April 2, 1957 D. H. ROWLAND 2,787,670

HEARING AID

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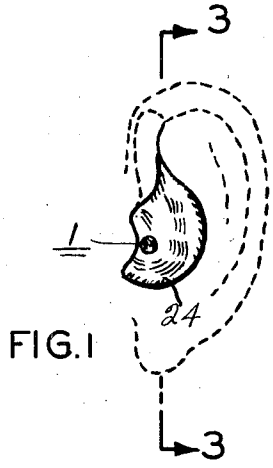



FIG. 1

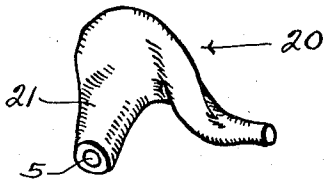



FIG. 2

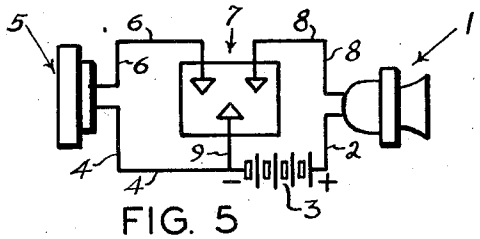



FIG. 5

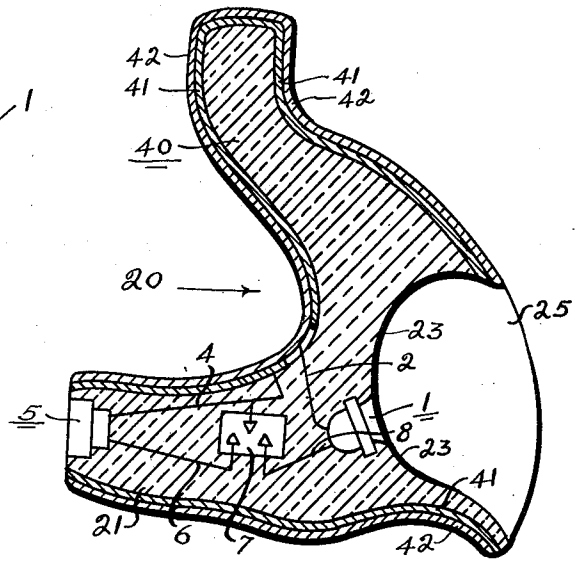



FIG. 3

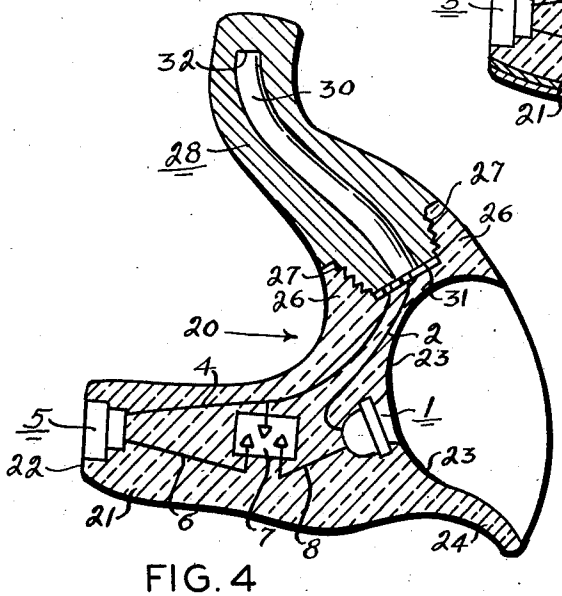



FIG. 4

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# HEARING AID

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4 Claims. (Cl. 179—107)

The present invention relates to apparatus for amplifying sound, and more particularly to sound amplifying mechanism of the type commonly called a "hearing aid," in contradistinction to public address systems, radio receiving sets, and the like.

The principal object of the invention is to provide a hearing aid which, a person having faulty hearing faculties may wear in his ear, to at least partially overcome his affliction.

A further important object is to provide a single-unit hearing aid which requires no externally exposed wires, and which eliminates the necessity of carrying any battery package or receiving set.

All elements, which go to make up the apparatus of the present invention, are contained in an ear-piece.

Another object is to provide an apparatus of this class which is no larger than the ear-piece which forms a portion of most conventional hearing aids.

Other objects will be apparent from the following description when taken in conjunction with the accompanying single sheet of drawings, wherein:

Figure 1 is an elevational view of an ear-piece mounted in an aural orifice, the dotted lines showing a human ear within the orifice of which the ear-piece is mounted;

Figure 2 is a perspective view of the ear-piece, per se;

Figure 3 is a sectional view taken substantially along the line 3—3 of Fig. 1, said ear-piece containing one embodiment of the invention;

Figure 4 is a sectional view through an ear-piece containing a slightly different embodiment of the invention; and,

Figure 5 is a schematic view of an electric circuit made in accordance with the invention.

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

Referring more particularly to Fig. 5 of the drawings, wherein the various elements which go to make up the device are shown diagrammatically, the reference numeral 1 indicates, as a whole, a crystal pick-up transmitter or microphone which is conventional in operating principle. One terminal of the transmitter 1 is connected by a wire 2 to one pole of a seat 3 of electrical energy, and a wire 4 leads from the other pole of said seat to one terminal of a receiver 5. The receiver 5 is conventional and may well be any one of the small types in common use in electronic hearing aids.

The other terminal of the receiver 5 is connected by a wire 6 to a novel sound amplifying unit 7, more fully described hereinbelow which is connected to the transmitter 1 by a wire 8. A conductor 9 leads to a grid connection of the amplifier 7 from the wire 4.

It was said above that the transmitter 1 and the receiver 5 both operate on conventional principles, but this does not mean that they are entirely conventional in construction, since in order for them to function in a desired manner, they must be made very small, as will more fully appear hereinbelow. The sound amplifying unit 7 operates upon a conventional principle, but is much smaller than most conventional amplifiers.



The amplifier 7 is shown diagrammatically in the drawings to be a germanium transistor. This is important because in order to conserve space, a germanium transistor can be made very small and yet it will perform the functions of an electronic vacuum tube many times its size. Furthermore it consumes only a small fraction of the electrical energy used by an electronic tube designed for the same purpose and does not need any "warm-up" time before it starts operating. The seat 3 of electrical energy may be in the form of a dry-cell battery as shown in Fig. 5, or it may well be a bi-metal thermal generator energized by the application of heat, as illustrated in Fig. 3.

In accordance with the present invention, the above described apparatus is adapted for use as a hearing aid for one individual person, and as is more fully described hereinbelow, the apparatus is so arranged that it may all be embodied in a single plug or ear-piece.

Referring now more particularly to Fig. 4 of the drawings, the reference numeral 20 indicates, as a whole, a preformed body of some suitable non-conductive material, for instance one of the plastics, either mineral or vegetable. The configuration of the body 20 is such that it contiguously contacts the concha of the ear and has an inwardly extending stud portion 21 formed to fit snugly within the external auditory canal of a person's ear, said stud 21 having an inner end surface 22 and an outer end surface 23. The outer end 23 of the stud 21 is surrounded by an integral flange portion 24 which has a central cavity 25 which immediately surrounds said outer end 23. The body 20 further includes a laterally upwardly projecting portion 26 which is substantially cylindrical exteriorly, and the outermost end of which is provided with a cavity having tapered female threads 27.

A dry-cell battery element 28 having a threaded end-portion 29 engaged with the threads 27 and an exterior configuration to conform with the shape of the hollow of the fossa of the anthelix portion of an ear. The battery element 28 has a carbon core 30 which is the positive plate extending from the threaded end 29 to a point adjacent the opposite or upper end of the battery 28 as at 32, and is constructed in the conventional manner of dry-cell battery manufacture using a conventional electrolyte, except for the exterior configuration and having a metal shell, not shown, for the negative plate. The ends of the wires 2 and 4 are positioned to contact the positive and negative plate, respectively, of the battery 28.

In constructing the body 20, the sound receiving apparatus 1, is located as shown in Fig. 4, embedded within the outer end 23 of the stud 21 and at the foot of the cavity 25. The amplifying unit 7 is embedded in the central portion of the stud 21, and the receiver 5 is embedded in the stud 21 adjacent its inner end surface 22. The wires or conductors 2, 4, 6, 8 and 9 are all embedded in the stud 21 with the exception of slight portions of the wires 3 and 4 which terminate at the foot of the cavity in the laterally projecting portion 26.

In Figs. 2 and 3 of the drawings, there is shown an embodiment of the invention wherein the battery is supplanted by a bi-metal thermal generator. In this latter embodiment, the body 1 and the lateral extension are formed integrally, there being a lateral extension portion 40 in lieu of the battery 28 of Fig. 4. Otherwise, the body of Fig. 3 is quite similar in configuration and construction to the body shown in Fig. 4.

The bi-metal thermal generator of the present embodiment is made in the form of a two-sheet jacket which contiguously covers all exterior surfaces of the body 20, including all of the stud 21 except its innermost end 22, and all of the lateral extension 40. The flange portion 24 of the body and the bottom of the cavity 25 are left

uncovered by the jacket. The jacket is composed of two metal sheets, an inner sheet **41** and an outer sheet **42**. The wire **2** is connected to the inner sheet **41**, and the wire **4** is connected to the outer sheet **42** as shown in Fig. 3.

Operation of the device is thought to be obvious. Sound received by the transmitter **1** is amplified by the element **7**, and is then discharged by the receiver **5** in the proximity of the wearer's ear drum, not shown. Of course, more than one of the amplifying units may be interposed within the circuit, if desired.

Heat from the wearer's body actuates the thermal generator.

Obviously the invention is susceptible to some change or alteration without defeating its practicability, and I therefore do not wish to be confined to the preferred embodiment shown in the drawings and described herein, further than I am limited by the scope of the appended claims.

I claim:

1. In an electrical hearing aid for one ear of a human being, the combination with a body of non-conductive material formed to fit and be retained within the wearer's ear cavity and including a source of electric energy, of: an outwardly presented transmitter carried by said body; a receiver presented inwardly toward the inner ear of the wearer's ear cavity and carried by the wearer's body; and a germanium transistor disposed within said body and interconnected with said source of electric energy, transmitter, and receiver, whereby sonic signals picked up by the transmitter are amplified by the germanium transistor and reproduced through the receiver.

2. In an electrical hearing aid for one ear of a human being, the combination with a body of non-conductive material formed to contiguously nest within the concha and the hollow of the fossa of anthelix of the wearer's ear and be retained therein, said body having a stud-portion extending into the external auditory canal and a laterally extending portion which is nested by the hollow of the fossa of anthelix of the wearer's ear, and a source of electric energy carried by said laterally extending portion; of: an outwardly presented transmitter rigidly carried by said body within the concha of the wearer's ear; an inwardly presented receiver rigidly carried by the innermost end of said stud-portion; and at least one germanium transistor disposed within said body and operatively interconnected with said source of electric energy, transmitter, and receiver, whereby sonic signals picked up by the transmitter are amplified by the germanium transistor and reproduced through the receiver.



3. In a hearing aid for one ear of a human being, the combination with a body of non-conductive material formed to fit within and be retained by an ear cavity, of: the wearer's outwardly presented transmitter carried by said body; a receiver presented inwardly toward the inner ear of the wearer and carried by said body; a germanium transistor disposed within said body; and a bimetal thermogenerator externally carried by that part of said body in contact with the ear cavity of the wearer and interconnected with said transmitter, said receiver and said germanium transistor, whereby body heat from the ear generates a thermoelectric current which operates the transmitter, germanium transistor, and receiver for amplifying sonic signals.

4. In a hearing aid for one ear of a human being, the combination with a body of non-conductive material formed to contiguously nest within the concha and the hollow of the anthelix of the user's ear and be retained therein, and having a stud-portion extending into the external auditory canal, of: an outwardly presented transmitter rigidly carried by said body within the concha of the user's ear; an inwardly presented receiver rigidly carried by the innermost end of said stud-portion; a germanium transistor disposed within said body; and a bimetal thermogenerator externally carried by that part of said body in contact with the user's ear and interconnecting said transmitter, said receiver, and said germanium transistor, whereby body heat from the ear generates a thermoelectric current which operates the transmitter, germanium transistor, and receiver for amplifying sonic signals.

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