Sept. 12, 1950 H. E. HANSON 2,522,266

MAGNETIC RECEIVER

Filed May 25, 1948

FIG. 1

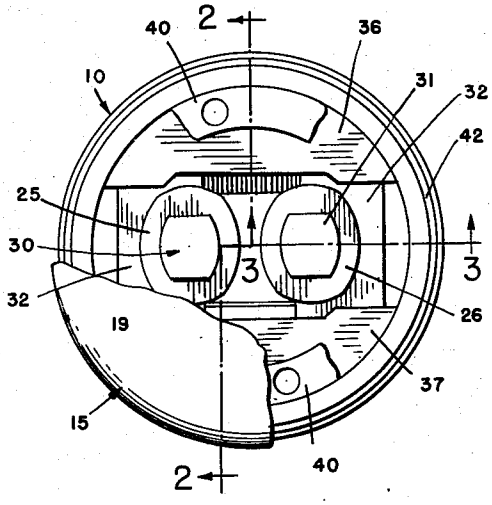


FIG. 2

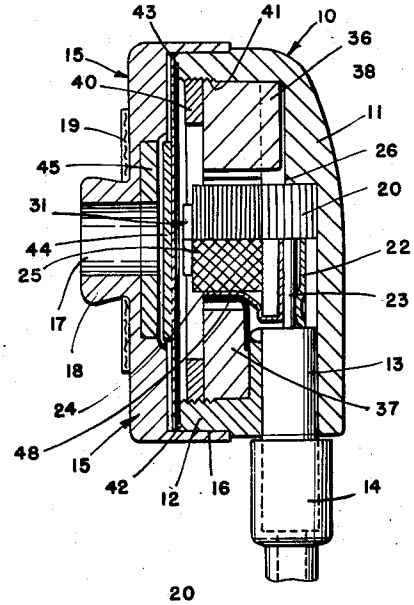
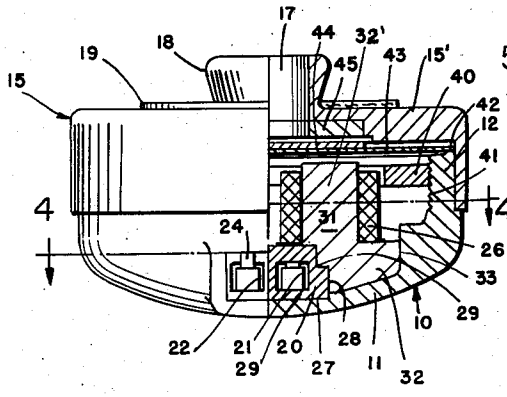


FIG. 3



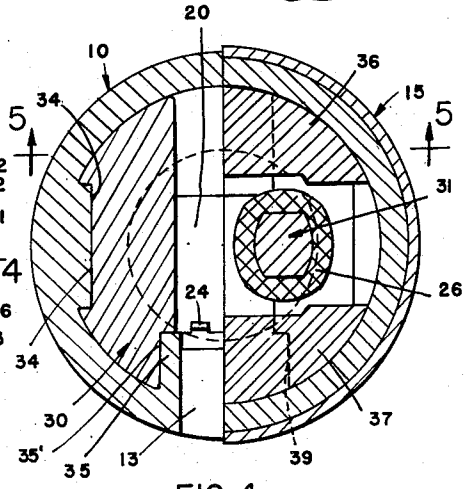
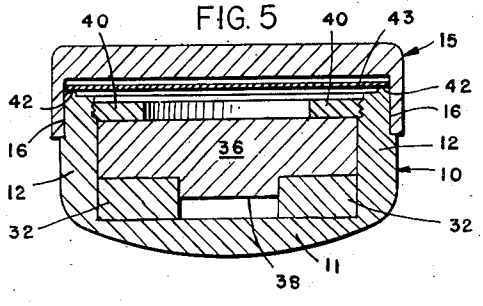


FIG. 4

FIG. 5



INVENTOR.

HARVEY E. HANSON

BY

AGENT

Patented Sept. 12, 1950 2,522,266

UNITED STATES PATENT OFFICE

2,522,266

MAGNETIC RECEIVER

Harvey E. Hanson, Chicago, Ill., assignor to Beltone Hearing Aid Co., Chicago, Ill., a corporation of Illinois

Application May 25, 1948, Serial No. 29,081

6 Claims. (Cl. 179—117)

1

This invention relates to midget receivers for hearing aids.

One of the objects of the invention is to provide a receiver for hearing aids which is extremely small in size but despite its small size is of very great efficiency.

During recent years the manufacturers of hearing aids have turned more and more to what is called a single unit instrument wherein the microphone, an electron tube amplifier and the batteries therefor are all placed in a common housing small enough to be worn in an ordinary vest pocket. At present, wearable hearing aids are built almost exclusively as single unit instruments, the size of the batteries used therein having become ever smaller. In view thereof, it is an object of this invention to provide a magnetic receiver for hearing aids which will assure a highly satisfactory acoustic output also with hearing aids using the smallest size batteries available at present for hearing aid purposes.

Another object of the invention is to provide a magnetic midget receiver for hearing aids having relatively low alternating current reluctance.

A further object of the invention is to provide in a magnetic midget receiver a source of permanent magnetism of low A. C. reluctance by arranging the permanently magnetic material in such a form as to afford a large effective surface for the volume of magnetic material used.

A further object of the invention is to provide a magnetic midget receiver having two permanent magnets connected in parallel by means of connecting members which form part of two pole pieces each carrying an energizing coil.

It is a further object of the invention to provide in a magnetic midget receiver two permanent magnets for the purpose of increasing the effective surface area of said permanent magnets, the latter being placed into the A. C. magnetic circuit at such points that reduction of the A. C. reluctance will result due to the increased leakage such two magnets will afford as compared with a single permanent magnet having the same weight as the two magnets together.

Another object of the invention is to provide a magnetic midget receiver wherein the permanent magnets and the pole pieces are maintained at their proper places within the housing without resort to soldering or screws for connecting the permanent magnets and the pole pieces.

A further object of the invention is to provide a magnetic midget receiver wherein the permanent magnets and the pole pieces as well as the socket which receives the plug coming from the amplifier of the hearing aid instrument are held in their proper relative positions by means of shaping these parts in such a manner that each of them interlocks with at least one other of the parts mentioned.

2

A further object of the invention is to provide a magnetic midget receiver wherein the permanent magnets and the pole pieces which carry the energizing coils are held within a housing by means of a non-magnetic retaining member without resort to soldering or screws for connecting the permanent magnets and the pole pieces so that upon removal of said retaining member the elements of the magnetic drive of the receiver can be easily and separately removed from the housing, such as for purposes of inspection or repair.

Still another object of the invention resides in the provision in a magnetic midget receiver which has a diaphragm carrying an armature for the pole pieces of a member of highly permeable material arranged so as to form a magnetic path in parallel to that magnetic path which extends through said armature.

Other objects will appear as the description proceeds, reference being had to the accompanying drawings which show at an enlarged scale (approximately 4:1) an electromagnetic midget receiver for a hearing aid embodying the invention and wherein:

Fig. 1 is a plan view, with parts partly broken away, of the receiver;

Fig. 2 is a sectional view along the line 2—2 in Fig. 1;

Fig. 3 is a side view of the receiver, the left half of the figure showing a section along the line 3—3 in Fig. 1;

Fig. 4 is a section on the lines 4—4 in Fig. 3; and

Fig. 5 is a section on the line 5—5 in Fig. 4.

A cup shaped housing 10 of non-magnetic material has a bottom 11, which may be of curved shape, a cylindrical side wall 12 and a side opening 13. Fitting over an undercut portion 16 on the outside of the cylindrical wall 12 of the housing 10 is a cap 15 which has a central opening 17 surrounded by a substantially frusto-conical extension 18. A washer 19, preferably made of a plastic material, e. g. vinylite, is placed around the extension 18 so as to rest against the surface 15' of the cap 15. The parts 18, 19 serve for the attachment of the so-called ear mold (not shown) adapted to be inserted into the ear of the user. Fitting into a recess 27 of the inner side of the bottom 11 of the housing 10 in such a manner as to face with one open side the inner end of the opening 13 in the side wall 12 of the housing is a socket 20 containing two contact sleeves 21, 22 adapted to receive two contact pins 23 of a plug 14 which in the usual manner forms part of a connection to the output terminals of the hearing aid instrument worn on the body of the user. The contact sleeves 21, 22 are provided each with a prong 24 for connection with one of two energizing coils 25, 26. Each coil 25, 26 is carried by

an arm 32' of one of two pole pieces 30, 31 having each a substantially plate-shaped member 32 which extends substantially perpendicularly to the coordinated arm 32'.

Establishing two parallel magnetic bridges between the two pole pieces 30 and 31 are two permanent magnets 36 and 37. While these two permanent magnets, in order to fulfill their functions as bridges between the two pole pieces, might be of such lengths only as to fit abuttingly between the pole pieces, it is preferable from the point of view of magnetic efficiency to make these permanent magnets as long as the dimensions of the housing 10 permit. In accordance with this consideration, the drawing shows permanent magnets 36, 37 which extend across the entire widths of the pole pieces 30, 31 and are held in contact with the latter by means to be described later. An insulating strip 48 serves to insulate the socket contacts 24 from the permanent magnet 37.

Supported by a rim 42 of the housing 10 is the peripheral edge of a diaphragm 43 carrying at its central portion a disk-shaped piece 44 serving as an armature for the pole pieces 30, 31. The armature 44, which consists of highly permeable material, e. g. soft iron, is arranged on that side of the diaphragm 43 which looks away from the pole pieces 30, 31, whereas the side of the diaphragm looking towards these pole pieces is flat.

It will be noted that in the arrangement shown the metallic parts of the magnetic paths are common for both the A.-C. magnetic circuit and the D.-C. magnetic circuit. Due to the fact that two permanent magnets 36, 37 are used which are connected by means of the plate-shaped members 32 of the pole pieces 30, 31, the effective surface of these magnets is greater than would be the effective surface of a single magnet of a volume equal to the combined volumes of the two magnets 36, 37. Thereby there is provided for the A.-C. magnetic flux a greater leakage and thereby a lower A.-C. reluctance of the system, which in turn means an increased output of the receiver. In order to reduce still further the reluctance of the system to the A.-C. magnetic flux the pole pieces 30, 31 are arranged as close to each other as the presence of the socket 20 in the receiver will permit, that is to say, these pole pieces are arranged so as to directly abut said socket and partly to overlap it, as is best seen in Fig. 3.

The provision of the permanent magnetism in the form of two segmental magnets 36 and 37 is not only beneficial from the viewpoint of reducing the A.-C. reluctance but also from the viewpoint of the utilization of the space available within the housing 10. By arranging two segmental magnets adjacent to two diametrically opposite portions of the cylindrical side wall of the housing 10, it becomes possible to accommodate the socket, the pole pieces and the energizing coils within a housing of smaller diameter than would be necessary if a single permanent magnet of the same energy product as the two magnets 36, 37 were used.

The system as described thus far develops a strong magnetic flux across the gap between the diaphragm 43 and the end surfaces of the arms 33' of the pole pieces 30, 31. The density of this flux is substantially increased by the arrangement within the cap 15 of a member 45 of highly permeable material, e. g. soft iron, which forms a magnetic path in parallel to the magnetic path which extends through the armature 44. In the example shown this member 45 is in the form of a ring sunk into a recess provided in the inner surface of the cap 15 so as to be flush with that surface. While this member 45 is magnetically in parallel with the armature 44 it will be noted that, in contrast to this armature, it does not vary its relative position to the pole pieces 30, 31 but is stationary in the cap 15.

Good contact between the permanent magnets 36, 37 and the plate-shaped members 33 of the pole pieces 30, 31 is necessary. In connection with magnetic midget receivers such good contact was heretofore sought to be achieved by either screwing together or soldering together pole piece and permanent magnet. The construction according to the present invention avoids such connecting means between pole pieces and permanent magnets and uses instead an arrangement wherein each of the parts: housing 10, socket 20, pole pieces 30, 31 and permanent magnets 36, 37 interlocks with at least one other of the parts mentioned to provide a self anchoring assembly and this assembly is retained in the housing 10 by a single retaining member 40. As an example of such an interlocking arrangement the drawing shows the side walls of the socket 10 as being provided with a step 27 whereas the housing 10 has projecting portions 33, 34 and 35 and the plate-shaped members 32 of the pole pieces 30 and 31 have correspondingly recessed portions 29, 34' and 35'. Thus, each of the members 32 of the two pole pieces 30 and 31 fits into a cavity delimited by the projecting and recessed portions of the inner wall of the housing 10 and by the staggered outside wall of the socket 10. Of the permanent magnets 36, 37, which are both flat at their top side looking towards the cap 15, the opposite side of the magnet 36 has a projecting portion 38 which in the assembled position of the parts fits between the inner edges of the members 32 of two pole pieces 30, 31, whereas the bottom side of the magnet 37 has a depressed portion 39 to fit over the raised portion 35 of the bottom of the housing 10. With the exception of the projecting portion 38 the magnet 36 rests flush against the upper surface of the members 32 of the two pole pieces 30, 31 and likewise the permanent magnet 37, with the exception of the depressed portion 39, rests upon the upper surface of the members 32 of the two pole pieces 30, 31, the arrangement being such that all the four contact surfaces existing between the two permanent magnets and the two pole pieces are situated in a common plane.

The aforementioned retaining member 40 is in the form of a ring having an outside thread that can be threaded into an inside thread 41 in the cylindrical wall 12 of the housing 10. When the ring 40 is threaded in sufficiently it will hold the pole pieces 30, 31 and the permanent magnets 36, 37 in contact with each other and at their proper places relative to each other and to the housing 10 as well as to the socket 20 by virtue of the interlocking arrangement of the parts above described. Upon unscrewing the ring 40, the elements contained in the housing 10 can be taken out without any further unscrewing operation or breaking of solder connections. It will be appreciated that the absence of solder connections not only facilitates the assembly and disassembly of the receiver and the achievement of greater uniformity between the individual units of the series produced, but that also space is saved and that additional re-

luctance is removed which the insertion of a soldering point creates in a magnetic path formed by magnetic material.

While I have shown in the drawing one particular embodiment of the invention, I desire it to be understood that this embodiment has been given by way of example only and that various changes, modifications, and re-arrangements of parts may be carried out without departing from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. A magnetic midget receiver for hearing aids, comprising a cup-shaped housing, a socket adapted to receive a plug extending into said housing, two pole pieces separated from each other by said socket, each of said pole pieces having an arm carrying an energizing coil and a substantially plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets extending across both said pole pieces and being in contact therewith, and each of said parts: housing, socket, pole pieces, and permanent magnets being shaped for interlocking with at least one other of these parts.

2. A magnetic midget receiver for hearing aids, comprising a housing, two pole pieces arranged at a distance from each other, each of said pole pieces having an arm extending axially through an energizing coil and a substantially plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets arranged at a distance from each other so as to have said pole piece arms between them and extending each across said plate-shaped members of both said pole pieces, so as to rest removably thereon said pole pieces and said permanent magnets having relatively projecting and recessed portions for interlocking with each other, and a non-magnetic retainer element for holding said interlocking pole pieces and said permanent magnets within said housing and in contact with each other.

3. A magnetic midget receiver for hearing aids, comprising a cup-shaped housing, a socket adapted to receive a plug extending into said housing, two pole pieces separated from each other by said socket, each of said pole pieces having an arm carrying an energizing coil and a plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets arranged at a distance from each other so as to have said pole piece arms between them and extending each across said plate-shaped members of both said pole pieces, each of said parts: housing, sockets, pole pieces and permanent magnets being shaped for interlocking with at least one other of these parts, and a non-magnetic retainer ring for holding said pole pieces and said permanent magnets within said housing and in contact with each other at said surfaces in said common plane.

4. A magnetic midget receiver for hearing aids, comprising a cup-shaped housing having a rim, a socket adapted to receive a plug extending into said housing, two pole pieces separated from each other by said socket, each of said pole pieces having an arm carrying an energizing coil and a substantially plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets extending across both said pole pieces and being in contact therewith, each of said parts: housing, socket, pole pieces and permanent magnets being shaped for interlocking with at least one other of these parts, and a diaphragm adapted to rest with its edge portion upon the rim of said housing.

5. A magnetic midget receiver for hearing aids, comprising a cup-shaped housing having a rim, a socket adapted to receive a plug extending into said housing, two pole pieces separated from each other by said socket, each of said pole pieces having an arm carrying an energizing coil and a substantially plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets extending across both said pole pieces and being in contact therewith, each of said parts: housing, socket, pole pieces and permanent magnets being shaped for interlocking with at least one other of these parts, a diaphragm supported at its edge portion by said rim and carrying a central armature for said pole pieces, and a member of highly permeable material within said cap for forming a magnetic path in parallel to the magnetic path through said armature on said diaphragm.

6. A magnetic midget receiver for hearing aids, comprising a cup-shaped housing, having a rim, a socket adapted to receive a plug extending into said housing, two pole pieces separated from each other by said socket, each of said pole pieces having an arm carrying an energizing coil and a substantially plate-shaped member extending substantially perpendicularly to said arm, one surface of the plate-shaped members of both said pole pieces extending in a common plane, two permanent magnets extending across both said pole pieces and being in contact therewith, each of said parts: housing, socket, pole pieces and permanent magnets being shaped for interlocking with at least one other of these parts, a diaphragm supported at its edge portion by said rim and carrying a central armature for said pole pieces, and a member of highly permeable material sunk into the inner surface of said cap so as to be flush with that surface for forming a magnetic path in parallel to the magnetic path through said armature on said diaphragm.

HARVEY E. HANSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,628,383	Young	May 10, 1927
2,069,817	Clarke	Feb. 9, 1937
2,086,630	Miner	July 13, 1937
2,141,820	Paredes	Dec. 27, 1938
2,231,084	Morrison et al.	Feb. 11, 1941
2,249,158	Morrison	July 15, 1941
2,371,453	Linell	Mar. 13, 1945
2,493,734	Pearson	Jan. 3, 1950