United States Patent [19]

Diethelm

[11] **3,852,540**

[45] **Dec. 3, 1974**

[54] **EAR HEARING APPARATUS**

[75] Inventor: **Beda Diethelm,** Zollikerberg, Switzerland

[73] Assignee: **AG fur Elektroakustik**

[22] Filed: **Dec. 13, 1972**

[21] Appl. No.: **314,902**

[30] **Foreign Application Priority Data**

Dec. 30, 1971 Switzerland 19184/71

[52] **U.S. Cl.** ..... **179/107 E**

[51] **Int. Cl.** **H04r 25/02**

[58] **Field of Search** ..... 179/107 E

[56] **References Cited**

UNITED STATES PATENTS

2,595,489	5/1952	Rutter et al.	179/107 E
2,950,357	8/1960	Mitchell et al.	179/107 E
2,959,645	11/1960	Ladd	179/107 E
2,971,065	2/1961	Busse	179/107 E
3,055,990	9/1962	Sidlo	179/107 E
3,265,819	8/1966	Herrmann	179/107 E

FOREIGN PATENTS OR APPLICATIONS

598,919	9/1957	Italy	179/107 E

Primary Examiner—Kathleen H. Claffy
Assistant Examiner—Mitchell Saffian

[57] **ABSTRACT**

A hearing apparatus equipped with an output transducer, a voltage source, an amplifier, an input transducer capable of magnetic or electrical reception and a gain control. There is provided an elongate bipartite housing constructed to be inserted into the auditory or hearing channel. In the lengthwise direction of the housing there are arranged adjacent to one another the output transducer, the voltage source, the amplifier, the input transducer and the gain control. The output transducer is arranged in a first part of the housing, the amplifier, the input transducer and the gain control are arranged in a second part of the housing which is detachably connected with the first part of the housing. The voltage source is arranged between the output transducer and the amplifier at the region of the connection location of the housing parts.

4 Claims, 3 Drawing Figures

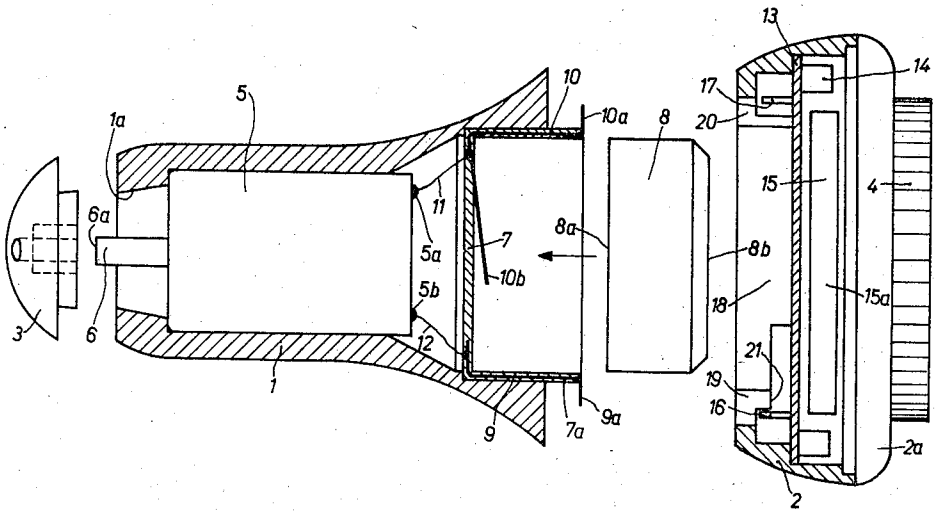


FIG. 3

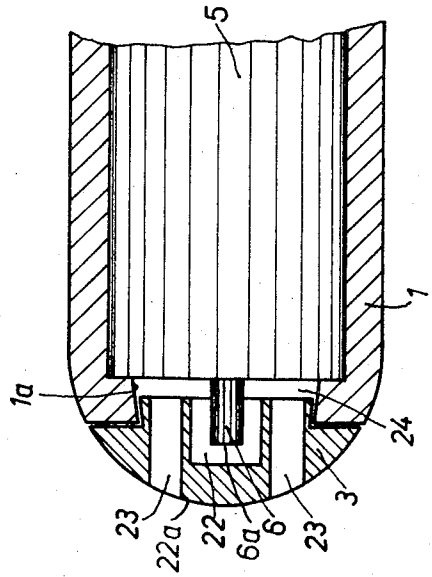
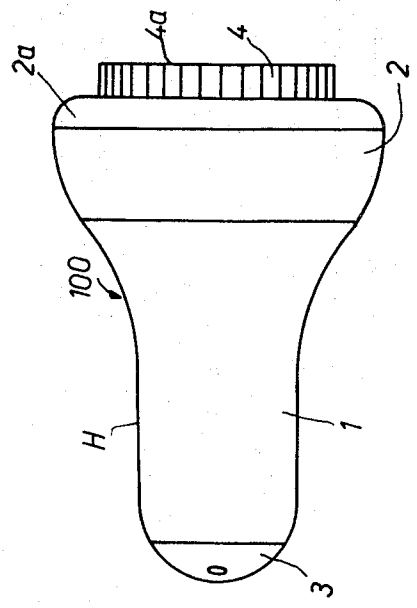


FIG. 1



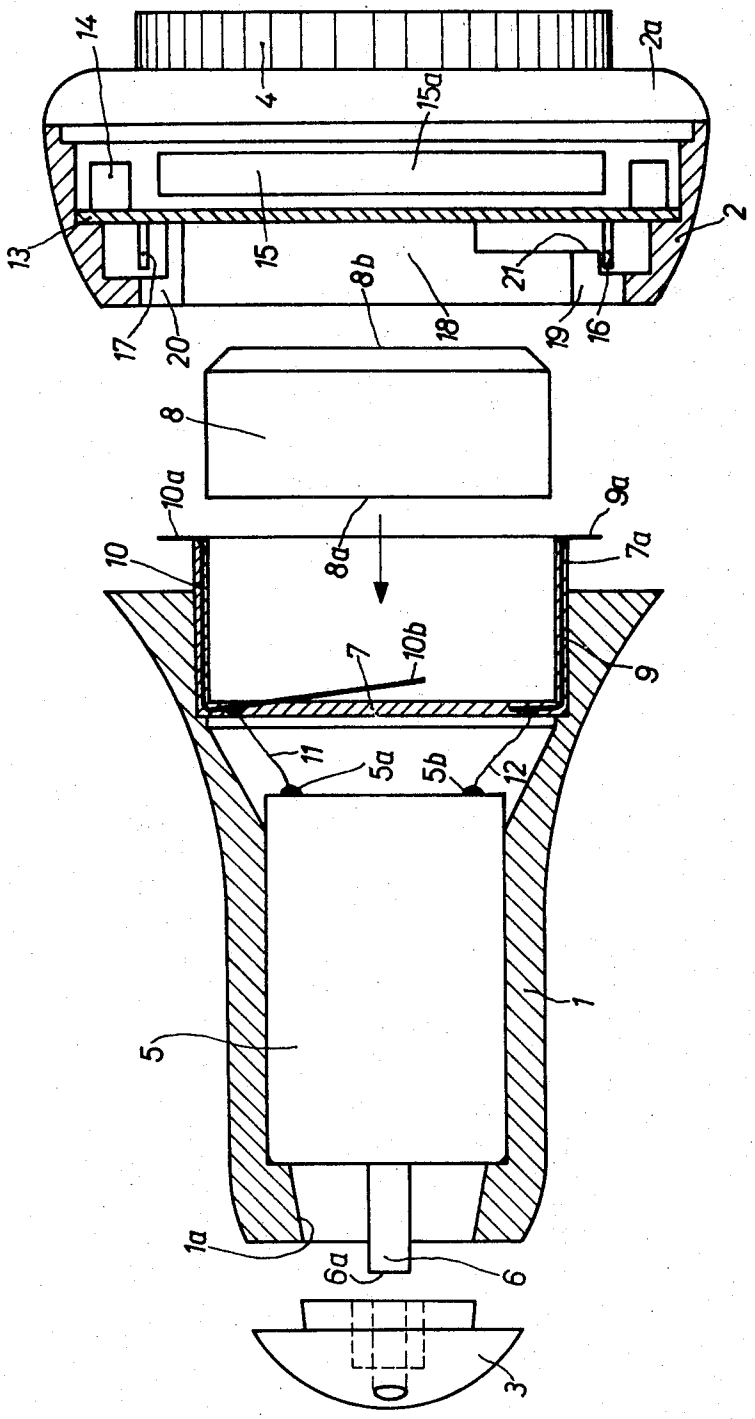

14
4
15a
2a
13
15
8b
21
2
17
20
18
19
16
8
10a
9a
8a
7a
10
7
10b
9
11
5a
5b
12
1
5
1a
6a
6
3

FIG. 2

EAR HEARING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved construction of hearing apparatus with a sound receiver or listening device, a voltage source, an amplifier, a signal receiver, and a gain control.

The known hearing devices which can be worn in the ear of the user typically possess a first component which can be inserted into the auditory or hearing channel and a second component which is situated externally of the auditory channel in the ear. Such type hearing apparatuses therefore can be considered to be known as such to the art.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a new and improved construction of hearing apparatus which essentially can be inserted as a unit in the hearing or auditory channel, so that it is practically invisible from the outside.

Another object of the present invention relates to a new and improved construction of hearing apparatus which can be comfortably worn by the user and is designed such that it can be essentially inserted into the auditory channel of the wearer without discomfort, and rendering same practically non-visible to a casual observer.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the hearing apparatus of this development is manifested by the features that there is provided a bipartite or two-part housing of substantially elongate configuration which is designed to be inserted into the auditory or hearing channel. In the lengthwise direction of the housing, there are juxtapositioned the output transducer, the voltage source, the amplifier, the input transducer and the gain control. The output transducer is arranged in a first housing part, and the amplifier, the signal receiver and the gain control are arranged in a second housing part releasably connected with the first housing part. The voltage source is arranged between the sound receiver and the amplifier at the connection location of both housing part with one another.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic side view of a hearing apparatus which can be inserted in the auditory or hearing channel of the user;

FIG. 2 is a longitudinal sectional view through the hearing apparatus depicted in FIG. 1 showing the components thereof in an exploded condition; and

FIG. 3 is a fragmentary sectional view through that end of the hearing apparatus of FIG. 1 which possesses the sound outlet opening.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIG. 1 there is depicted in side view the shape of the housing H of the

hearing apparatus or device **100.** This elongate extending housing H is designed to be rotationally symmetrical with respect to its lengthwise axis and will be understood to encompass a first housing part or component **1** and a second housing part or component **2** which can be detachably connected with the first housing part **1** in a manner fully to be described hereinafter. The housing part **2** is closed by a cover member **2***a* or other suitable closure device. At the end of the housing facing away from the second housing part **2** the first housing part **1** carries a protective cap **3** which protects the sound outlet opening **1***a*.

At the cover **2***a* of the second housing part or component **2** there is mounted at the outside thereof an accessible gain control **4,** preferably incorporating a conventional potentiometer which can be actuated by a knob **4***a*, so that when the hearing apparatus **100** is inserted into the auditory channel of the user it is accessible from the outside for the purpose of controlling the sound intensity.

The cross-section of the housing H conically tapers in the direction of its lengthwise axis towards the end of the first housing part **1** which carries the protective cap **3.**

FIG. **2** shows a sectional view along the lengthwise axis of the hearing apparatus and wherein the individual components thereof have been portrayed in an exploded view to facilitate the showing thereof and to more readily explain the underlying concepts of the instant development.

Continuing, it will be seen that a output transducer **5** is arranged in the first housing part **1,** the output transducer **5** possessing a sound departure tube **6** which piercingly extends through the opening **1***a* provided at the end of the housing part **1.** The protective cap **3** is inserted into this opening **1***a* in order to protect the outlet opening **6***a* of the tube **6** against contamination by dirt or other foreign particles.

A hollow cylindrical holding or retaining element **7** is fixedly seated in the end of the first housing part **1** which is opposite the sound outlet opening **1**a. This retaining element **7** serves to receive a substantially cylindrically constructed voltage source **8.** The retaining element **7** protrudes in the direction of the lengthwise axis of the housing part **1** past such, as will be clearly seen from FIG. **2.**

Two contact elements **9** and **10** are accommodated at the wall **7***a* of the retaining or holding element **7.** These contact elements **9** and **10** are flexed at their ends **9***a* and **10***a* respectively and protrude from the retaining or holding element **7.**

Both of the contact elements **9** and **10** are electrically coupled via the conductors or lines **11** and **12** with the respective input terminals **5***a* and **5***b* of the output transducer **5.** The contact element **10** possesses a contact tongue **10***b* which, when the voltage source **8** is inserted into the retaining or holding element **7,** comes into contact therewith by means of one pole **8***a* thereof.

The second housing part **2,** closed by means of the cover **2***a*, and which carries the gain control **4,** is internally provided with a carrier or support plate **13** constructed as a printed circuit and supported upon projections or protuberances, and on this support plate **13** there are accommodated the electrical components **14** of the amplifier. The components **14** are arranged at the outer edge of the substantially circular-shaped sup-

port plate **13** along the periphery thereof, so that space is provided at the center thereof for installing thereat an input signal receiver **15**, which can be considered to constitute a microphone or an induction coil for inductive signal reception serving as the listening or hearing coil, and generally indicated by reference character **15***a*.

Contact springs or blades **16** and **17** are mounted at the underface of the support plate **13** and which, when the hearing apparatus is assembled together come into contact with the ends **9***a* and **10***a* respectively of the contact elements **9** and **10** respectively.

Upon assembly of both housing parts **1** and **2** the protruding portion of the retaining or holding element **7** accommodating the voltage source **8** is introduced into the hollow compartment or space **18** provided in the housing part **2**. As a result, the contact element ends **9***a* and **10***a* are guided through slots **19** and **20** at the floor of the housing part **2** and following rotation of the first housing part **1** such contact element ends travel upon run-on surfaces of ridges or rims **21** provided at the housing part **2**, only one of which is visible in the drawing, so that there is provided a bayonet-type releasable closure connection between the housing parts **1** and **2**. The ends **9***a* and **10***a* of the contact elements **9** and **10** respectively, thus serve both for the electrical as well as mechanical connection of both housing parts **1** and **2**.

Instead of using the aforedescribed bayonet connection it would be also possible to use other types of connections, such as a threaded connection, in which case the retaining element **7** and the base of the housing part **2** each would be provided with suitable threading.

With the hearing apparatus **100** assembled together the second pole **8***b* of the voltage source **8** which extends into the hollow compartment **18** comes into contact with a contact provided at the underside of the support or carrier plate **13**.

In FIG. **3** there is shown in sectional view the end of the first housing part **1** which carries the protective cap **3** and with the sound receiver or listening device **5** mounted therein. The protective cap **3** is introduced into the slightly conically tapering opening **1a** where it is fixedly clamped or seated.

The protective cap **3** possesses a cylindrical hollow compartment or space **22** which is closed at one side, as indicated as **22***a*, and the lengthwise axis of which is in alignment with that of the sound outlet tube **6**. Throughpassage openings **23**, only two of which are visible, are arranged at the protective cap around the hollow compartment **22**. The lengthwise axes of such throughpassage openings **23** are essentially parallel to the lengthwise axis of the hollow compartment **22**.

The sound waves generated by the sound receiver **5** depart from the sound outlet tube **6** into the hollow compartment **22**, from which location such sound waves arrive at the compartment **24** between the sound receiver or listening device **5** and the protective cap **3**. From the location of the compartment **24** the sound waves can escape through the throughpassage openings **23** out of the hearing apparatus.

By means of the protective cap **3** there is prevented penetration of dirt particles which might be located in the auditory channel of the user through the opening **6***a* of the sound outlet tube **6** into the output transducer **5**.

In order to be able to clean the protective cap **3** and the possibly clogged throughpassage openings **23** it is readily possible to remove such protective cap from the housing part **1**.

Owing to the chosen arrangement of the individual components essentially along one axis it is possible to impart to the hearing apparatus an essentially elongate configuration which is accommodated to the shape of the auditory channel and to maintain small the dimensional size of the hearing apparatus.

Removal or exchange of the voltage source **8** can occur quickly and without effort by merely separating both housing parts from one another in the described manner.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. A hearing apparatus arranged to be inserted into the auditory channel of the user, said apparatus including:

a. a substantially elongate two-part housing;
b. means for releasably interconnecting the two portions of said housing;
c. an output transducer arranged in a first portion of said housing;
d. an input transducer capable of magnetic and electrical reception, an amplifier and a gain control arranged in the second portion of said housing;
e. a voltage source;
f. means for receiving and retaining said voltage source in said first housing portion between said output transducer and said amplifier when said portions of said housing are releasably connected at the region of interconnection;
g. said output transducer having a pair of input terminals;
h. said amplifier having contacts; and
i. said retaining means being provided with two contact elements which are fixedly connected, respectively with the two input terminals of said output transducer and releasably connected with the contacts of said amplifier, one such contact element coming into contact with one pole of said voltage source whereas the other pole of said voltage source is coupled with the amplifier.

2. The hearing apparatus as defined in claim **1**, wherein the second housing part is provided with ridge means, the ends of said contact elements being constructed as protruding extended portions which engage in a bayonet-closure like fashion behind the ridge means of the second housing part and contact the contacts of the amplifier.

3. The hearing apparatus as defined in claim **1**, wherein the retaining device is provided with threading and the first housing part is connected by means of the threading of the retaining device with the second housing part.

4. The hearing apparatus as set forth in claim **1**, and;

a. said amplifier comprises a support plate in the form of a printed circuit, one face of said support plate being provided with contacts which come into contact with said contacts of said retaining device and said voltage source; and
b. components of said amplifier being arranged about the periphery of said support plate on the other side thereof.

* * * * *