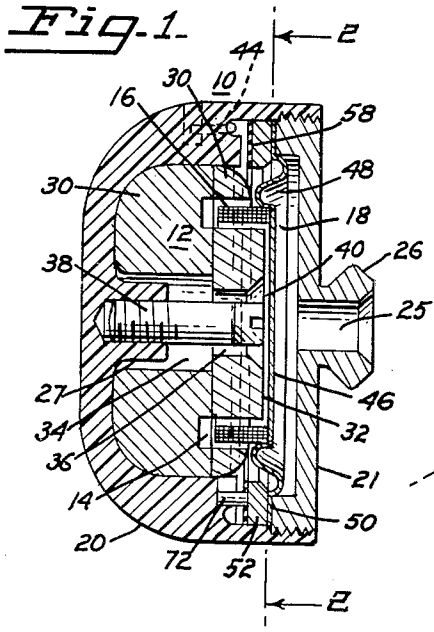


Fig. 2.

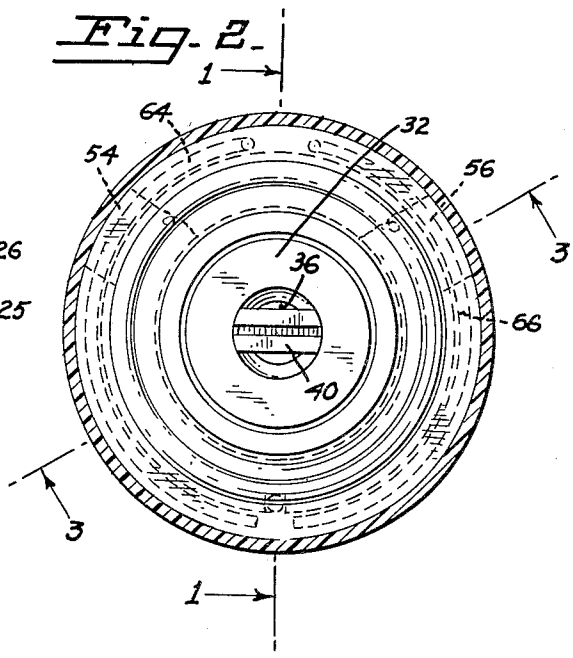


Fig. 3.

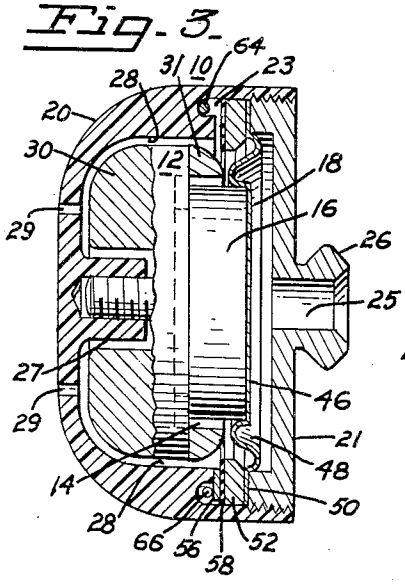
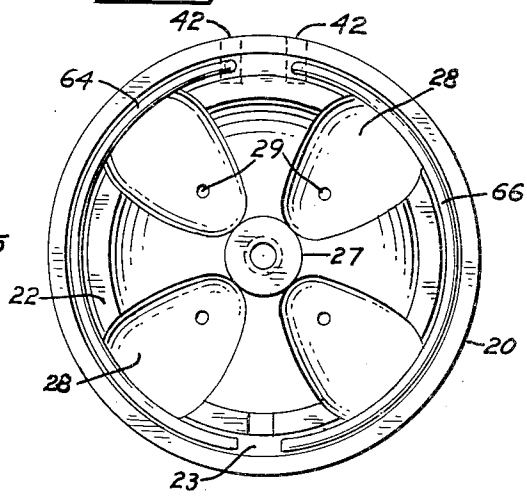


Fig. 4.



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Fig. 5.

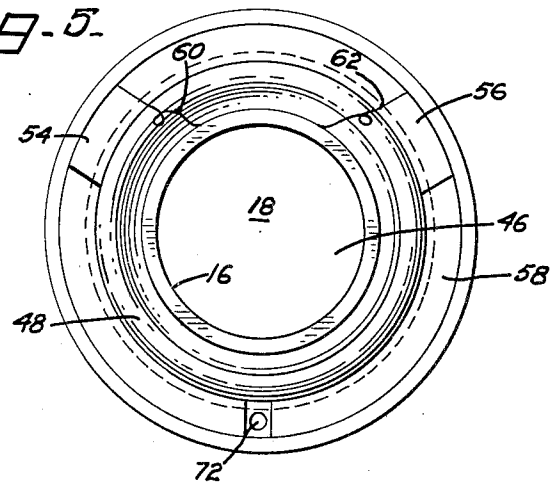


Fig. 6.

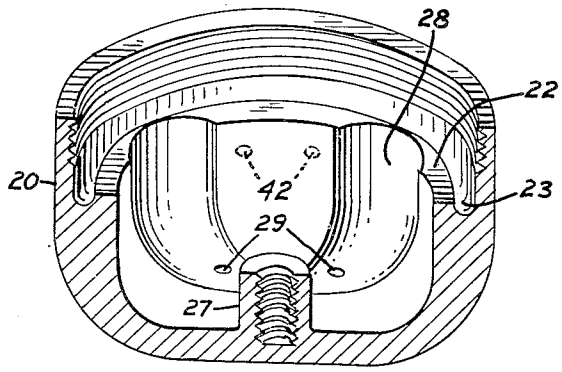
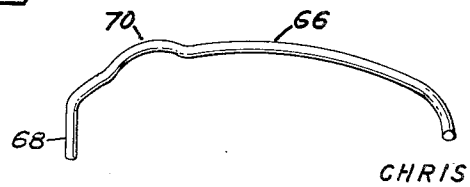


Fig. 7.



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ELECTRODYNAMIC TELEPHONE RECEIVER

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Application August 20, 1946, Serial No. 691,839

13 Claims. (Cl. 179—115.5)

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My invention relates to electro-acoustic transducers and more particularly to dynamic receivers.

One object of my invention is to provide an improved dynamic receiver which is compact and of light weight.

Another object of my invention is to provide a powerful distortionless dynamic receiver of improved construction.

Another object of my invention is to provide a dynamic receiver composed of parts which are self-aligning and which may be easily assembled.

Another object of my invention is to provide a dynamic receiver with a novel arrangement of air chambers, or air vents.

Another object of my invention is to provide a dynamic receiver with an improved arrangement for providing electrical connections between the voice coil thereof and an external circuit.

Another object of my invention is to provide a resilient conductor for incorporation in a dynamic receiver which serves to provide contacts for both the voice coil and for an external plug connector.

A further object of my invention is to provide a voice coil assembly which includes an improved arrangement for making electrical contacts between the voice coil and an external circuit.

A still further object of my invention is to provide a voice coil assembly which provides a resilient diaphragm of improved construction.

And still a further object of my invention is to provide an improved magnet structure for a dynamic receiver which may be readily aligned and assembled and which may be magnetized after installation in the receiver.

An additional object of my invention is to provide a new and improved dynamic receiver for use as a hearing aid.

My invention possesses many other advantages and has other objects which will be more readily apparent from a consideration of one embodiment of the invention. For this purpose there is shown one form of the invention in the drawings accompanying and forming a part of this specification. This form of the invention will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims. In the drawings:

Figure 1 is a side elevational view, in section, of my improved dynamic receiver taken on the line 1—1 of Fig. 2;

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Figure 2 is an end view of the dynamic receiver taken on the line 2—2 of Figure 1 and exposing the center pole piece;

Figure 3 is a view of the dynamic receiver, partly in section, taken on the line 3—3 of Figure 2;

Figure 4 is a plan view of the base member of the housing showing the spring connectors in place;

Figure 5 is an underside view of the diaphragm and voice coil assembly;

Figure 6 is an isometric view of the base member of the casing shown in section; and

Figure 7 is an isometric view of the spring connectors.

Referring to the drawings and more particularly to Figures 1 and 3, the dynamic receiver of the present invention comprises a casing or housing 10 in which a magnetic assembly 12 defining a flux gap 14 is mounted. A voice coil 16 is suspended in the flux gap by means of a resilient diaphragm 18.

According to the present invention at least four main novel features are incorporated in this receiver, namely, a novel arrangement of air passages which establish an acoustical chamber around the magnetic system behind the diaphragm; second, a novel arrangement for suspending the voice coil within the flux gap; third, a novel arrangement for establishing electrical connections between the voice coil and an external circuit; and fourth, a novel magnet structure; all as more fully described herein below.

The housing 10 comprises a shell 20, and a cap 21 which is threadedly receivable or otherwise secured in the shell. An internal peripheral shoulder 22 within the shell is provided with a circular groove 23. The shell is preferably composed of some light weight non-metallic material, such as a thermoset plastic and the cap 21 might advantageously be formed of similar material.

The cap has a sound exit passage 25 terminating in a knob 26 for attachment to a standard earmold of a head set (not shown), when the invention is employed as a hearing aid.

The shell is provided with a central internally threaded boss 27, while the interior wall is formed with a plurality of similar radial channels 28, though equivalent channels may be realized by the formation of radial ribs on the surface of the interior wall. These radial channels are preferably arranged symmetrically

about the boss as clearly illustrated in Figure 4. A vent opening 29 to the atmosphere may be provided at the lower end of each channel, though the addition of such vents is purely optional.

The magnetic system 12, when considered in more detail, is found to involve a main magnet body 30 preferably of a permanent magnet material, an annular pole piece 31 and a center pole piece 32, the latter two elements being preferably composed of soft iron or other readily magnetizable material.

The main magnet body is generally toroidal in shape, having an outer contour complementary to the interior wall of the casing, and an axial passage 34 of somewhat greater diameter than the boss 27, whereby upon nesting the main magnet body in the casing, the same cooperates therewith to form connected air passages as clearly depicted in Figure 3.

The annular pole piece has an outside diameter such as to provide a snug fit in the casing, which thereby causes it to be centered with respect to the main magnet body, the outer edge of the pole piece being rounded off to bring about a more uniform flux distribution therethrough and to effectively expose the underside of the diaphragm to the channels 28.

The center pole piece has an axial passage 36 countersunk at its upper end. It is properly centered and held in position by a screw 38 of smaller diameter than the axial passage 36, the screw having a beveled head 40 with side sections removed to expose the underside of the diaphragm to the passage 36.

Thus an acoustical chamber is formed about the magnetic system behind the diaphragm, and in communication with the flux gap and this has a profound effect on the tonal qualities of the receiver.

The shell 20 is provided with two similar closely spaced plug openings 42 in the wall thereof and these are in communication with the groove 23 by way of corresponding connecting passages 44. This arrangement of grooves, holes, and recesses serves to facilitate electrical connection between the voice coil and an external circuit, as more fully described hereinbelow.

Consider now the means for supporting the voice coil in the flux gap and the means for making electrical connections between the voice coil and an external circuit which delivers electric signals to the voice coil.

The voice coil 16 is suitably secured to a flat central disc 46 which is connected by an annular resilient corrugated section 48 to an annular ring 50; the disc 46, the corrugated section of 48 and the ring 50, together forming the voice coil diaphragm 18. To mount the voice coil 16 in the flux gap 14, the annular ring section 50 of the diaphragm is located between a brass ring 52 and the cap 21.

Electrical connection to the voice coil is partially effected by two mutually spaced tabs or contacts 54 and 56 which are mounted on an insulated ring 58 between the shoulder 22 and the brass ring 52. These two contacts are connected to opposite ends of the voice coil by means of two electric leads 60 and 62 respectively as illustrated in Figure 5.

In order to complete the electrical connections, two spring connectors 64 and 66 are provided, one of these being illustrated in Figure 7. The two spring connectors are of substantially semicircular shape, and of such length that when located in the groove 23, they are spaced apart

therein and accordingly insulated from each other. These connectors each has an end 68 at right angles to the main body thereof. These ends project through the respective connecting passages 44 to intersect the plug openings 42, to provide contacts to which electrical connection may be made by means of a suitable plug (not shown).

The two connectors are also each formed with a raised or offset portion 70 which extends outwardly of the groove to be engaged by the respective contacts 54 and 56. In order to register these contacts with the raised portions of the connectors, pilot holes are provided in the shoulder 22 and in the insulated ring 58 for engagement by a register pin 72 extending from one side of the brass ring 52.

In assembling the receiver, the components of the magnetic assembly 12 are positioned within the shell 20, the annular pole piece 31 being initially held therein by virtue of a snug fit between this pole piece and the internal wall of the shell, while the center pole piece 32 is held therein by means of the screw 38. In the event that the magnet was not previously magnetized, it may be magnetized in its assembled position by means of a magnetizing coil which is temporarily positioned within the gap 14. The magnetic force acting on the pole piece 30 is sufficient to hold it in place even in the absence of the tight fit.

The two spring connectors 64 and 66 are then positioned within the appropriate portions of the groove 23 with their corresponding ends 68 projecting through the connecting passages 44 to intersect the associated plug openings 42.

The voice coil unit comprising the brass ring 52, the diaphragm 18, the insulating ring 58, the contacts 54 and 56, and the voice coil 16 itself are first assembled as a unit and then positioned in the housing 10 with the contacts 54 and 56 in engagement with the respective raised portions 70 of the spring connectors, the register pin 72 and associated pilot holes serving to guide one in properly assembling these components. The cap 21 is then screwed into place to complete the receiver unit and retain the voice coil assembly in its proper operating relationship to the rest of the assembly.

From the foregoing description of one embodiment of my invention it will be readily apparent that I have provided a dynamic receiver which accomplishes the objects set forth. It will also be apparent that many modifications may be made in the detailed construction and arrangement of the parts of this dynamic receiver without departing from the true spirit and scope of my invention. While my invention has been particularly described in connection with its application to a dynamic receiver, one form of electro-acoustic transducer, it will be clear that it may also be applied to a dynamic microphone, another form of electro-acoustic transducer.

As a receiver, it is particularly useful as a hearing aid, since the diaphragm may be made to control large volume output from an assembly which has been reduced to a size adapted for such use.

It is therefore to be understood that my invention is not to be limited to the particular details illustrated and described, but only in so far as required by the appended claims.

I claim:

1. An electro-acoustic transducer comprising a housing, a magnet structure supported within said housing and defining a flux gap therein, said magnet structure having a central passage there-

through, a diaphragm mounted in said housing for resiliently supporting a voice coil in said flux gap, a sound orifice in said housing to one side of said diaphragm, and means including said central passage for defining an acoustical chamber sectionally about said magnet structure and in communication with said flux gap.

2. An electro-acoustic transducer comprising a housing, a magnet structure supported within said housing and defining a flux gap therein, said magnet structure having a central passage therethrough, a diaphragm mounted in said housing for resiliently supporting a voice coil in said flux gap, a sound orifice in said housing to one side of said diaphragm, means defining a hole in said housing at a point remote from said sound orifice, and means including said central passage for defining an air conduction path between said flux gap and said hole.

3. An electro-acoustic transducer comprising a housing having a plurality of channels in its interior wall, a diaphragm mounted within said housing for resiliently supporting a voice coil therein, a sound orifice in said housing to one side of said diaphragm, means defining a plurality of holes in said housing communicating with said channels at points remote from said sound orifice, and a magnet structure disposed within said housing and having a flux gap operatively disposed with respect to said coil, said magnet structure defining with said channels, air conduction paths between said holes and said flux gap.

4. An electro-acoustic transducer comprising a housing of axial symmetry having a plurality of channels in its interior wall symmetrically disposed about the axis thereof, a diaphragm mounted within said housing in a plane normal to said axis and resiliently supporting a voice coil therein about said axis, a sound orifice axially located in said housing to one side of said diaphragm, means defining a plurality of holes in said housing symmetrically disposed about said axis at the side of said housing remote from said sound orifice and communicating with the respective channels, and a magnet structure disposed within said housing and having an annular flux gap concentric with said coil, said magnet structure defining with said channels, air conduction paths between said holes and said air gap.

5. A housing member for an electro-acoustical transducer having a cup-shaped cavity therein including a plurality of channels in the wall thereof extending radially outward of the center of said cavity, and a plurality of vents establishing air conduction between the outer surface of said member and the respective channels.

6. A housing member for an electro-acoustical transducer having a cup-shaped cavity therein including a radial channel in the wall of said cavity, and a vent establishing air conduction between the outer surface of said member and the channel.

7. A housing member for an electro-acoustical transducer having a cup-shaped cavity therein including a plurality of channels in the wall thereof extending radially outward of the center of said cavity and regularly spaced therein, and a plurality of centrally located vents establishing air conduction between the outer surface of said member and the respective channels.

8. In an electro-acoustic transducer, a housing member having a pair of holes therein, a pair of springs of conductive material having ends

adapted to project through the respective holes, a voice coil, a pair of mutually insulated contacts electrically connected to the respective ends of said voice coil, and means for supporting said voice coil and said contacts and said spring in assembled position in said housing member with said contacts pressed into resilient electrical engagement with said springs.

9. In an electro-acoustic transducer, a housing member having an internal peripheral groove and a pair of holes passing through said member and communicating with said peripheral groove, a pair of spaced springs of conductive material having main portions lying in said groove and ends projecting into the respective holes, a voice coil, a pair of mutually insulated contacts electrically connected to the respective ends of said voice coil, and means supporting said voice coil and said contacts in assembled position in said casing with said contacts pressed into resilient electrical engagement with said springs.

10. In an electro-acoustic transducer, a housing member having a peripheral groove in one wall thereof and a pair of holes through said wall and terminating in said peripheral groove, a pair of spaced springs of conductive material lying in said groove having raised portions tending to extend out of said groove and having ends projecting into the respective holes, a voice coil, a pair of mutually insulated contacts electrically connected to the respective ends of said voice coil, and means for supporting said voice coil and said contacts in assembled position in said housing with said contacts pressing the respective raised portions of said springs into said grooves.

11. An electro-acoustic transducer comprising a housing member having a peripheral groove in one wall of said member and a pair of holes passing through said member and communicating with said peripheral groove, a pair of springs having main portions lying in said groove and ends projecting into the respective holes, a magnet structure supported within said casing member and defining an annular flux gap concentric with said groove, a voice coil, a pair of contacts electrically connected to the respective ends of said voice coil, and means including an insulating spacer for resiliently supporting said voice coil in said flux gap and for pressing said contacts into electrical engagement with the respective springs.

12. An electro-acoustic transducer comprising a housing member having a peripheral groove interiorly thereof and a pair of holes passing through said member and communicating with said groove, a pair of springs having main portions lying in said groove and ends projecting into the respective holes, a magnet structure supported within said housing member and defining a flux gap therein, a voice coil resiliently supported in said flux gap, a pair of mutually insulated contacts electrically connected to the respective ends of said voice coil, and means for pressing said contacts into electrical engagement with said springs.

13. An electro-acoustic transducer comprising a housing member having a peripheral groove interiorly thereof and a pair of holes passing through said member and communicating with said groove, a pair of springs having main portions lying in said groove and ends projecting into the respective holes, a magnet structure supported within said casing member and defining an annular flux gap concentric with said groove, a voice coil resiliently supported in said flux gap, a pair

of mutually insulated contacts electrically connected to the respective ends of said voice coil, and means for pressing said contacts into electrical engagement with the respective springs, said holes being of greater diameter at their exterior ends to permit of insertion of plug terminals and effect contact with the ends of said springs.

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