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(71) Applicant: **Bernafon AG**
3018 Bern (CH)

(72) Inventors:
- **Chiaravalli, David**
  3018 Switzerland (CH)
- **Jost, Stefan**
  3018 Switzerland (CH)
- **Thomet, Stefan**
  3018 Switzerland (CH)
- **Joss, Aaron**
  3018 Switzerland (CH)
- **Braun, Carsten**
  12277 Berlin (DE)
- **Maretschek, Heiko**
  12277 Berlin (DE)

(74) Representative: **Nielsen, Hans Jørgen Vind**
Oticon A/S
IP Management
Kongebakken 9
2765 Smørum (DK)

(54) HEARING DEVICE COMPARISON DEVICE

(57) A hearing device comparison device is disclosed which is adapted to be worn at the head of a user for comparing the audio signals provided by hearing devices adapted for generating audio signals. The hearing device comparison device comprises an output transducer, a mounting support, electric circuitry and a switch. The output transducer is adapted to be arranged in or at a user's ear and to provide audio signals perceivable as sound to the user's ear. The mounting support is adapted for mounting at least two hearing devices at or in close proximity to the user's ear. The electric circuitry is adapted to allow a connection between the hearing devices and the output transducer. The switch is adapted to allow establishing only one connection between any one of the hearing devices and the output transducer at the same time in order to allow the output transducer to receive audio signals from only one of the hearing devices.

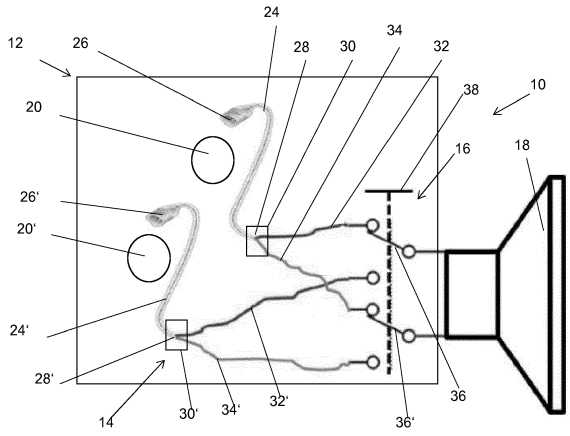

Figure 1

EP 3 021 598 A1

Description

FIELD

[0001] The present disclosure relates to a hearing device comparison device for comparing audio signals provided by hearing devices adapted for generating audio signals.

BACKGROUND

[0002] Hearing devices are typically used in order to improve the hearing of a user. In order to determine which type and configuration of a hearing device corresponds to the needs of a user it is necessary to compare different hearing devices and configurations of the hearing devices one to one. The time between the comparisons of audio signals generated by the hearing devices is essential, as the memory of the user looses information on audiological impression in short time. Hearing care professionals and industry specialists desire a tool which enables them to demonstrate different hearing device technology levels, such as hearing aid technology levels one to one with minimal time difference between audible comparisons.

[0003] Therefore, there is a need to provide a solution that allows for comparison of audio signals generated by different hearing devices with only a small time difference. The present disclosure provides at least an alternative to the prior art.

SUMMARY

[0004] According to an aspect, a hearing device comparison device is adapted to be worn at the head of a user for comparing the audio signals provided by hearing devices adapted for generating audio signals. The hearing device comparison device comprises an output transducer, a mounting support, electric circuitry and a switch. The output transducer is adapted to be arranged in or at a user's ear and to provide audio signals perceivable as sound to the user's ear. The mounting support is adapted for mounting at least two hearing devices at or in close proximity to the user's ear. The electric circuitry is adapted to allow a connection between the hearing devices and the output transducer. The switch is adapted to allow establishing only one connection between any one of the hearing devices and the output transducer at the same time in order to allow the output transducer to receive audio signals from only one of the hearing devices.

[0005] The hearing device comparison device according to the disclosure allows for a fast and convenient switching between different hearing devices in order to allow the user to compare the audio signals generated by different hearing devices or hearing devices with different configurations, e.g., different parameters. It allows for comparison of different types of hearing devices, different settings/configurations of hearing devices or different hearing device features. Furthermore the hearing device comparison device can be worn at the head of the user, which allows for a realistic hearing experience, as hearing devices mounted at the mounting support of the hearing device comparison device have the same orientation and nearly the same position as hearing devices mounted directly at the ears of the user. This allows for benefitting of features such as directionality, noise reduction or the like that result from the arrangement at or in close proximity to the user's ear. The hearing device comparison device according to the disclosure allows sales personnel and hearing care professionals to optimize the search for the hearing device and its configuration which best fits the user's needs and/or preferences.

[0006] According to another aspect, a hearing device comparison system comprises a hearing device comparison device according to the disclosure and at least two hearing devices mounted at the mounting support of the hearing device comparison device. The hearing device comparison system is adapted to allow a user to compare the audio signals of the hearing devices by using the switch of the hearing device comparison device.

[0007] The hearing device comparison system allows to compare the audio signals of at least two hearing devices. Hearing device parameters, such as directionality, noise reduction, or the like are reproduced in a manner corresponding to an actual hearing situation where the hearing device is worn directly at the user's ear, as the hearing devices are mounted at or in close proximity to the ear of the user. This allows for an improved and more realistic hearing experience in the audible comparisons. The hearing device comparison system can also comprise three, four or more hearing devices. The hearing device comparison device can be used to switch between the different hearing devices in order to compare the audio signals of the different hearing devices in a fast and convenient manner without the need of cumbersome or tedious mounting of each of the hearing devices to the user's ear after the user finished listening to one of the hearing devices and wants to compare it to another one.

[0008] According to yet another aspect, a hearing device comparison system comprises a hearing device comparison device according to the disclosure with a second output transducer and a second mounting support and at least two hearing devices mounted at each of the two mounting supports of the hearing device comparison device (e.g. at least two different binaural hearing systems, each binaural hearing system comprising a pair of configurable hearing devices adapted for being located in or at left and right ears, respectively, of the user). Each of the output transducers is adapted

to be arranged at one of the user's ears. Each of the mounting supports is adapted to be arranged at or in close proximity to one of the user's ears and adapted for mounting at least two hearing devices at or in close proximity to the corresponding user's ear. The hearing device comparison device can comprise a headband adapted to be worn at the head of the user and comprising the mounting supports. In an embodiment, the switch of the hearing device comparison device is configured to (simultaneously) switch first and second (corresponding) hearing devices (e.g. of a particular binaural hearing system) to the first and second output transducers, respectively. The hearing device comparison device can further comprise a second switch. Both switches can be arranged at one mounting support or each of the switches can be arranged at (a separate) one of the mounting supports or the switches can be arranged at some other position or positions of the hearing device comparison device. If the hearing device comparison device comprises two switches, preferably each of the switches is adapted to establish only one connection between the output transducer and any one of the corresponding hearing devices arranged at one of the user's ears at the same time in order to allow the output transducer to receive audio signals from only one of the hearing devices. Alternatively, each of the switches can be adapted to allow one of the hearing devices to establish a connection to both output transducers when only one of the switches is switched (e.g. so that both ears are supplied by one hearing device). Yet as another alternative each of the switches can be adapted to allow one of the hearing devices at each of the user's ears to establish a connection to a corresponding output transducer in or at the user's ear. In an embodiment, the switches and electric circuitry are configured to allow any one of the hearing devices that are currently mounted in the hearing device comparison system to be connected to any one of the (first and second) output transducers (full connectivity, e.g. one at a time). The hearing device comparison system is adapted to allow a user to compare the audio signals of the hearing devices by using the switch or switches of the hearing device comparison device. It is to be understood that switching one of the switches or the only switch - in case of a hearing device comparison device with only one switch - can lead to the establishment of the following connections depending on the arrangement of the switch or switches and electric circuitry or how the switch or switches are adapted: one hearing device at one of the user's ears can be connected to both output transducers, two hearing devices can be connected to two output transducers, one hearing device can be connected to one output transducer, or there can be no connection between hearing devices and output transducers at all. The aforementioned connections can be established either by switching one, two or none of the switches.

[0009] The hearing device comparison system with a hearing device comparison device that comprises two output transducers and two mounting supports allows for comparison of audio signals generated by binaural hearing systems. A binaural hearing system in this case comprises two hearing devices with one of them mounted at each of the mounting supports. Preferably one of the mounting supports is adapted to be arranged at the left ear or a user and the other one of the mounting supports is adapted to be arranged at the right right ear of the user. The hearing devices of the binaural hearing system can be connected, e.g., wirelessly connected or connected by wire, in a manner to allow the exchange of binaural data, e.g., audio signals, control signals, status signals, information signals or the like. The hearing device comparison system can for example be adapted to allow a user to compare the audio signals of one binaural hearing system to another binaural hearing system by switching only one switch or by switching two switches. This allows for an improved comparison which is closer to the realistic listening experience of the user when wearing hearing devices in everyday life.

[0010] According to yet another aspect, an audio signal comparison method for a hearing device comparison device comprises the following steps. Providing an output transducer. Preferably the output transducer is provided in or at a user's ear. Mounting at least two hearing devices adapted for generating audio signals at or in close proximity to an ear of a user. Establishing only one connection between the output transducer and any one of the hearing devices in order to receive a first audio signal. Presenting the first audio signal to the ear of the user using the output transducer. Establishing only one connection between the output transducer and another of the hearing devices by switching in order to receive a second audio signal. Presenting the second audio signal to the ear of the user using the output transducer. Presenting the second audio signal to the ear of the user is started in a predefined time, e.g. less than 3 or 4 seconds, after presenting the first audio signal to the ear of the user was terminated by switching. The predefined time is intended to allow a user to remember a first sound impression from the first audio signal of the first hearing device (or a first *pair* of hearing devices) when a second sound impression from the second audio signal of the second hearing device (or a second *pair* of hearing devices) is presented to the user.

[0011] The audio signal comparison method according to the disclosure allows for an improved comparison between the audio signals generated by two different hearing devices. Due to the small (predefined) time difference between the switching from one audio signal to the other, the user listening to the two different audio signals can experience also slight differences in the quality of the two audio signals. This allows for an improved optimisation procedure for finding the hearing device or its configuration, which best fits the needs of the user.

[0012] The audio signal comparison method can also be performed with more than two hearing devices, e.g., three hearing devices. In this case the audio signals of two hearing devices are compared to each other, such that a first audio signal generated by the first hearing device is compared to a second audio signal generated by the second hearing device and after this comparison the first audio signal is compared to a third audio signal generated by a third hearing

device or the second audio signal is compared to the third audio signal. In this manner, the hearing device of the, three which is closest to the needs of the user, can be determined. Preferably, the settings of the parameters of the hearing devices, e.g., gain or other feature settings are identical in order to allow a meaningful comparison of the hearing devices. Furthermore, it is possible to exchange one or both of the hearing devices after a first comparison in order to compare two other hearing devices. For example only one of the hearing devices can be exchanged, preferably the one which provided a worse audio signal. Then the remaining hearing device can be compared to another hearing device provided to the user. It is possible to find the best fitting hearing device for the user in this manner.

[0013] According to yet another aspect, the hearing device comparison system according to the disclosure is used in order to perform the signal processing method according to the disclosure.

[0014] The use of the hearing device comparison system according to the disclosure in order to perform the signal processing method according to the disclosure allows for comparison of audio signals generated by different hearing devices with only a small time difference. This allows for example hearing care professionals to compare hearing devices of different manufacturers or different types of hearing devices of an identical manufacturer in a fast manner and realistic sound setting.

[0015] According to one embodiment of the hearing device comparison device the electric circuitry is adapted to allow a connection between hearing aid devices and the output transducer. This allows for comparing the audio signals generated by hearing aid devices. This embodiment of the hearing device comparison device is particularly useful for hearing impaired users in order to assess which hearing aid device benefits them the most.

[0016] According to another embodiment of the hearing device comparison device the electric circuitry is adapted to allow a connection between Receiver-In-The-Ear (RITE) hearing aid devices and the output transducer. This allows for comparing audio signals generated by different RITE hearing aid devices. RITE hearing aid devices typically comprise an output transducer, such as a receiver or speaker that is adapted to be arranged in an ear of a user, an external RITE unit adapted to be arranged behind, on or at the ear of the user and a lead (or a number of leads) connecting the speaker and the external RITE unit. The lead or leads may comprise a number of individual (mutually insulated) electrical conductors (e.g. 1, 2, or 3 or more). The external RITE unit comprises a microphone for receiving sound and generating audio signals and a signal processing unit for processing the audio signals. The audio signals can be provided to the output transducer via the lead (during normal use of the RITE hearing aid). In the present context it is to be understood that the electric circuitry of the hearing device comparison device is adapted to be connected to the external RITE unit and only the external RITE unit of the RITE hearing aid is used for the comparison of the audio signals. The electric circuitry of the hearing device comparison device can comprise a RITE connector cable, e.g., comprising CS-43 connectors, for connecting the Receiver-In-The-Ear hearing aid devices, i.e., the external RITE unit, with the hearing device comparison device.

[0017] According to yet another embodiment of the hearing device comparison device the switch is an actuator control for establishing a connection between the output transducer and any one of the hearing devices. The connection can be established either by manually switching or by an automatic switch. The automatic switch is adapted to automatically establish a connection to any one of the hearing devices when a certain switching condition is met. Possible switching conditions are for example reaching a time limit, an overall sound level limit, or any other suitable condition in order to switch to another hearing device, i.e., establishing the connection to another hearing device in order to receive an audio signal generated from it for comparison to the previously received audio signal from another hearing device. The switch allows for fast switching between the connections to different hearing devices. The switch can alternatively also be any interface known in the art used for establishing a switchable connection. The user interface of the switch can for example be a button, a push switch, a touch screen display, or the like. The user interface can be activated manually by the user in order to switch the switch. The user interface can e.g. be implemented in a separate remote control device, e.g. as an APP of a smartphone.

[0018] According to an embodiment of the hearing device comparison device the mounting support is adapted to arrange the hearing devices as close as possible to a position in relation to a hearing device worn directly at the user's ear, when the hearing device comparison device is worn by the user. Preferably the hearing device is arranged in an orientation that corresponds to the orientation of the hearing device worn directly at the user's ear. This allows for improving the hearing experience of the user when comparing audio signals from different hearing devices, as the hearing devices are in a position and orientation that correspond to the position and orientation when worn by the user directly at his ear. Therefore the hearing experience is more realistic and allows for a better assessment whether the hearing device meets the requirements and needs of the user.

[0019] According to another embodiment of the hearing device comparison device, the hearing device comparison device comprises a second output transducer. Each of the output transducers is adapted to be arranged in or at one of the user's ears. This allows for audio signal comparison from one hearing device at both ears at the same time. Audio signal comparison of the same audio signal at both ears at the same time may for example be helpful for hearing impaired users with different hearing impairment level at each of their ears.

[0020] According to yet another embodiment of the hearing device comparison device the hearing device comparison

device comprises a second mounting support. Each of the mounting supports is adapted to be arranged at or in close proximity to one of the user's ears and adapted for mounting at least two hearing devices at or in close proximity to the corresponding user's ear. This allows for increasing the number of hearing devices for comparison and further the anatomy of the user is considered, as the mounting supports allow mounting hearing devices at the right, as well as on the left side of the head of the user. The hearing device comparison device can further comprise a headband adapted to be worn at the head of the user and comprising the mounting supports. This allows for wearing the mounting supports by the user in a convenient manner.

[0021] The hearing device comparison device can comprise fasteners, such as adhesive strips, Velcro strips, or the like, in order to fasten the hearing devices at the mounting supports. This allows for a better fastening of the hearing devices when the hearing device comparison device is in use and the user turns his head. The movement of the head might lead to movement of the hearing devices and thus could cause unwanted noise, as the microphones of the hearing devices rub against the mounting support, which can for example comprise a casing in which the output transducers can be arranged. The fasteners can be nearly invisible when applied and allow preventing or at least reducing accidental noise from occurring.

[0022] According to yet another embodiment of the hearing device comparison device the hearing device comparison device comprises a second switch. Preferably the hearing device comparison device comprises the second switch if it comprises two output transducers and/or two mounting supports. Preferably each of the switches is adapted to establish only one connection between the output transducer and any one of the corresponding hearing devices arranged at one of the user's ear at the same time in order to allow the output transducer to receive audio signals from only one of the hearing devices. Alternative switch configurations allowing for example to establish connections between two hearing devices and two output transducers in any known way will be readily apparent to those skilled in the art.

[0023] According to an embodiment of the signal processing method according to the disclosure the hearing devices are hearing aid devices.

[0024] In an embodiment, the hearing device comparison device comprises a local energy source for energizing its electric components, e.g. including the switch or switches and the electric circuitry. In an embodiment, the local energy source comprises a battery, e.g. a rechargeable battery. In an embodiment, the hearing device comparison device comprises an electric interface to a charging or power supply unit, e.g. a USB or other appropriate interface, allowing the hearing device comparison device to be powered or recharged from another device, e.g. a PC.

BRIEF DESCRIPTION OF DRAWINGS

[0025] The aspects of the disclosure may be best understood from the following detailed description taken in conjunction with the accompanying figures. The figures are schematic and simplified for clarity, and they just show details to improve the understanding of the claims, while other details are left out. Throughout, the same reference numerals are used for identical or corresponding parts. The individual features of each aspect may each be combined with any or all features of the other aspects. These and other aspects, features and/or technical effect will be apparent from and elucidated with reference to the illustrations described hereinafter in which:

Figure 1 illustrates a hearing device comparison device according to a first embodiment of the disclosure;
Figure 2 illustrates a hearing device comparison device according to a second embodiment of the disclosure with a mounted hearing device;
Figure 3 illustrates a Receiver-In-The-Ear (RITE) connector cable;
Figure 4 illustrates a socket and a connector of the RITE connector cable;
Figure 5A illustrates a hearing device comparison system according to a first embodiment of the disclosure with a switch in a first position;
Figure 5B illustrates the hearing device comparison system according to the first embodiment of the disclosure with the switch in a second position;
Figure 5C illustrates the hearing device comparison system according to the first embodiment of the disclosure with the switch in a third position;
Figure 6 illustrates a hearing device comparison device according to a third embodiment of the disclosure and a hearing device comparison system according to a second embodiment of the disclosure;
Figure 7 illustrates a fastener;
Figure 8 illustrates a hearing device comparison device according to a fourth embodiment of the disclosure and a hearing device comparison system according to a third embodiment of the disclosure; and
Figure 9 illustrates a signal comparison method according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0026] The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practised without these specific details. Several aspects of the system/apparatus/device and methods are described by various blocks, functional units, modules, components, circuits, steps, processes, algorithms, etc. (collectively referred to as "elements"). Depending upon particular application, design constraints or other reasons, these elements may be implemented using electronic hardware, computer program, or any combination thereof.

[0027] The electronic hardware may include microprocessors, microcontrollers, digital signal processors (DSPs), signal processing units, field programmable gate arrays (FPGAs), programmable logic devices (PLDs), gated logic, discrete hardware circuits, and other suitable hardware configured to perform the various functionality described throughout this disclosure. Computer program shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software modules, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise.

[0028] A hearing device may include a hearing aid that is adapted to improve or augment the hearing capability of a user by receiving an acoustic signal from a user's surroundings, generating a corresponding audio signal, possibly modifying the audio signal and providing the possibly modified audio signal as an audible signal to at least one of the user's ears. The "hearing device" may further refer to a device such as an earphone or a headset adapted to receive an audio signal electronically, possibly modifying the audio signal and providing the possibly modified audio signals as an audible signal to at least one of the user's ears. Such audible signals may be provided in the form of an acoustic signal radiated into the user's outer ear, or an acoustic signal transferred as mechanical vibrations to the user's inner ears through bone structure of the user's head and/or through parts of middle ear of the user.

[0029] The hearing device is adapted to be worn in any known way. This may include i) arranging a unit of the hearing device behind the ear with a tube leading air-borne acoustic signals into the ear canal or with a receiver/ loudspeaker arranged close to or in the ear canal such as in a Behind-the-Ear type hearing aid, and/ or ii) arranging the hearing device entirely or partly in the pinna and/ or in the ear canal of the user such as in a In-the-Ear type hearing aid or In-the-Canal/ Completely-in-Canal type hearing aid, or iii) arranging a unit of the hearing device attached to a fixture implanted into the skull bone such as in Bone Anchored Hearing Aid (or attached to a head band).

[0030] A "hearing system" refers to a system comprising one or two hearing devices, and a "binaural hearing system" refers to a system comprising two hearing devices where the devices are adapted to cooperatively provide audible signals to both of the user's ears. The hearing system or binaural hearing system may further include auxiliary device(s) that communicates with at least one hearing device, the auxiliary device affecting the operation of the hearing devices and/or benefitting from the functioning of the hearing devices. A wired or wireless communication link between the at least one hearing device and the auxiliary device is established that allows for exchanging information (e.g. control and status signals, possibly audio signals) between the at least one hearing device and the auxiliary device. Such auxiliary devices may include at least one of remote controls, remote microphones, audio gateway devices, mobile phones, public-address systems, car audio systems or music players or a combination thereof. The audio gateway is adapted to receive a multitude of audio signals such as from an entertainment device like a TV or a music player, a telephone apparatus like a mobile telephone or a computer, a PC. The audio gateway is further adapted to select and/or combine an appropriate one of the received audio signals (or combination of signals) for transmission to the at least one hearing device. The remote control is adapted to control functionality and operation of the at least one hearing device. The function of the remote control may be implemented in a SmartPhone or other electronic device, the SmartPhone/ electronic device possibly running an application that controls functionality of the at least one hearing device.

[0031] In general, a hearing device includes i) an input unit such as a microphone for receiving an acoustic signal from a user's surroundings and providing a corresponding input audio signal, and/or ii) a receiving unit for electronically receiving an input audio signal. The hearing device further includes a signal processing unit for processing the input audio signal and an output unit for providing an audible signal to the user in dependence on the processed audio signal.

[0032] The input unit may include multiple input microphones, e.g. for providing direction-dependent audio signal processing. Such directional microphone system is adapted to enhance a target acoustic source among a multitude of acoustic sources in the user's environment. In one aspect, the directional system is adapted to detect (such as adaptively detect) from which direction a particular part of the microphone signal originates. This may be achieved by using conventionally known methods. The signal processing unit may include amplifier that is adapted to apply a time, level and/or frequency dependent gain to the input audio signal. The signal processing unit may further be adapted to provide other relevant functionality such as frequency compression, noise reduction, etc. The output unit may include an output transducer such as a loudspeaker/ receiver for providing an air-borne acoustic signal transcutaneously or percutaneously to the skull bone or a vibrator for providing a structure-borne or liquid-borne acoustic signal. In some hearing devices,

the output unit may include one or more output electrodes for providing the electric signals such as in a Cochlear Implant.

[0033] Figure 1 illustrates a hearing device comparison device 10 according to a first embodiment of the disclosure. The hearing device comparison device 10 comprises a mounting support 12, electric circuitry 14, a switch 16, and a speaker 18.

[0034] The mounting support 12 in this embodiment comprises two mounting posts 20 and 20'. The mounting support 12 can also comprise three, four or more mounting posts (not shown). The mounting posts 20 and 20' each allow mounting of a hearing device 22 (cf. Fig. 2). The mounting posts 20 and 20' can be arranged at or in close proximity to the user's ear in order to allow the hearing device 22 to be arranged in a position as close as possible to a position in relation to a hearing device worn directly at the user's ear. The hearing device 22 intended for being mounted in a mounting post 20,20' of the mounting support is e.g. of the Receiver-In-The-Ear (RITE) type comprising a loudspeaker ('receiver') for being located in the ear canal of a user and electrically connected (via a connector cable) to an external part located outside the ear canal, e.g. at or behind an ear of the user, and comprising audio input unit(s), e.g. microphone(s), and audio processing circuitry for generating processed (customized) audio signals.

[0035] The electric circuitry 14 comprises two Receiver-In-The-Ear (RITE) connector cables 24 and 24' each with a RITE connector 26 and 26' and a speaker connector 28 and 28' (cf. Figs. 3). The RITE connectors 26 and 26' allow connecting hearing devices, in particular RITE hearing aid devices, with the electric circuitry 14. The speaker connectors 28 and 28' can be connected with sockets 30 and 30' which are arranged in the mounting support 12 (cf. Fig. 2 and 4).

[0036] The electric circuitry 14 furthermore comprises leads (electrical conductors) 32, 34 and 32', 34' which connect the sockets 30 and 30' to the switch 16.

[0037] Switch 16 in this embodiment comprises an actuator control 38 and two toggle switches 36 and 36' which can be controlled by the actuator control 38. Switch 16 can also comprise any kind of other switch that allows switching between at least two and preferably a number of connection states, e.g., a flip switch, a membrane switch, a piezo switch, a timer switch, a touch switch, a transfer switch, or the like. Actuator control 38 can be operated by the user in order to control the two toggle switches 36 and 36'. When the actuator control 38 is operated, i.e., when switch 16 is switched the toggle switches 36 and 36' are moved. In this embodiment of switch 16 there are three states/positions for switch 16 (cf. Fig. 5). Fig. 1 shows the first position in which leads 32 and 34 are connected to the toggle switches 36 and 36' (cf. 'Position 1' in Fig. 5A for hearing device comparison device 10'). In a second position the toggle switches 36 and 36' are not connected to any of the leads 32, 34, 32' and 34' (cf. 'Position 2' in Fig. 5B for hearing device comparison device 10'). In the second position the hearing device comparison device 10 therefore does not provide any sound, i.e., it is muted. A muted state allows for removing the hearing device comparison device 10 from the user's head without generating feedback or noise. Furthermore the second position of switch 16 allows extending the battery lifetime of the hearing device comparison device 10. In the third position of switch 16 the toggle switches 36 and 36' are connected to the leads 32' and 34' (cf. Fig. 2 and 'Position 3' in 5C for hearing device comparison device 10').

[0038] The switch 16 is connected to speaker 18 and allows establishing a connection between the electric circuitry 14 and the speaker 18. The speaker 18 can be arranged in or at a user's ear in order to provide audio signals perceivable as sound to the user.

[0039] Figure 2 illustrates a hearing device comparison device 10' according to a second embodiment of the disclosure with a hearing device 22 mounted at mounting post 20. The hearing device comparison device 10' comprises a mounting support 12, electric circuitry 14 (not shown), a switch 16, and a speaker 18 (not shown). The hearing device comparison device 10' is similar to the hearing device comparison device 10 with the difference that it comprises a headband 40.

[0040] Figure 3 illustrates a Receiver-In-The-Ear (RITE) connector cable. The connector cable 24 comprises a number of leads (e.g. 2 or more mutually insulated electrical conductors) with an electrical connector 26, 28 at each end. The electrical connector 26 is adapted for electrical connection to the external (pick-up and processing) part of the hearing device. This connector is e.g. identical to (at least compatible with) the connector used to connect the external part of the hearing device to the receiver part (comprising the loudspeaker) of the hearing device during normal use of the hearing device. The electrical connector 28 is adapted for electrical connection to a matching connector (e.g. a socket, cf. 30 in Fig. 1, 2) in the mounting support (cf. 12 in Fig. 1, 2) and thereby to electrical circuitry of the hearing device comparison device to allow the hearing device in question to be connected to the output transducer of the hearing device comparison device.

[0041] Figure 4 illustrates a socket 30 of mounting support 12 and a connector 28 of the RITE connector cable 24. The plug 28 and socket 30 solution is adapted for easy and robust connection and disconnection of the hearing devices to the mounting support 12.

[0042] The headband 40 is connected to the mounting support 12. If the headband 40 is worn at the head of a user 300 (cf. Fig. 5) the hearing device 22 mounted at the mounting post 20 is in a position which is close to a position in relation to a hearing device worn directly at the user's ear (cf. Fig. 5). The headband 40 therefore allows for an improved positioning of the hearing device 22 and hence an improved hearing experience.

[0043] In the following the function of the hearing device comparison devices 10 and 10' is explained for two hearing devices 22, 22' being arranged at the mounting support 12 (cf. Fig. 5). The hearing device comparison device 10' together

with the two hearing devices 22 and 22' build a hearing device comparison system 100 according to a first embodiment of the disclosure (cf. Fig. 5). The hearing device comparison system 100 in Figure 5 is worn by user 300. The electric circuitry 14 of the hearing device comparison device 10' is essentially the same as the electric circuitry 14 of the first embodiment of hearing device comparison device 10, therefore the following explanation is to be understood to also point to the electric circuitry presented in Fig. 1.

[0044] The hearing devices 22 and 22' receive sound from the surroundings with their microphones and generate audio signals. The audio signals are then processed in the hearing devices 22 and 22' by signal processing units which generate a processed audio signal. The processed audio signals are then transmitted via the RITE connector cables 24 and 24' from each of the hearing devices 22 and 22' to switch 16. Depending on the position of switch 16 the audio signal of hearing device 22, hearing device 22' or none of them can pass switch 16 in order to be provided to the speaker 18. In the first position of switch 16 the audio signal of hearing device 22 is transmitted (cf. 'right' position ('Position 1') of actuator control 38 in Fig. 5A). In the second position of switch 16 no audio signal is transmitted (cf. 'middle' position ('Position 2') of actuator control 38 in Fig. 5B). In the third position of switch 16 the audio signal of hearing device 22' is transmitted (cf. 'left' position ('Position 3') of actuator control 38 in Fig. 5C). Switching the switch allows for a fast and convenient comparison of the audio signals of two hearing devices 22 and 22'. As the hearing devices 22 and 22' are mounted in close proximity to the ear of the user, i.e., in a position which is close to the position of the hearing device directly worn at the ear of the user, the user can get a realistic experience of how the hearing device would sound in every day's life.

[0045] Figure 6 illustrates a hearing device comparison device 10" according to a third embodiment of the disclosure. The hearing device comparison device 10" is similar to the first two embodiments of the hearing device comparison devices 10 and 10' with the difference that it comprises two mounting supports 12 and 12b, two switches 16 and 16b (and two actuator controls 38 and 38b), and two speakers 18 and 18b. In an alternative embodiment the hearing device comparison device can also only comprise one switch 16 (not shown).

[0046] In the following the function of the hearing device comparison device 10" is explained for two pairs of hearing devices 22, 22', 22b and 22b' being arranged at the mounting supports 12 and 12b. The hearing device comparison device 10" together with the two pairs of hearing devices 22, 22', 22b, and 22b' builds the hearing device comparison system 100' according to a second embodiment of the disclosure.

[0047] As for the previous explanation of the function of the first two hearing device comparison devices 10 and 10' above that included only one switch 16 and only one speaker 18 the hearing devices 22, 22', 22b, and 22b' receive sound signals by their microphones and generate audio signals. The audio signals are processed using signal processing units (of the respective hearing devices) and the (resulting) audio signals are provided to the RITE connector cables (not shown). The third embodiment of the hearing device comparison device 10" comprises a total of 4 RITE connector cables connecting the hearing devices 22, 22' via leads with the switch 16 and hearing devices 22b, 22b' via leads with switch 16b. Depending on the position of the two switches 16 and 16b the audio signals generated by hearing devices 22, 22', 22b, or 22b' will be received by the speakers 18 and 18b.

[0048] In the present third embodiment of the hearing device comparison device 10" actuator controls 38 and 38b are connected such that switching one of the actuator controls 38 or 38b will switch both switches 16 and 16b. Hence if the actuator control 38 or 38b is switched the user will either listen to the pair of hearing devices 22, 22b or 22', 22b' or the hearing device comparison device 10" will be muted. This is particularly helpful for comparing binaural hearing systems, e.g., if the hearing devices 22, 22b and 22', 22b', respectively, each build a binaural hearing system.

[0049] Alternatively the actuator controls 38 and 38b can also be adapted to individually switch the switches 16 and 16b. This allows comparing two hearing devices at each individual ear. Various combinations how the actuator controls 38 and 38b can control switches 16 and 16b which allow to switch between a number of hearing devices mounted at the mounting supports 12, 12b, e.g., two, three or four hearing devices will be readily apparent to those skilled in the art.

[0050] Figure 7 illustrates a fastener 42. In this embodiment the fastener 42 corresponds to Velcro strips. Any other kind of fastener 42 know in the prior art, e.g., adhesives, screw joints, or the like can be used. Fastener 42 can be used in order to fasten hearing devices 22 to the mounting support 12 (cf. Fig. 8) or in order to improve the fastening of the hearing devices 22, 22' to the mounting posts 20, 20'. If the hearing devices 22, 22' are additionally fastened by fastener 42 the risk of rubbing of the microphones of hearing devices 22, 22' on the mounting support 12 is reduced and thus less noise is to be expected when the user moves his head during comparison of hearing devices. In a further embodiment, the mounting support is adapted to receive and hold relevant hearing devices via magnetic forces, or mechanically formed to allow a (reversible) click-on mounting and easy removal of the hearing devices on and from, respectively, the mounting support.

[0051] Figure 8 illustrates a hearing device comparison system 100" according to a third embodiment of the disclosure. The hearing device comparison system 100" comprises a hearing device comparison device 10'" according to a fourth embodiment of the disclosure and four hearing devices 22, 22' (cf. Fig. 8), 22b, 22b' (not shown).

[0052] Two hearing devices 22, 22' and 22b, 22b' are arranged on each of the mounting supports 12, 12b by fastening the hearing devices 22, 22', 22b, and 22b' using fastener 42. In contrast to the previous embodiments of the hearing

device comparison device the hearing devices are arranged along the same horizontal line behind each other. In the previously presented embodiments the mounting posts 20 and 20' are vertically separated with a slight horizontal offset. Various arrangements are apparent for the person skilled in the art.

[0053] The function of the hearing device comparison device 10'" is identical to the function of the hearing device comparison device 10" according to the third embodiment of the disclosure.

[0054] Figure 9 illustrates a signal comparison method according to an embodiment of the disclosure. The audio signal comparison method for a hearing device comparison device comprises the steps

[0055] 200 Providing an output transducer. The output transducer is provided in or at the ear of a user. Alternatively it is also possible to arrange the output transducer at another position that allows the user to receive an audible signal from the output transducer.

[0056] 210 Mounting two hearing devices adapted for generating audio signals at or in close proximity to an ear of a user. In the present embodiment of the method two hearing devices are mounted. Alternatively it is also possible to mount 3, 4 or more hearing devices. The hearing devices can for example be hearing aid devices, such as Receiver-In-The-Ear hearing aid devices.

[0057] 220 Establishing only one connection between the output transducer and any one of the hearing devices in order to receive a first audio signal.

[0058] 230 Presenting the first audio signal to the ear of the user using the output transducer.

[0059] 240 Establishing only one connection between the output transducer and another of the hearing devices by switching in order to receive a second audio signal.

[0060] 250 Presenting the second audio signal to the ear of the user using the output transducer. Presenting the second audio signal to the ear of the user is preferably started in less than 3 or 4 seconds after presenting the first audio signal to the ear of the user was terminated by switching.

[0061] After step 250 is finished the hearing devices can be removed and new hearing devices can be mounted in order to test another set of hearing devices. It is also possible to exchange only one of the hearing devices in order to compare the audio signal of a known hearing device, e.g., preferably the hearing device that had the better correspondence to the needs of the user, to the audio signal of an unknown hearing device. The user can thus iteratively find the hearing device that best fits his requirements and needs.

[0062] In an aspect, at least some of the functions may be stored on or encoded as one or more instructions or code on a tangible computer-readable medium. The computer readable medium includes computer storage media adapted to store a computer program comprising program codes, which when run on a processing system causes the data processing system to perform at least some (such as a majority or all) of the steps of the method described above, in the description and in the claims.

[0063] By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media. In addition to being stored on a tangible medium, the computer program can also be transmitted via a transmission medium such as a wired or wireless link or a network, e.g. the Internet, and loaded into a data processing system for being executed at a location different from that of the tangible medium.

[0064] The signal comparison method can be at least partially implemented in a computer program or software which automatically switches between the hearing devices when a certain condition is met, e.g., after a certain amount of time, such as after about 2, 3 or 4 seconds, when a certain threshold sound level is reached or the like. The signal comparison method can for example be automatically repeated until the user manually ends the repetition cycle or it can be automatically terminated after a predetermined number of cycles. The computer program can also be controlled manually by the user by certain input commands.

[0065] In an aspect, a data processing system comprises a processor adapted to execute the computer program for causing the processor to perform at least some (such as a majority or all) of the steps of the method described above, in the description and in the claims.

[0066] It is intended that the structural features of the devices described above, either in the detailed description and/or in the claims, may be combined with steps of the method, when appropriately substituted by a corresponding process.

[0067] As used, the singular forms "a," "an," and "the" are intended to include the plural forms as well (i.e. to have the meaning "at least one"), unless expressly stated otherwise. It will be further understood that the terms "includes," "comprises," "including," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. It will also be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled

to the other element but an intervening elements may also be present, unless expressly stated otherwise. Furthermore, "connected" or "coupled" as used herein may include wirelessly connected or coupled. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. The steps of any disclosed method is not limited to the exact order stated herein, unless expressly stated otherwise.

[0068] It should be appreciated that reference throughout this specification to "one embodiment" or "an embodiment" or "an aspect" or features included as "may" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. Furthermore, the particular features, structures or characteristics may be combined as suitable in one or more embodiments of the disclosure. The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects.

[0069] The claims are not intended to be limited to the aspects shown herein, but is to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more." Unless specifically stated otherwise, the term "some" refers to one or more.

[0070] Accordingly, the scope should be judged in terms of the claims that follow.

REFERENCE SIGNS

[0071]

10, 10', 10", 10"'	hearing device comparison device
12, 12b	mounting support
14	electric circuitry
16, 16b	switch
18	speaker
20, 20', 20b, 20b'	mounting post
22, 22', 22b, 22b'	hearing device
24, 24'	Receiver-In-The-Ear (RITE) connector cable
26, 26'	Receiver-In-The-Ear (RITE) connector
28, 28'	hearing device connector
30, 30'	socket
32, 32'	lead
34, 34'	lead
36, 36'	toggle switch
38	actuator control
40	headband
42	fastener
100, 100', 100"	hearing device comparison system
300	user

Claims

1. A hearing device comparison device (10, 10', 10", 10"') adapted to be worn at the head of a user (300) for comparing audio signals provided by hearing devices (22, 22', 22b, 22b') adapted for generating audio signals, the hearing device comparison device comprising:

    • an output transducer (18) adapted to be arranged in or at a user's ear and to provide audio signals perceivable as sound to the user's ear,
    • a mounting support (12,12b) adapted for mounting at least two hearing devices (22, 22', 22b, 22b') at or in close proximity to the user's ear,
    • electric circuitry (14) adapted to allow a connection between the hearing devices (22, 22', 22b, 22b') and the output transducer (18), and
    • a switch (16, 16b) adapted to allow establishing only one connection between any one of the hearing devices (22, 22', 22b, 22b') and the output transducer (18) at the same time in order to allow the output transducer (18) to receive audio signals from only one of the hearing devices (22, 22', 22b, 22b').

2. The hearing device comparison device (10, 10', 10", 10'") according to claim 1, wherein the electric circuitry (14) is adapted to allow a connection between Receiver-In-The-Ear (RITE) hearing aid devices (22, 22', 22b, 22b') and the output transducer (18).

3. The hearing device comparison device (10, 10', 10", 10'") according to claim 2, wherein the electric circuitry (14) comprises a RITE connector cable (24, 24') for connecting the Receiver-In-The-Ear hearing aid devices (22, 22', 22b, 22b') with the hearing device comparison device (10, 10', 10", 10'").

4. The hearing device comparison device (10, 10', 10", 10'") according to at least one of the claims 1 to 3, wherein the switch (16, 16b) is an actuator control (38) for establishing a connection between the output transducer (18) and any one of the hearing devices (22, 22', 22b, 22b') by manually switching or an automatic switch (16, 16b) adapted to automatically establish a connection to any one of the hearing devices (22, 22', 22b, 22b') when a certain switching condition is met.

5. The hearing device comparison device (10, 10', 10", 10"') according to at least one of the claims 1 to 4, wherein the mounting support (12, 12b) is adapted to arrange the hearing devices (22, 22', 22b, 22b') as close as possible to a position in relation to a hearing device (22, 22', 22b, 22b') worn directly at the user's ear.

6. The hearing device comparison device (10, 10', 10", 10"') according to at least one of the claims 1 to 5, wherein the hearing device comparison device (10, 10', 10", 10'") comprises a second output transducer (18b) and wherein each of the output transducers (18, 18b) is adapted to be arranged in or at one of the user's ears.

7. The hearing device comparison device (10, 10', 10", 10'") according to at least one of the claims 1 to 6, wherein the hearing device comparison device (10, 10', 10", 10'") comprises a second mounting support (12b) and wherein each of the mounting supports (12, 12b) is adapted to be arranged at or in close proximity to one of the user's ears and adapted for mounting at least two hearing devices (22, 22', 22b, 22b') at or in close proximity to the corresponding user's ear.

8. The hearing device comparison device (10', 10", 10'") according to claim 7, wherein the hearing device comparison device (10', 10", 10"') comprises a headband (40) adapted to be worn at the head of the user (300) and comprising or supporting the mounting supports (12, 12b).

9. The hearing device comparison device (10, 10', 10", 10'") according to claim 6 and claim 7 or 8, wherein the hearing device comparison device (10, 10', 10", 10'") comprises a second switch (16b) and wherein each of the switches (16, 16b) is adapted to establish only one connection between the output transducer (18, 18b) and any one of the corresponding hearing devices (22, 22', 22b, 22b') arranged at one of the user's ears at the same time in order to allow the output transducer (18, 18b) to receive audio signals from only one of the hearing devices (22, 22', 22b, 22b').

10. A hearing device comparison system (100, 100', 100") comprising

- a hearing device comparison device (10, 10', 10", 10"') according to at least one of the claims 1 to 9 and
- at least two hearing devices (22, 22', 22b, 22b') mounted at the mounting support (12, 12b) ofthe hearing device comparison device (10, 10', 10", 10"'),
- wherein the hearing device comparison system (100, 100', 100") is adapted to allow a user (300) to compare the audio signals of the hearing devices (22, 22', 22b, 22b') by using the switch (16, 16b) ofthe hearing device comparison device (10, 10', 10", 10'").

11. A hearing device comparison system (100, 100', 100") comprising

- a hearing device comparison device (10, 10', 10", 10'") according to claim 6 and at least one of the claims 7 to 9 and
- at least two hearing devices (22, 22', 22b, 22b') mounted at each of the two mounting supports (12, 12b) ofthe hearing device comparison device (10, 10', 10", 10'"),
- wherein the hearing device comparison system (100, 100', 100") is adapted to allow a user (300) to compare the audio signals of the hearing devices (22, 22', 22b, 22b') by using the switch (16, 16b) or switches (16, 16b) ofthe hearing device comparison device (10, 10', 10", 10'").

12. A hearing device comparison system according to claim 10 or 11 wherein the at least two hearing devices are of the receiver in the ear type.

13. An audio signal comparison method for a hearing device comparison device comprising the steps of

- providing an output transducer,
- mounting at least two hearing devices adapted for generating audio signals at or in close proximity to an ear of a user,
- establishing only one connection between the output transducer and any one of the hearing devices in order to receive a first audio signal,
- presenting the first audio signal to the ear of the user using the output transducer,
- establishing only one connection between the output transducer and another of the hearing devices by switching in order to receive a second audio signal,
- presenting the second audio signal to the ear of the user using the output transducer,
- wherein presenting the second audio signal to the ear of the user is started in less than 3 or 4 seconds after presenting the first audio signal to the ear of the user was terminated by switching.

14. The signal processing method according to claim 13, wherein the hearing devices are hearing aid devices, such as hearing devices of the receiver in the ear type.

15. Use of the hearing device comparison system (100, 100', 100") according to claim 11 or 12 in order to perform the signal processing method of claim 13 or claim 14.

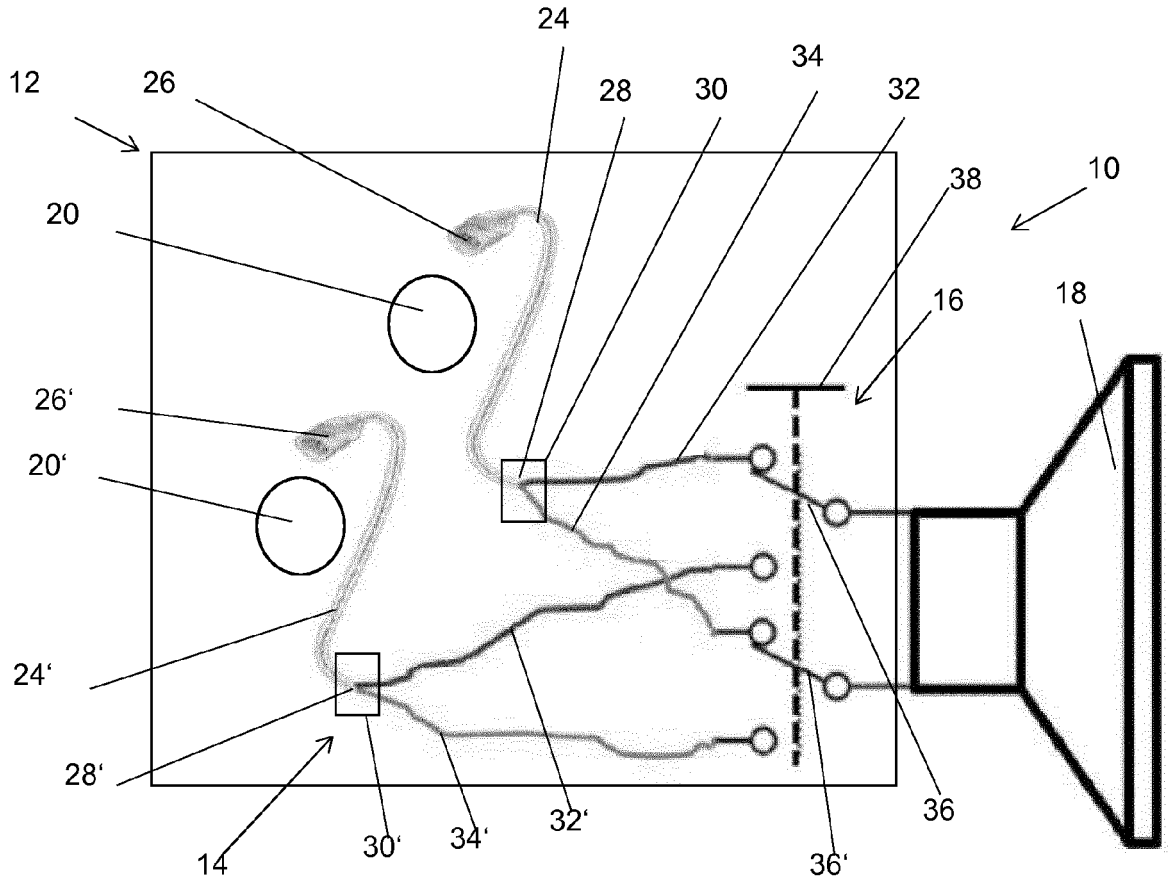

Figure 1

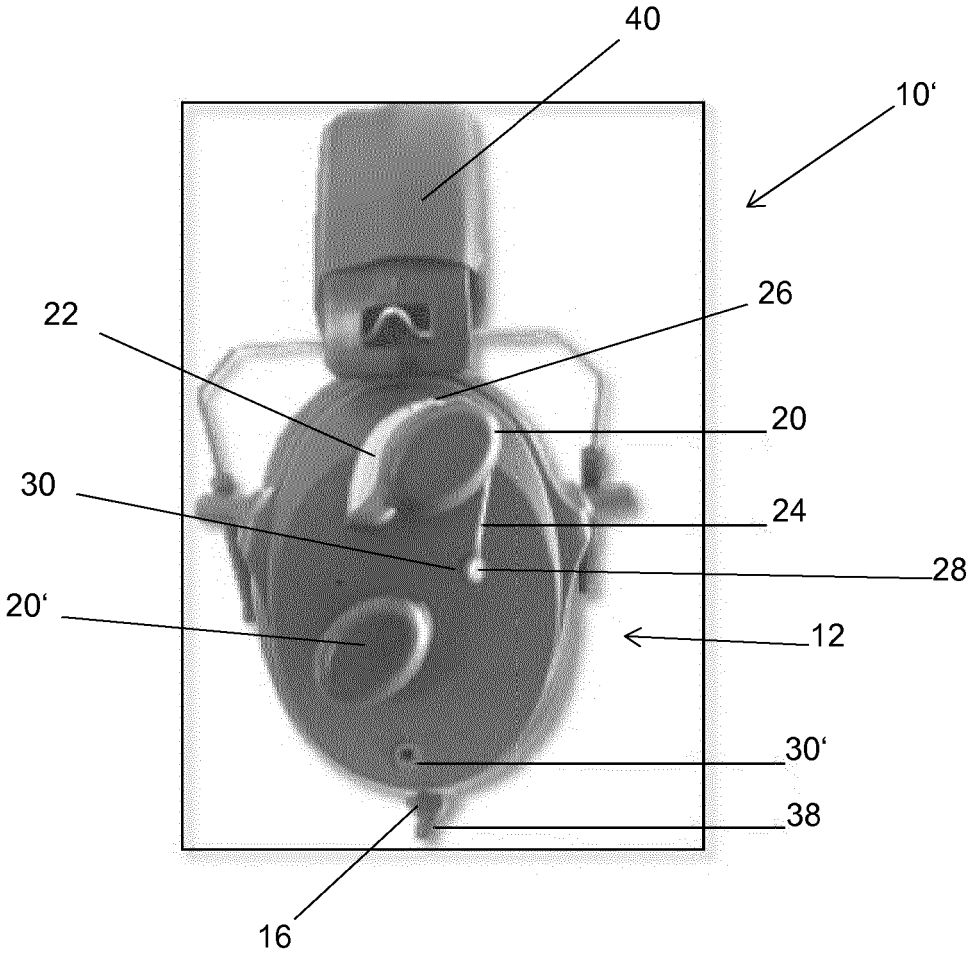

Figure 2

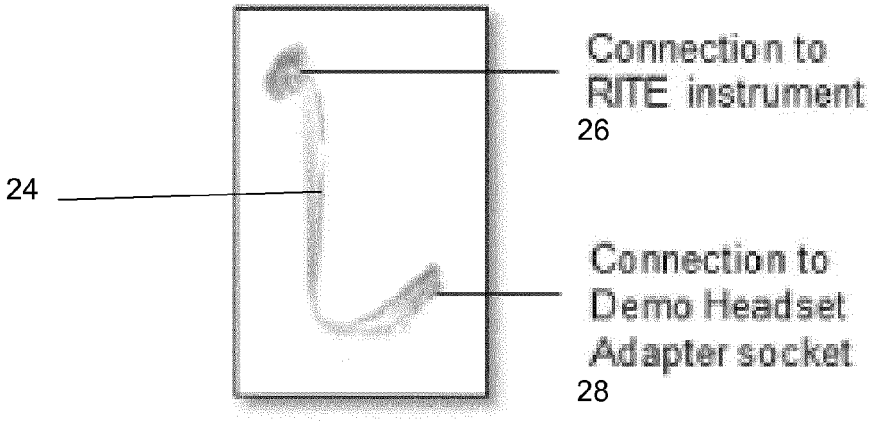

Figure 3

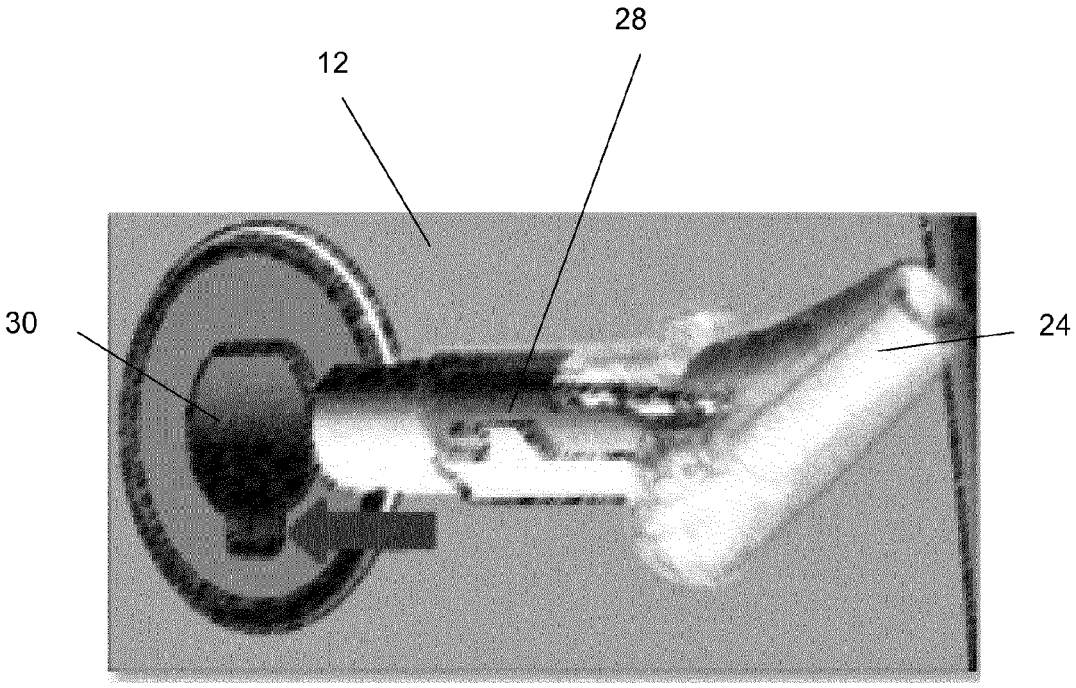

Figure 4

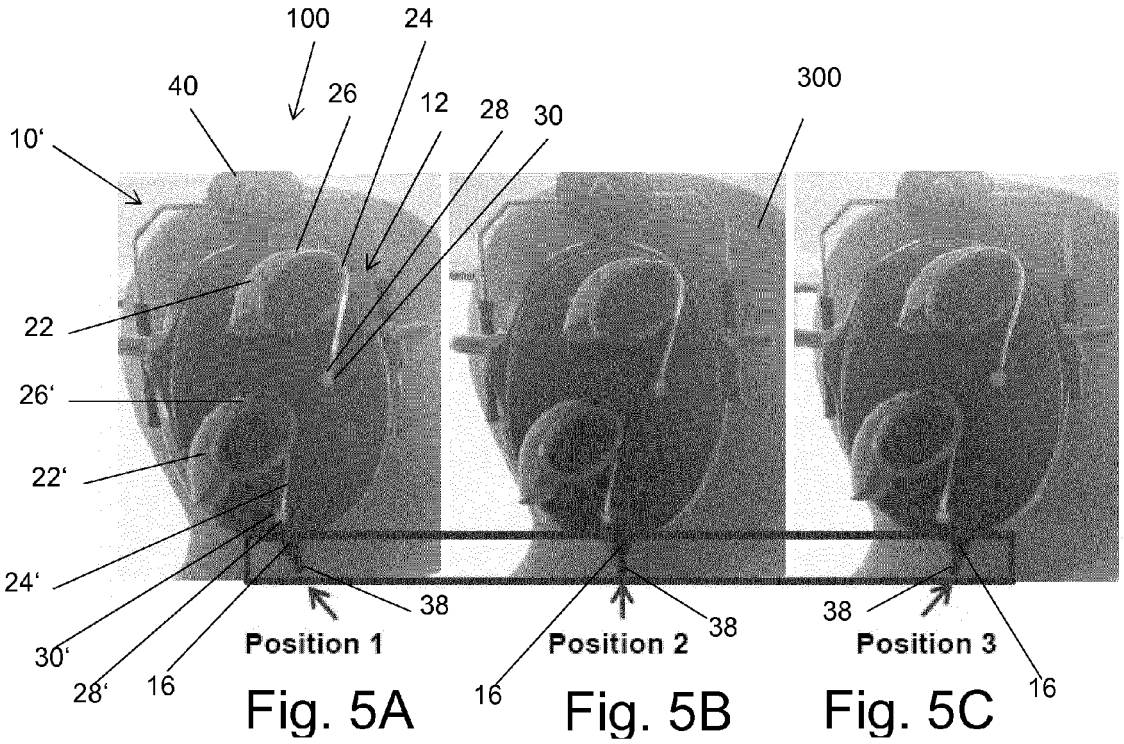

Fig. 5A Fig. 5B Fig. 5C

Figure 5

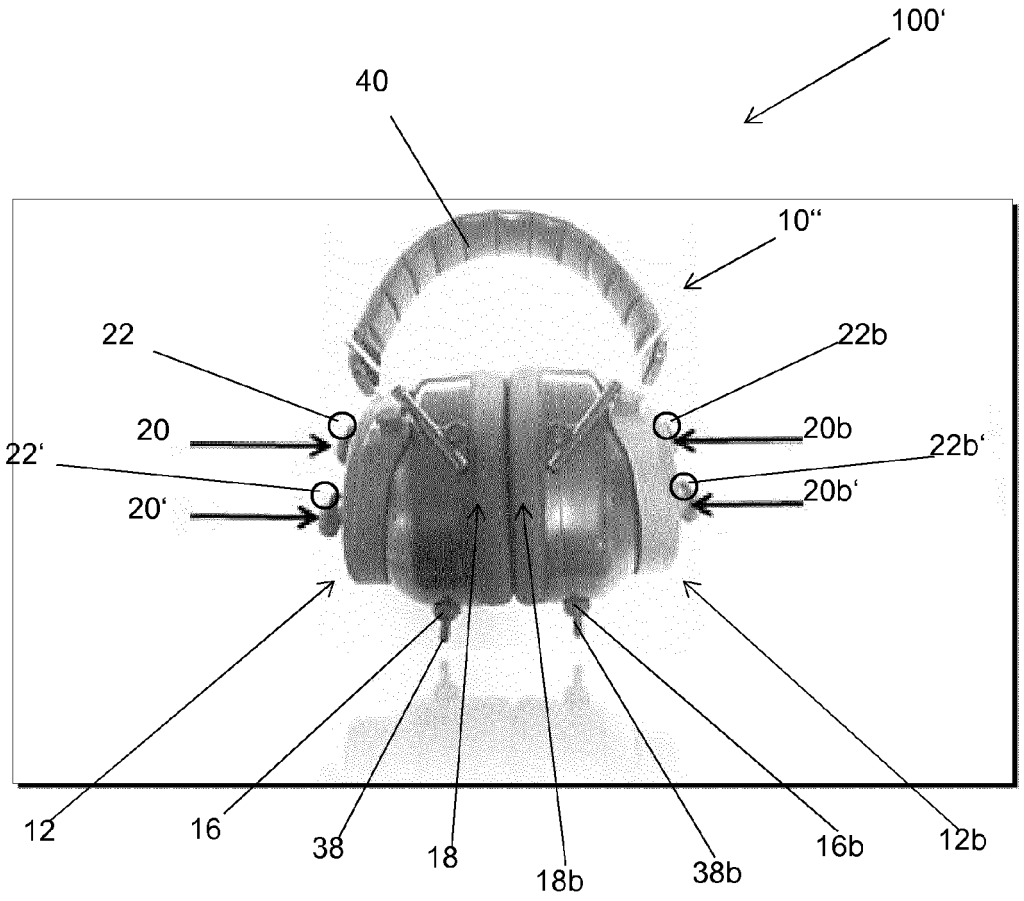

Figure 6

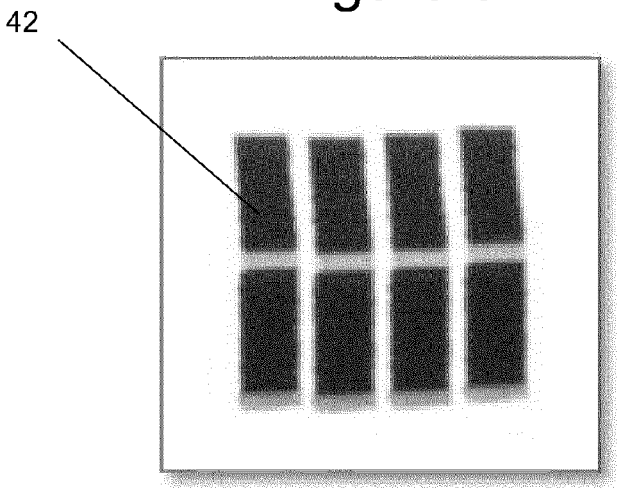

Figure 7

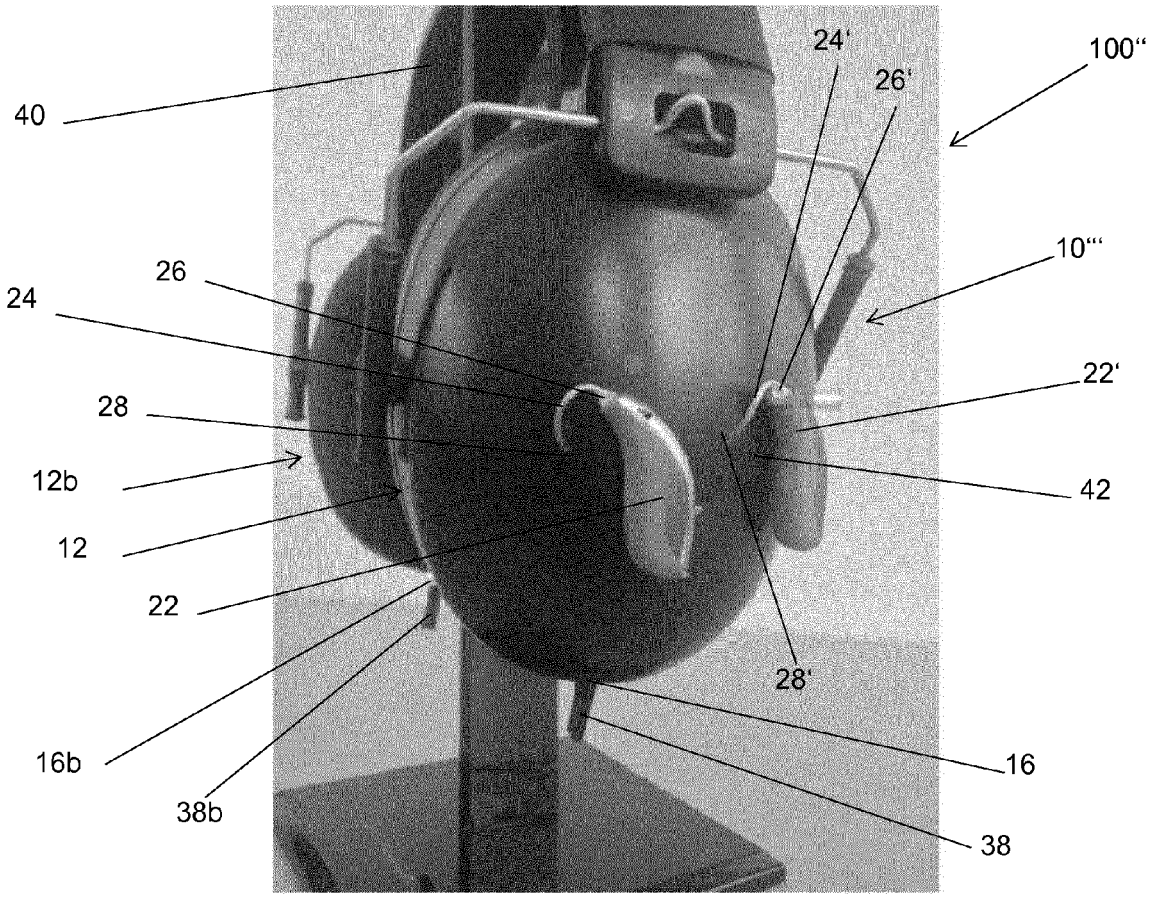

Figure 8

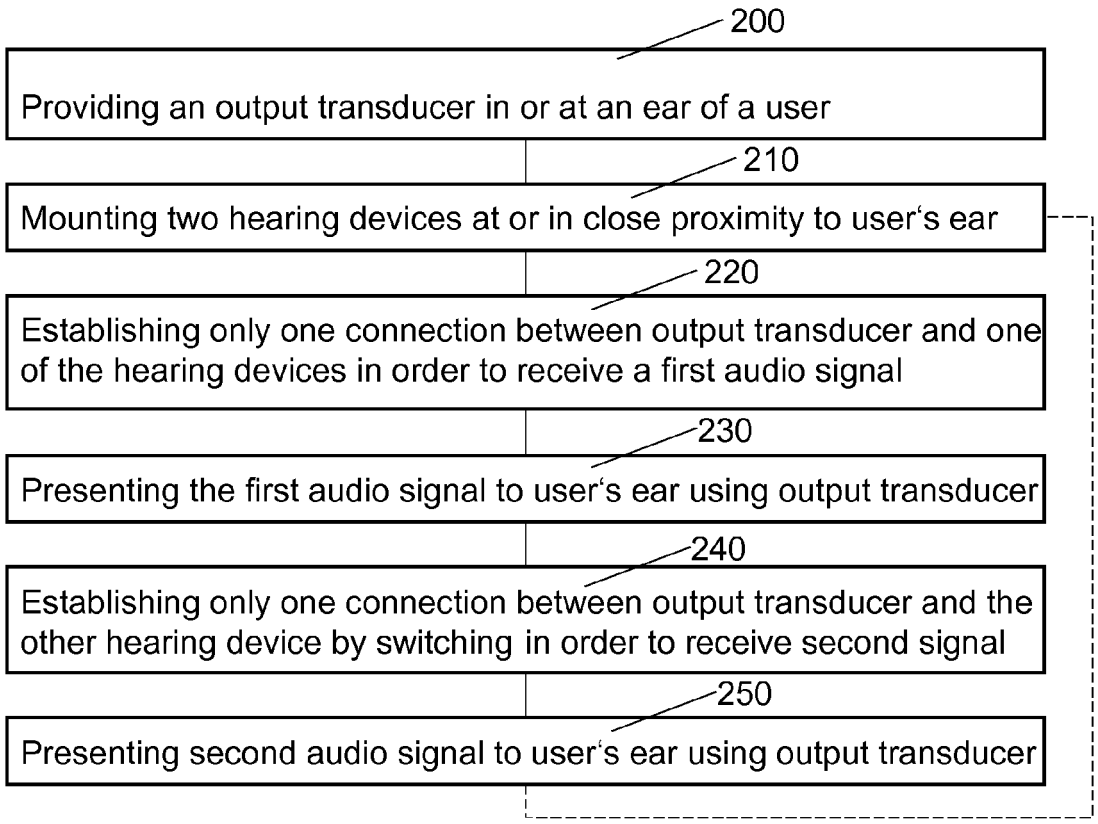
200
Providing an output transducer in or at an ear of a user
210
Mounting two hearing devices at or in close proximity to user's ear
220
Establishing only one connection between output transducer and one of the hearing devices in order to receive a first audio signal
230
Presenting the first audio signal to user's ear using output transducer
240
Establishing only one connection between output transducer and the other hearing device by switching in order to receive second signal
250
Presenting second audio signal to user's ear using output transducer

Figure 9

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 3336

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 September 2015	Valenzuela, Miriam

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29-09-2015

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