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(54) Title: ADJUSTMENTOF COMPONENTS IN AUDIO DEVICES

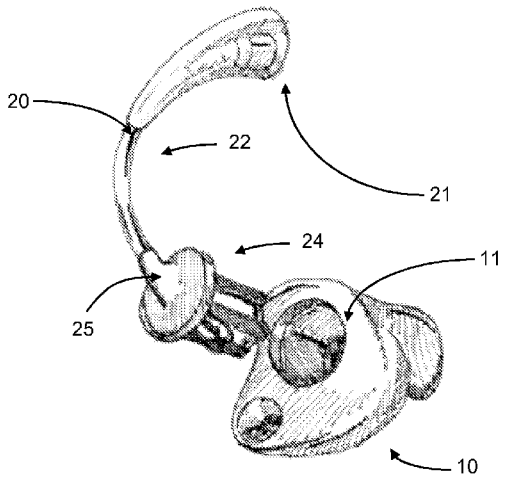


Fig. 3

(57) Abstract: A hearing aid assembly including a behind the ear device, an in the ear device, and a cable adapted to be connected between the behind the ear device and the in the ear device. The cable may be an electrical connection or a sound pipe. In order to allow correct fitting of the assembly, the effective distance between the device can be altered using a repositionable attachment, without requiring alteration of the length of the cable by the fitting clinician.

ADJUSTMENT OF COMPONENTS IN AUDIO DEVICES

TECHNICAL FIELD

The present invention relates to the correct physical positioning of the components of auditory devices.

BACKGROUND TO THE INVENTION

A certain category of hearing aid users are best assisted using a combination of hardware components for the ear which is being treated. A sound processor device, typically including one or more microphones, is provided in a behind the ear (BTE) device. A receiver unit is then provided in the ear canal, either partially or totally in the canal, in order to provide amplified acoustic stimulation for the user. The receiver is connected to the BTE device using an electrical cable which passes over or under the ear and then into the receiver.

It has been recognised that, for some users, the combination of a cochlear implant with acoustic stimulation in the same ear has significant benefits. In some such arrangements, a BTE device is provided, which is electrically connected via a cable to the receiver in the ear canal. The BTE device provides sound processing and outputs an electrical signal to the receiver via the cable.

The term ITE device is intended to encompass a device which is wholly or partially within the ear canal, whether for a cochlear implant system, hearing aid, or other hearing prosthesis.

An electro-acoustic system is commercially provided under the Duet brand by Advanced Bionics Corporation (ABC). In this device, the receiver is integrated into the BTE device. The acoustic connection between the BTE device and the ear canal is a sound pipe for channelling the acoustic signals – the acoustic signals are generated within the BTE device.

US Patent Nos. 6748094, 7020298 and 7142926, all assigned to ABC, describe the connection of the connection of the earhook to a BTE sound processor via different types of electro-mechanical connectors.

WO 2008//074898 by Phonak A.G. discloses affixing a sound tube or wire using a channel with protruding ribs within the hearing aid body.

One issue with all such arrangements, in which a BTE device is electrically connected to a receiver in the ear, or mechanically connected by a sound tube to an ITE, relates to the connecting cable or tube. A hearing device is worn more or less constantly by the user and consequently issues such as comfort and cosmetic appeal are very important. The cable is also the part of the system which is typically most vulnerable to damage. In many BTE hearing aid systems, an S shaped cable is used to provide some degree of adjustment and accommodation between the receiver and the BTE device. This allows for a small number of standard lengths of cable, and earhook combinations, to be used for all users.

It is an object of the present invention to provide a BTE device having a connection to an ITE component which can be readily adjusted when fitting to adjust for variations in user anatomy.

SUMMARY OF THE INVENTION

In a broad form, the present invention provides an arrangement in which the effective length between the BTE unit and an ITE component can be adjusted by repositioning of the attachment where the cable or tube attaches to the ITE shell component. In the case of an electrical connection, adjustment is possible without altering the electrical attachment.

According to one aspect, the present invention provides a hearing aid assembly, including a BTE device, an ITE device, and a cable electrically connecting the BTE device and the ITE device, the cable connecting to the ITE device at a repositionable attachment, wherein repositioning of the attachment alters the effective distance between the ITE and BTE without requiring alteration of the cable length.

According to another aspect, the present invention provides a hearing aid sub-assembly, including an earhook adapted for connection to a BTE device, a receiver, and a cable electrically connecting the receiver and BTE device, the receiver being operatively adapted to be fitted to an ear fitting.

According to a further aspect, the present invention provides a hearing aid assembly, including a BTE device, an ITE device, and a sound tube connecting the BTE device and the ITE device, the sound tube connecting to the ITE device at a repositionable attachment, wherein repositioning of the attachment alters the effective distance between the ITE and BTE without requiring alteration of the sound tube length.

The term hearing aid assembly refers to both a hearing aid per se, and to devices which include a hearing aid, for example the acoustic stimulation component of a combined acoustic and electrical stimulation device, or a similar component of any other type of hearing prosthesis.

BRIEF DESCRIPTION OF THE DRAWINGS

Illustrative embodiments of the present invention will now be described with reference to the accompanying figures, in which:

Figure 1 is a schematic illustration of an implementation of a hybrid BTE device;

Figure 2 is a photograph illustrating an implementation of the present invention in use;

Figure 3 is an illustration of an implementation of the present invention, showing the face plate assembly;

Figure 4 is a view, partly showing hidden components, of the ear hook connection arrangement according to an implementation of the present invention;

Figure 5 is a detailed view of the implementation of Figure 4;

Figure 6 is photograph showing connections to a receiver;

Figure 7 is a perspective view showing assembly of the faceplate, receiver and ear shell according to an implementation of the present invention;

Figure 8 is a perspective exploded view of a sound tube implementation of the present invention; and

Figure 9 is an assembled perspective view of the implementation of Figure 8.

DETAILED DESCRIPTION

The present invention will be mainly described with reference to a particular illustrative example, which is a device intended for use in a hybrid electrical and acoustic stimulation system. However, it will be appreciated that the present invention is applicable wherever a cable or tube is used to connect a BTE device to an ITE device. It may be applied to a cochlear implant system such as a hybrid electrical/acoustic system, a hearing aid system, or any other suitable hearing prosthesis. It may be applied to a system with implanted components, or a fully external system. The ITE device may be connected to the BTE device by an electrical cable, a sound tube or any other suitable arrangement. The ITE device may be acoustic only, or may include other functions, for example electrical or communications components. The ITE device may be solely a carrier for an acoustic signal generated by the BTE device, or may even be used purely to assist with mechanical support for a BTE device. It will be appreciated that the present implementation is described for illustrative purposes, and its features are not intended to be limitative of the scope of the present invention. Many variations and additions are possible within the scope of the present invention.

Correctly selecting the length of the cable is important for several reasons. A neat cable is visually discreet and more aesthetically pleasing. One of the major reasons for rejection of hearing aids, and especially BTE devices, is a lack of cosmetic acceptability. If a cable is correctly fitted in accordance with implementations of the present invention, the combined assembly has a more homogenous appearance, and blends into the shape of the pinna in a less visible way.

A further issue with BTE devices is that in some cases they can be quite heavy, and hence uncomfortable for the user. A cable of incorrect length or orientation can exacerbate this, by introducing tensions between the BTE and the ITE components. It is also important the cable has the correct stiffness characteristics to avoid this outcome. A stiff or semi-stiff cable can provide significant benefit in keeping the BTE in place and reducing the pressure on the pinna, but only when it is very closely matched to length and rotation. Any

mismatch will create difficulties. However, a particularly advantageous outcome of a cable of correct length and placement is that via the cable the ITE can bear part of the weight of the BTE device and assist in retention of the assembly as a whole.

Figure 1 illustrates the components of an implementation of the present invention for a hybrid system. A BTE device 40 is positioned behind the pinna 50, with an ear hook, cable and receiver assembly 20 extending from BTE device 40 over pinna 50. A coil assembly 30 is also connected, for example via a removable connector, to BTE device 40, for transferring power and data to an implanted cochlear implant (not shown). It will be appreciated that the specific details of functional operation of the BTE device 40 and coil assembly 30 are not critical to the present invention, which is concerned with the mechanical connections. Similarly, it will be apparent that alternative positioning of the cable is possible in suitable systems, for example under the ear.

The ear hook assembly 20 terminates in a circular face plate 24, with the receiver assembly (not visible in this view) depending from it. Face plate 24 is received within the ear shell 10. As will be explained in more detail below, by rotating face plate 24, the effective length of the connection between the ear shell 10 and BTE device 40 can be changed, without interfering with the actual mechanical or electrical connections of the cable itself.

Figure 2 is a photograph illustrating an implementation of the present invention. The ear hook 21, cable 22 and face plate 24 can be seen.

Figure 3 illustrates one implementation of an assembly 20 according to the present invention. At one end cable 22 is connected to ear hook 21, using conventional mechanical and electrical connections. Cable 22 is connected at the other end to face plate 24, and then to the receiver unit 23 using conventional electrical connections. Cable 22 is connected through raised cable entry point 25, which fits around cable 22. It will be apparent that raised opening 25 will maintain a consistent exit orientation between cable 22 and face plate 24.

One implementation of the ear hook connection arrangement is more fully illustrated in figures 4 and 5. The end of cable 22 is stripped into two electrical

leads 26, 27 and a separate bundle of Kevlar strands 31. The electrical connections are soldered to appropriate points on socket 28. The Kevlar strands 31 are glued to the exterior of socket 28, at such length that they bear the pulling stresses, instead of the stresses being transferred to the soldered connections of leads 26, 27. The pre-assembled unit is then overmolded with a 'pre-molding', and that is finally overmolded with the earhook itself 21. Socket 28 makes electrical connections with BTE device 40 via plug 41, which is integral therewith.

The receiver used with this implementation of the present invention may be of any suitable type. For example, suitable receivers are available from various suppliers, for example Knowles and Sonion.

In a conventional connection, two or three soldering points are provided at the receiver top side, the soldering being performed after passing the cable through the face plate. Figure 6 illustrates a conventional receiver 23 connected through a face plate 65, with soldered connections 60. In contrast, in the implementation of the present invention illustrated in figure 7, the connection is similar, but the Kevlar strands 31 of the cable are also attached (glued) to the face plate so as to absorb the tension load (connections are not visible in this view).

Figure 7 illustrates the receiver end structures according to an implementation of the present invention. Receiver unit 23 is operatively received within the ear shell 10, via opening 11. It will be appreciated that the face plate 24 and opening 11 are circular in this implementation, allowing for rotation between the face plate 24 and the opening 11. However, alternative shapes could be used in suitable implementations. As the face plate is rotated relative to ear shell 10, the cable may have a greater or shorter effective length, by virtue of the shifting cable entry point and angle, and the cable stiffness.

A preferred implementation of the present invention uses a type of cable that has a layer of Kevlar strands under the outer insulation for extra strength and for maximum protection against breaking. The Kevlar strands are very strong but must be glued to the plastic separately to act properly as a strain relief. This solution is correctly applied at the earhook side only. Alternative

approaches to affixing the cable, involving adjustment and soldering by the audiologist or other professional, do not allow for the affixing of the Kevlar or other strengthening strands of the cable at the ITE end. Accordingly, these approaches have the disadvantage that as the Kevlar layer is not attached, it cannot help to protect the cable against breaking, or the electrical connections from strain, from an external pulling force.

A suitable cable may be, for example, 1.4mm in diameter, and constructed with a central high tension fibre, a conductor, and insulator, a shield and a sheath. Tensile strength is preferably above 49N per metre for one minute. Insulation resistance is preferably above 100Ω per metre at 150 V DC and resistance of the conductor is preferably less than 1Ω per metre.

Thus, without interfering with the primary mechanical or electrical connections of the cable, the assembly may be adjusted for optimum fit, in situ, by the audiologist. The effect on the resulting comfortable positioning of the ITE and BTE in/on the ear depends on cable stiffness, face plate diameter, acceptable adjusting angle, and it can typically amount to about 5mm.

Adjusting the cable length with this rotational system influences the exit angle of the cable from the ear shell. For optimum aesthetics, it is preferred that the angle of rotation is limited, for example to 30 degrees.

The total required adjustment has been determined against a model using anatomical measurements of a sample of the general population, so that appropriate parameters could be determined. The model indicates that for 95.0% of the population (i.e. 2 standard deviations) the cable requires 7.5mm of length tuning, from 30 to 37.5mm (measured to the exterior of the ITE unit). For 99.7% of the population (3 standard deviations), the cable requires 13.4mm of tuning (29.6 to 43mm). Accordingly, it can be seen that if three different alternative lengths were manufactured, this would allow adjustment to cover the required population. Depending upon the geometry, materials and so forth chosen, in most cases two to four different lengths will be required.

The ITE component according to this implementation of the present invention is assembled from two main elements: a made-to-measure plastic part (called the earshell) fitting exactly in the ear canal of the individual recipient, and

a standard face plate. During the final adjustment by the audiologist, the face plate is rotated to the desired position.

The earshell is preferably custom manufactured from a mould of the user's ear. This process may be the same as that used to form a conventional ITE device, for example a hearing aid, and will accordingly not be described in detail. The earshell so produced needs to have an exposed surface and opening suitable for connection to the face plate. Whilst not preferred, non-custom earshells could be used, with corresponding detriment to comfort.

The adjustment of the rotational position of the face plate can take place whilst the whole assembly is fitted to the recipient, which allows the user to assess comfort before 'freezing' the position of the face plate. The fixation of the face plate can either be permanent (for instance glued) or re-adjustable (for instance snapped). Removing the face plate in the latter case is then performed preferably with a dedicated tool, only made available to trained audiologists. A removable fixation may also allow for later re-adjustment of the position for optimizing the wearer's comfort.

It will be appreciated that there are a variety of different arrangements by which the receiver may be fixed into the selected rotational position. In one implementation, illustrated in figure 7, the ITE shell 10 is equipped with a mass-produced interface ring 43 glued permanently in place. The face plate 24 fits to interface ring 43 by a rubber 'snapping' contour 42, and the rubber has an extension holding the receiver in a somewhat floating way. During assembly the receiver spout will make contact to the sound pipe in the lower portion of shell 10. Face plate 24 is preferably constructed so that for replacement or for re-orientating the cable exit angle, a cylindrical gripper tool must be inserted between face plate 24 and shell 10 to release the rubber snap.

A removable fixation allows replacing the entire electronic sub-assembly (earhook + cable + receiver) in case of necessity, while using the existing custom earshell. This will greatly facilitate servicing because these components can be replaced without having to reproduce the custom earshell. For example, a replacement unit can be provided and easily attached to the user's customised earshell, as a final solution or whilst servicing or repair is performed.

This arrangement also readily facilitates upgrading or replacing the receiver, without the delay and expense of re-moulding the earshell.

Whilst the implementation disclosed uses a circular, rotatable arrangement for the face plate, it will be appreciated that other repositionable fittings, for example having several selectable fixed orientations, may be used for providing the length adjustment.

An important practical requirement for an implementation of the present invention is to create a reliable fit between the industrially produced face plate and the custom-made earshell. The hearing aid industry works with established dedicated suppliers that have solutions for doing this with entire hearing aids. The challenge presented by the present implementation is significantly smaller, because hearing aids are equipped with a battery compartment which needs to be opened regularly by the recipient, unlike the present ITE device.

In practical implementations, it is desirable that the earshell and opening are designed so that they do not limit the ability to design alternative receivers, and so that the receiver assembly fits the sound channel 'blindly'. It is also desirable that the repositioning is not able to be performed readily by a user, as the adjustment is best done by a trained professional.

Alternatively, the mechanical design of the cable fixation may be to allow the user to remove and replace a pre-assembled unit, including the earhook, cable, face plate and receiver. That would allow self-servicing by the user in case of a failing cable or receiver.

A particular advantage of implementations of the present invention is that all the electrical connections and mechanical connections can be formed in a controlled way, prior to supply to the audiologist. This allows for a much more reliable arrangement, compared to adjustment regimes where the electrical connections need to be completed after final adjustment on the user. In the implementation described, one sub-assembly contains all the electronic components and delicate production steps. Manufacturing can be centralised and performed within a specialised plant. Manufacturing of the earshell is kept to its simplest form and can be executed by any local production centre with the correct software.

The present invention may also be implemented for a sound tube type arrangement, in which the sound is generated in the BTE device and passed through a tube to the sound pipe in the earshell. One implementation of this type is illustrated in figures 8 and 9. A custom earshell 10 is provided, as for the electrical version. The ear hook 53 has an internal tubular region, carrying sound produced by a receiver in the ITE assembly down the ear hook. The face plate 51 is attached to a portion of the tube 52, adapted to connect firmly and mechanically to ear hook 53. It will be understood that the angle of this attachment may be adjusted in use for comfort. It can be seen, for example from figure 9, that the precise angle selected for face plate 51 relative to shell 10 alters the effective length and configuration of the overall ITE and BTE assembly 50, so as to maximise comfort in use. Adjustment is performed in a similar way to that described in relation to the electrical implementation.

It will be understood that the connecting tube portion 52 connects at the ITE end to the sound path through the shell 10, so as to conduct the sound signal from the BTE device to the ear canal of the user. Although it is not necessary to maintain an electrical connection in such systems, the quality of sound delivered is critically dependant upon the quality of the mechanical connection. The present invention may be implemented so that the tube passes through an entry point with a specific angle, for example as shown, but adapted to receive the sound tube. The tube could be retained in a conventional way within the earshell, and adjusted in a similar way to the cable implementation.

CLAIMS:

1. A hearing aid assembly, including a BTE device, an ITE device, and a cable adapted to be connected between the BTE device and the ITE device, the cable connecting to the ITE device through a repositionable attachment, wherein repositioning of the attachment alters the effective distance between the ITE and BTE without requiring alteration of the length.

2. A hearing aid assembly according to claim 1, wherein the repositionable attachment is a face plate, which is rotatable relative to the ITE device, so as to alter the effective distance between the ITE and BTE.

3. A hearing aid sub-assembly, including an earhook adapted for connection to a BTE device, a receiver, and a cable electrically connecting the receiver and BTE device, the receiver being operatively adapted to be fitted to an ear fitting.

4. A hearing aid sub-assembly according to claim 3, wherein the receiver is adapted to be positioned in one of a plurality of positions when fitted to the ear fitting, the positions corresponding to different effective cable lengths between the BTE and the receiver.

5. A hearing aid assembly, including a BTE device, an ITE device, and a sound tube connecting the BTE device and the ITE device, the sound tube connecting to the ITE device at a repositionable attachment, wherein repositioning of the attachment alters the effective distance between the ITE and BTE without requiring alteration of the sound tube length.

6. A hearing aid assembly according to claim 5, wherein the repositionable attachment is a face plate, which is rotatable relative to the ITE device, so as to alter the effective distance between the ITE and BTE.

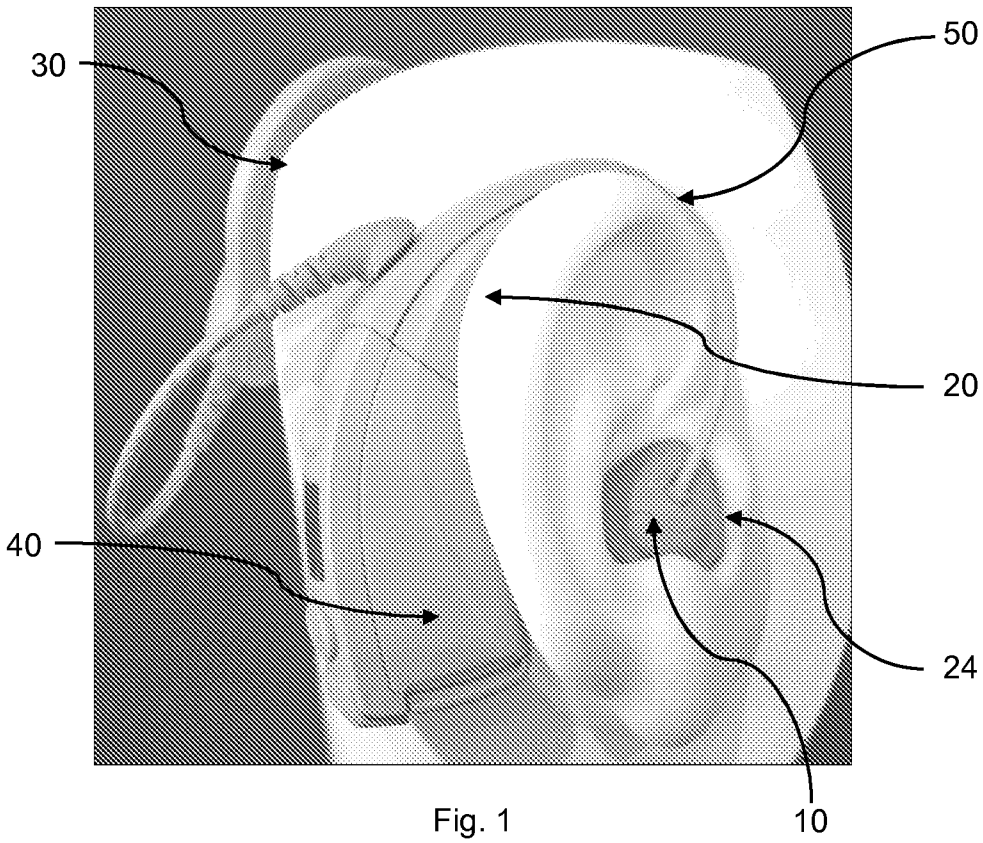


Fig. 1

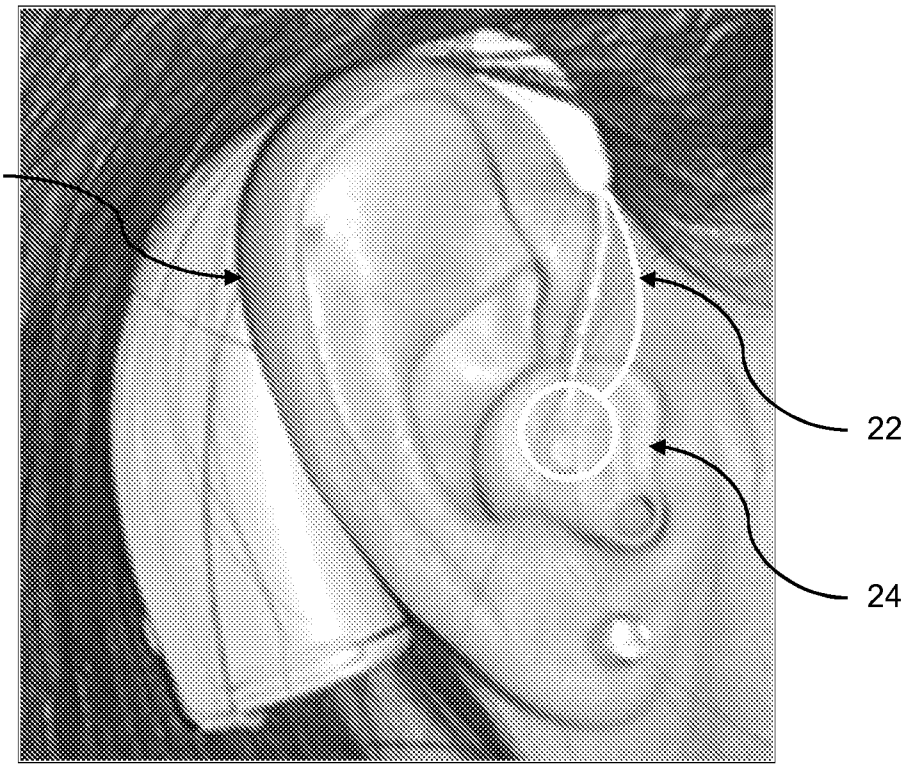


Fig. 2

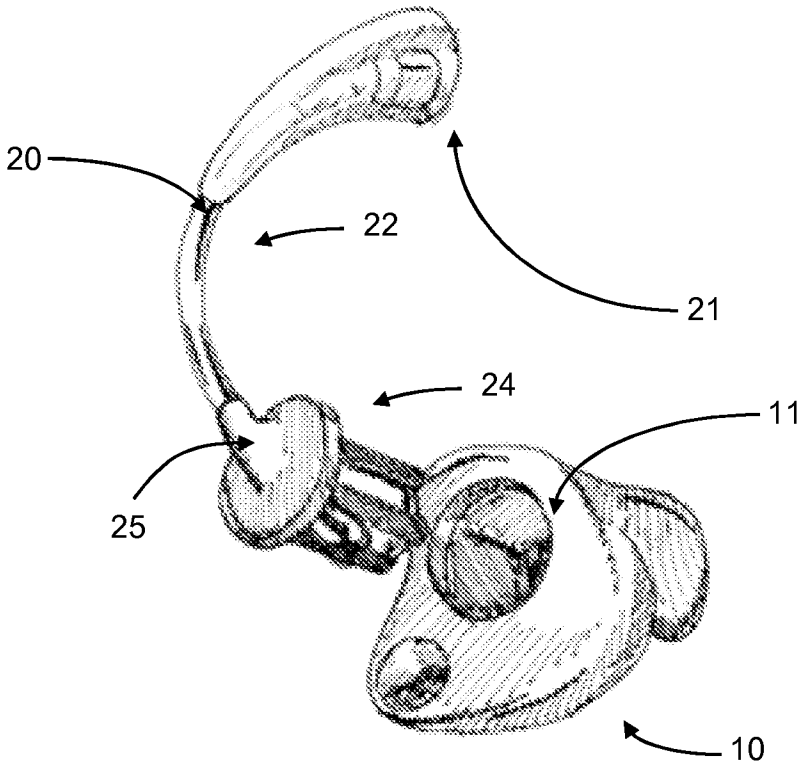


Fig. 3

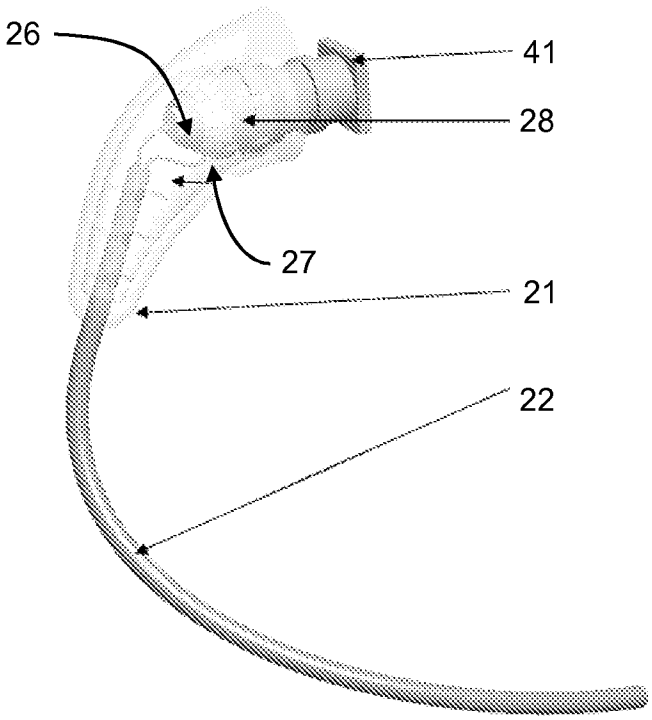


Fig. 4

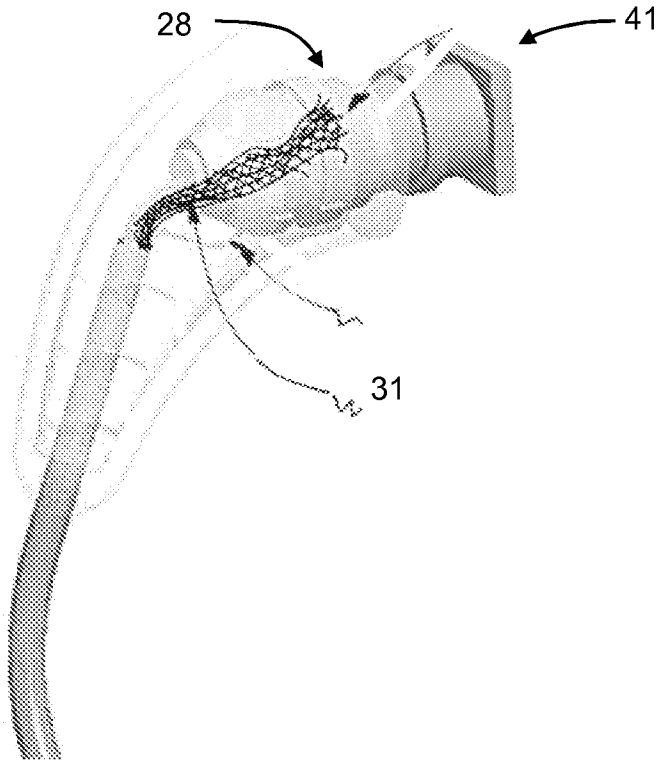


Fig. 5

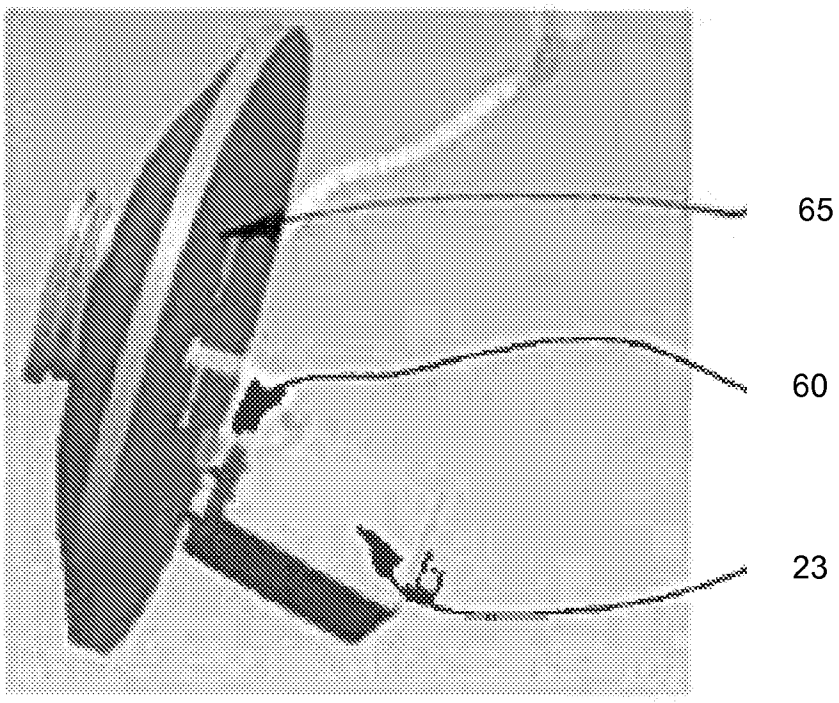


Fig. 6

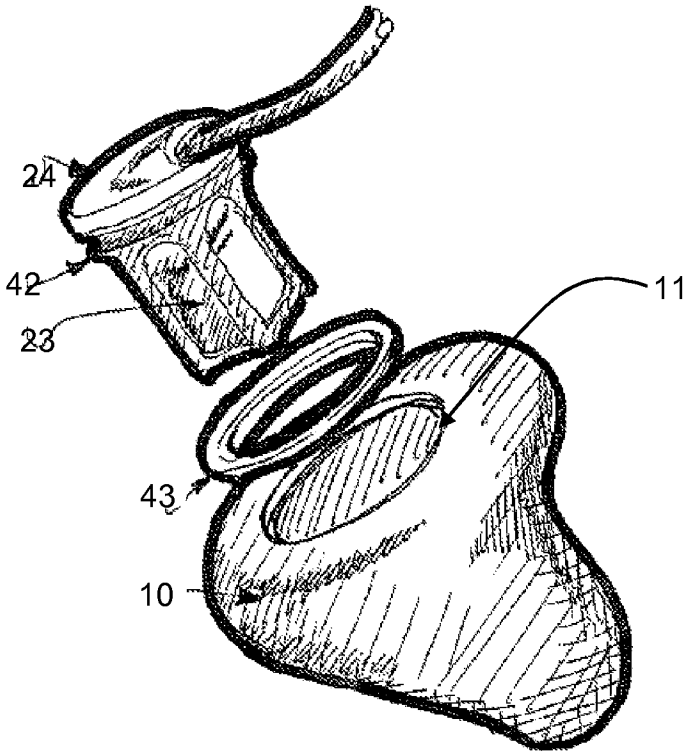


Fig. 7

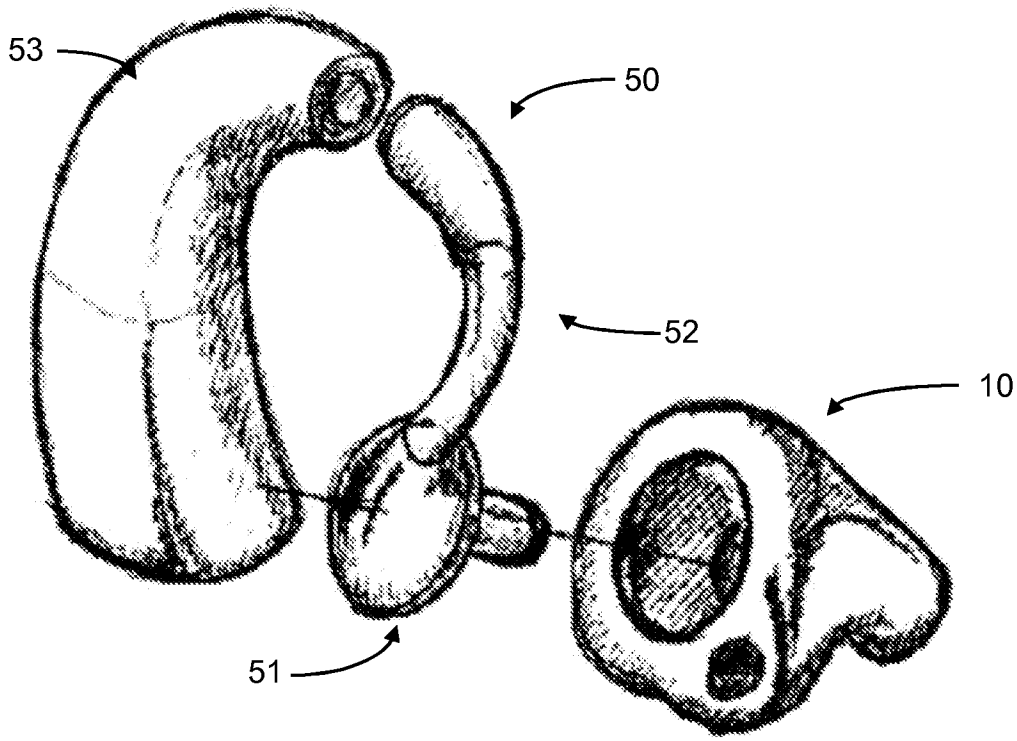


Fig. 8

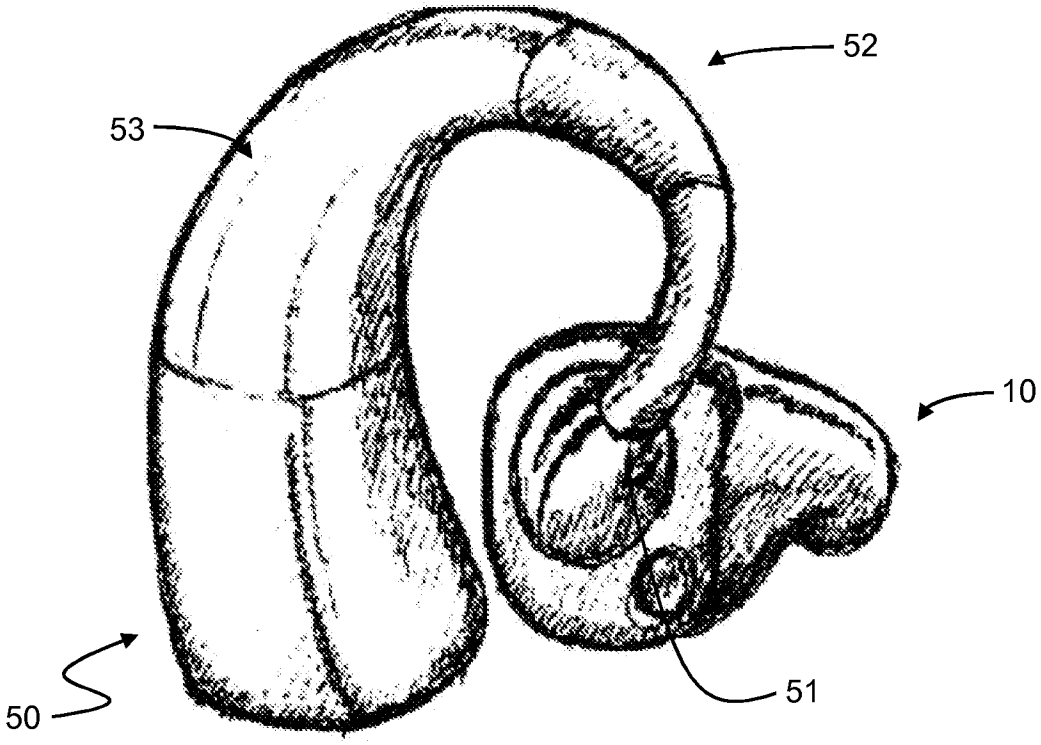


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/000262

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H04R 25/00 (2006.01) *A61F 11/00* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPOQUE (WPI & EPODOC) & Google Patents: Cochlear, ear implant, hearing prosthesis, hearing aid, ITE, BTE, earhook, reposition, alter, adjust, fit, change, rotate, swivel, turn , twist and like terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*.	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4727582 A (DE VRIES et al.) 23 February 1988 (Figs 1, 2 & 3; Col 4, Lines 21-68)	3, 4
A	US 7003876 B2 (CRAWFORD et al.) 28 February 2006 (See whole document specially drawings – Figs 2 & 5)	
A	US 4827525 A (HOTVET et al.) 2 May 1989 (See whole document specially drawings – Figs 6 & 9)	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 April 2010	12 APR 2010
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **DEVANAND NAGARAJAN** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2698

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/000262

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

As reasoned on the extra sheet : Supplemental Box 1

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Supplemental Box 1
(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1, 2, 5 & 6 are directed to a hearing aid assembly, including a BTE device, an ITE device, and a cable connecting to the ITE device through a repositionable attachment. It is considered that the attachment of the cable connecting to the ITE device can be repositioned to alter the effective distance between the ITE and BTE without requiring to alter the length of the cable, comprises a first distinguishing feature.

- Claims 3 & 4 are directed to a hearing aid sub-assembly including an earhook adapted for connection to a BTE device, a receiver, and a cable electrically connecting the receiver and BTE device. It is considered that a hearing aid sub-assembly including an earhook adapted for connection to a BTE device and the receiver being operatively adapted to be fitted to an ear fitting comprises a second distinguishing feature.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

The only feature common to all of the claims is a hearing aid, including a BTE device, ITE device and a cable connected between the BTE device and the ITE device (receiver). However this concept is not novel in the light of:

D1: US 4727582 A (DE VRIES et al.) 23 February 1988

D1 (Fig 1) discloses a hearing aid assembly (Fig 1), including a BTE device (1), an ITE device (2), and a cable adapted to be connected between the BTE device and the ITE device (14) (Col 4, Lines 21-54).

This means that the common feature can not constitute a special technical feature within the meaning of PCT Rule 13.2, second sentence, since it makes no contribution over the prior art.

Because the common feature does not satisfy the requirement for being a special technical feature it follows that it cannot provide the necessary technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a posteriori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2010/000262

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4727582	CA	1241732	DK	125185	EP	0158391
		JP	60232800	NL	8400925		
US	7003876	EP	1414520	US	2003031336	US	6775389
		US	2004114776	US	7106873	US	7167572
		US	2007003089	US	7526096	US	2007001552
		US	2007118011	US	2007173683	WO	03015470
US	4827525	US	4827524				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX