Sept. 28, 1965 W. GÜTTNER ETAL 3,209,080

ELECTRICAL HEARING AID

Filed June 29, 1961

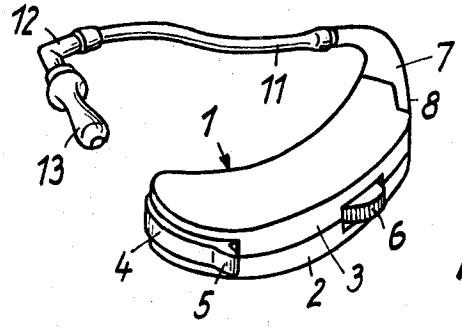

Fig. 1

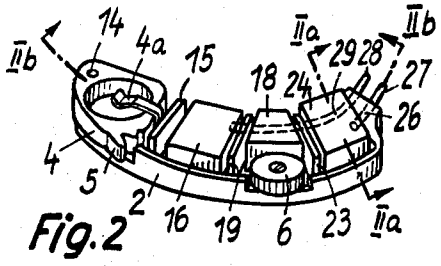

Fig. 2

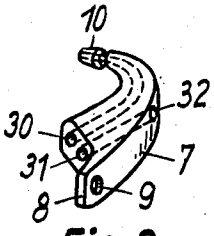

Fig. 3

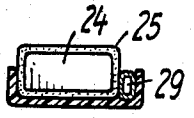

Fig. 2a

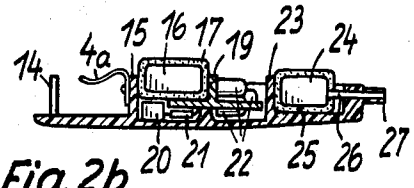

Fig. 2b

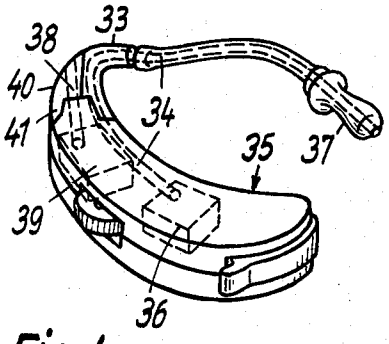

Fig. 4

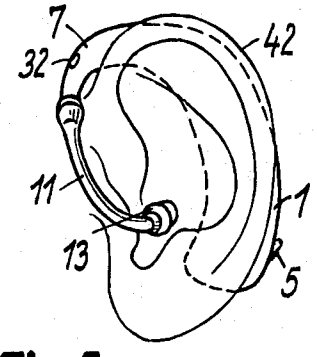

Fig. 5

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ELECTRICAL HEARING AID

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7 Claims. (Cl. 179—107)

This invention is concerned with an electrical hearing aid to be worn in back of the ear, comprising a housing containing electrical components including the microphone, amplifier with regulating elements, battery and receiver, and having a hookshaped carrier portion which is free of electrical components, preferably removably connected with the housing and attachable to the upper part of the auricle.

The housing of a hearing aid which is worn in this manner, is thus positioned in back of the ear while the carrier portion extends toward the front of the ear. Accordingly, the microphone, which is disposed in the housing, is at a place lying in back of the ear. The entry or inlet opening through which the sound comes to the microphone is thereby provided as close as possible to the microphone, that is, at a place of the housing which is in back of the ear below and remote from the hooklike carrier. The sound inlet opening, also referred to as the speak-in opening, is thus frontally largely shielded by the auricle and also by the head. This is a disadvantage because sound waves generated in the course of a conversation come to the person who is hard of hearing, from the front and can be received and amplified only along a detour over a path extending in back of the ear.

The invention provides a hearing aid of the initially indicated kind, comprising means forming a sound-conducting line extending contiguous to the sound entry element of the microphone provided in the housing, such line extending to the end of the housing facing the carrier part and continuing in the carrier part or approximately parallel thereto to a microphone sound supply line which terminates in a preferably frontally visible sound inlet opening. This makes it possible that sound waves coming directly from the front can reach the microphone without going over a detour. The person hard of hearing is thus, with the use of the hearing aid according to the invention, in a better position to follow speech which a conversation partner directs at him from the front.

The hearing aid according to the invention comprises, in an exemplary embodiment, a carrier which contains in known manner an acoustic passageway forming the sound exit channel extending from the receiver to the ear piece. In addition, this carrier contains an acoustic passageway forming the sound inlet channel extending to the microphone, such latter channel terminating in the region of the greatest curvature in a frontally visible opening of the convex wall of the carrier. The carrier which is constructed in this manner is advantageously plugged to tubular studs extending respectively from the receiver sound exit line and the microphone sound inlet line forming parts of the housing. The fastening of the carrier on the housing is effected by means of an extension which may be screw connected to the housing.

The receiver is advantageously disposed in the housing about midway of the longitudinal extent thereof and the sound exit line to the ear piece is carried past a narrow side of the microphone which is positioned ahead of the receiver. The sound exit line extending from the receiver is formed by a tubular part which is flattened at least at the portion thereof which passes along the microphone.

The flattened portion of this tubular part is thereby positioned in parallel with the narrow side of the microphone, thus providing for a space saving disposition of the sound exit line.

The various objects and features of the invention will appear from the description which will be rendered below with reference to the accompanying drawing showing in perspective representation and in sectional views examples of details of hearing aids constructed according to the invention.

FIG. 1 shows an embodiment of the hearing aid in perspective view;

FIG. 2 shows the housing with the cover detached therefrom;

FIGS. 2*a* and 2*b* show sectional views taken respectively along lines II*a*—II*a* and II*b*—II*b* in FIG. 2;

FIG. 3 shows the carrier part of the hearing aid illustrated in FIG. 1;

FIG. 4 shows in perspective view an embodiment of a hearing aid wherein the carrier is made of two parts, one part containing only the sound exit line extending from the receiver to the ear piece, while the other part contains the sound inlet line extending to the microphone; and

FIG. 5 shows a hearing aid made in accordance with the invention in its position in connection with the ear.

The acurately shaped housing **1** which is made of synthetic material is constructed of two shells **2** and **3**. The housing contains a drawer **4** for receiving the battery, such drawer being pivotally journalled at **14** and being provided with a handle **5**. From the convex outer wall of the housing extends part of the sound volume adjusting member **6**. At the end of the housing **1** opposite the pivoted drawer **4** is disposed the carrier **7** which is curved hooklike and has an extension **8** provided with a hole formed therein (FIG. 3) through which a screw is projected for firmly fastening the carrier to the housing. The carrier terminates in a nipple **10** (FIG. 3) to which is attached a flexible hose **11** carrying an angular member **12** which in turn carries the flexible ear piece **13** to be inserted into the aural opening of the ear.

FIG. 2 shows the shell **2** of the housing with the component parts as they become visible after removal of the shell **3** and detachment therefrom of the carrier **7**. Adjacent the battery drawer **4** is a partition **15** carrying the contact spring **4***a*, followed by the receiver **16** which is wrapped in foam rubber **17** (FIG. 2*b*). Next to the receiver **16** and partially thereunder are disposed parts of the amplifier **18**. The amplifier parts, including also the volume control with the regulator **6**, are mounted on a bracket **19**. Below the bracket **19**, and fastened thereto, are positioned capacitors and resistors which are schematically indicated respectively at **20** and **21**, and at the portion of the bracket **19** which is next to the telephone **16**, are positioned transistors **22** (FIG. 2*b*). Next to a partition **23**, which delimits the amplifier space, is disposed the microphone **24** which is wrapped in foam rubber **25**.

From the microphone **24** extends an acoustic passageway or sound inlet line **26** terminating in a tubular part **27** which projects from the housing. From the receiver **16** extends an acoustic passageway or sound exit line **29** which terminates in a tubular part **28**, the latter likewise projecting from the housing. The sound exit line **29** which extends from the receiver **16** to the tubular member **28** is of oval cross-section at the portion thereof which passes along the microphone **24** (see FIG. 2*a*). The carrier **7** through which extend the sound channels **30** and **31**, as shown in FIG. 3, is plugged to the tubular connecting members **27** and **28**. The sound exit channel **30** extends to the nipple **10** to which is connected the flexible hose **11** leading to the ear piece **13**, and the sound inlet channel **31**

(for the microphone 24) terminates in the sound inlet opening 32.

The hearing aid illustrated in FIG. 4 corresponds substantially to the hearing aid described with reference to FIGS. 1 to 3. The only difference resides in the construction of the carrier, indicated in FIGS. 1 and 3 at 7, which in FIG. 4 is made in two parts, one part 33 containing only the sound exit channel 34 leading from the receiver 36 to the ear piece 37. The sound inlet channel 38 leading to the microphone 39 extends through the other part 40 which is fastened to the housing 35 by means of an extension 41. The part 40 can also be constructed as a tube which is screw connected with the connecting tube 27 (FIGS. 2 and 2*b*), it being of course assumed that appropriate threads are provided for this purpose.

As will be seen from FIG. 5, the housing (1 in FIG. 1 or 35 in FIG. 4) is in operation positioned in back of the ear 42 while the carrier 7 (33, 40 in FIG. 4) extends forwardly of the ear 42. The sound inlet opening 32 (opening of inlet channel 38 in FIG. 4) thus comes to lie at a point which is in the use of the hearing aid directed toward the front. Sound waves directed toward the person wearing the hearing aid can accordingly directly enter at the sound inlet opening such as 32 for direct propagation without any detour, to the microphone 24 over the lines 31 and 26 (FIGS. 2 and 3) or to the microphone 39 over the line 38 (FIG. 4). The microphone converts the sound waves into electrical signals which are amplified in the amplifier such as 18 (FIG. 2) and made audible again in the receiver such as 16 in FIG. 2 or 36 in FIG. 4. The amplified sound waves are in FIGS. 1–3 conducted to the aural passage of the ear 42 over the line 29, channels 30, 11, and through the ear piece 13, while being in FIG. 4 conducted to the aural passage over the lines 34 and the ear piece 37.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

We claim:

1. An electrical hearing aid comprising a housing constructed to be disposed and worn behind the ear, said housing containing components including a battery, a microphone, an amplifier with regulation means and a receiver, a hooklike curved carrier free of electrical components, which is to be worn upon the upper part of the auricle, means forming an elongated tubular acoustic passageway for conducting sound waves from exteriorly the housing to said microphone, said acoustic passageway terminating at its outer end in a frontally directed opening near the upper part of the auricle when the hearing aid is worn, with said acoustic passageway extending rearwardly over the auricle to said microphone.

2. An electrical hearing aid comprising a housing constructed to be worn behind the ear, said housing containing components including a battery, a microphone, an amplifier with regulation means and a receiver, a hooklike curved carrier free of electrical components, which is to

be worn upon the upper part of the auricle, means for removably connecting said carrier with said housing, said housing having an elongated tubular acoustic passageway formed therein for conducting sound waves to said microphone, said carrier having an elongated tubular acoustic passageway formed therein communicating at its connection end with the free end of said first-mentioned passageway, and terminating at its opposite end in a frontally directed and frontally visible sound inlet opening, said second-mentioned passageway extending rearwardly over the auricle to said first-mentioned passageway.

3. A hearing aid according to claim 2, comprising a bracketlike portion extending from said carrier for mounting the carrier in assembly with the housing.

4. A hearing aid according to claim 2, wherein said second-mentioned acoustic passageway terminates in a sound inlet opening in the portion of the wall of said hook-like carrier which has the greatest convex curvature, said carrier also having a tubular acoustic passageway formed therein which communicates at one end, with the receiver and at the opposite end with the ear piece of the device.

5. A hearing aid according to claim 4, comprising means forming a tubular acoustic passageway for conducting sound waves from said receiver, tubular studs extending from the housing and communicating respectively with the line to said microphone and the line from said receiver, said studs extending in assembled position of said carrier into the respective acoustic passageways formed therein.

6. A hearing aid according to claim 4, wherein the receiver is disposed in said housing within a centrally extending region thereof while the microphone is disposed therein near the end thereof facing said carrier, and means forming an acoustic passageway extending from said receiver alongside a narrow side of said microphone to the ear piece of said hearing aid.

7. A hearing aid according to claim 6, comprising a tubular member disposed in said housing and forming said acoustic passageway from the receiver, said tubular member being flattened at least for the portion thereof which passes along the narrow side of said microphone, with the long cross sectional axis of said flattened portion extending in parallel with said narrow side.

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