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(54) **In-situ-fitted hearing device**

Hörgerät mit in-situ Anpassung

Prothèse auditive avec adaptation in-situ

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Description

Technical Field

[0001] The invention relates to a method for fitting a hearing device. Described is a hearing device, which can be fitted to a user's hearing preferences. The hearing device can be a hearing aid, worn in or near the ear or implanted, a headphone, an earphone, a hearing protection device, a communication device or the like.

State of the Art

[0002] From US 6'668'204 two-channel hearing devices, in particular a headphone and a hearing aid, are known, which can be adapted to a user's hearing preferences or hearing imperfections, more particularly to compensate for differences between the perception in the left and the right ear. The hearing device can be connected to a personal computer, which personal computer has a user interface and contains a sound source as well as computation means. The user can choose a frequency and will thereupon hear an according sound from the sound source, downloaded to the hearing device. Via the user interface the user can then adjust the balance at that frequency until the sound is perceived centered between the left and right channels. This can be done for different frequencies, and thereafter the user can equalize the system to compensate for perceived differences in amplitude between different frequencies. After that, compensation coefficients are obtained by means of the personal computer. The compensation coefficients can be downloaded to the hearing device and can be used by a signal processor for providing for real-time equalization for each ear, so as to obtain corrected analog audio signals according to the user's hearing preferences.

[0003] In US 2003/0133578 A1 a hearing aid is presented, which can be audio-fitted by the user himself. The user can make pairwise comparisons between parameter settings (settings of gains, compression ratios, frequency values and the like) by toggling between the two different settings, and then choose that one setting which provides him with the better listening experience. Numerous such pairwise comparisons are necessary. By means of a genetic algorithm the numerous preferences, as derived from the user's choices, are converged and result in a single solution, which is expected to precisely fit the user's hearing needs.

[0004] The fitting procedure disclosed in US 2003/0133578 A1 requires to store a very large number of finally unused parameter settings. In addition, this fitting procedure is expected to take a considerable amount of time, due to the large number of required comparisons.

[0005] Another programmable method for fitting a hearing device is disclosed in WO99/48323.

Summary of the Invention

[0006] An object of the invention is to provide for a method for fitting a hearing device to a user's needs without or largely without additional means.

[0007] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs fully or largely by the user himself.

[0008] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs without or substantially without the help of a professional hearing device fitter.

[0009] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs even when no personal computer or similar means is available.

[0010] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs within a relatively short period of time.

[0011] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs, wherein main time-consuming steps during the fitting can be performed by the user himself.

[0012] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs without measuring an audiogram or middle ear reflexes or brainstem responses or the like.

[0013] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs while using only little memory space for storing parameter settings.

[0014] Another object of the invention is to provide for a method for fitting a hearing device to a user's needs without storing a large number of finally unused parameter settings.

[0015] These objects are achieved by a method for fitting a hearing device according to present claim 1.

[0016] In an exemplary aspect, a hearing device is operable in a fitting mode and in a listening mode, and the device comprises

- a transducer for receiving, in the fitting mode, audio test signals, and for converting the audio test signals into signals to be perceived by a user of the hearing device in the fitting mode;
- a parameter memory means for storing parameter settings, which parameter settings are obtained from user input received through a user interface in response to the signals perceived by the user in the fitting mode; and
- a signal processor using the parameter settings for correcting audio signals at least in the listening mode;

wherein the user interface is comprised in the hearing device, and that the hearing device comprises an audio

signal source, in which audio signal source the audio test signals are stored or generated.

[0017] This way a stand-alone fitting (audio-fitting) of the hearing device can be achieved. The hearing device can be adapted to the user's hearing needs in-situ and without additional means like a personal computer or an external module. The hearing device can be fitted autonomously by the user.

[0018] A hearing device can be, e.g., a hearing aid, worn in or near the ear or implanted, a headphone, an earphone, a hearing protection device, a communication device. The hearing device may comprise a remote control, an add-on device like, e.g., a radio frequency receiver pluggable onto an ear piece of the hearing device, or other associated devices belonging to the hearing device.

[0019] The hearing device may comprise means for obtaining parameter settings from the user input. This means can, e.g., be an algorithm implemented in a software or in a signal processor. This can make the fitting fully independent from external software and external devices like personal computers. The means contains the rules for obtaining parameter settings from the user input. The means for obtaining parameter settings can comprise look-up tables and/or rules for an interpolation between pre-programmed parameter settings.

[0020] The transducer may also be used for receiving, in the listening mode, audio signals, and for converting the audio signals into signals to be perceived by the user in the listening mode. This way, the transducer is used in the fitting mode as well as in the listening mode, which not only allows to design the hearing device more compact, but also improves the quality of the fitting, since possible differences between one transducer used in the fitting mode and another transducer used in the listening mode are intrinsically eliminated.

[0021] The user interface may have controls, which are, at least in part, identical with controls of the hearing device to be used by the user in the listening mode. This allows for a more compact design of the hearing device.

[0022] The hearing device may comprise a remote control or another separable device, and such a device may comprise, fully or in part, the user interface. Such a separable device may also comprise, fully or in part, the audio signal source and/or the parameter memory means.

[0023] The signal processor may use the parameter settings for correcting audio signals in the fitting mode and in the listening mode. An increased quality of the fitting can be achieved if those parameters are used in the listening mode, which have been obtained from and used in the fitting mode.

[0024] The parameter settings may comprise values for gains for at least one or at least two or at least three different frequency bands. Gains for different frequency bands are often times important parameters, in particular in hearing aids. And the influence of such gains can usually be reasonably well judged by an average user.

[0025] The audio test signals may comprise signals representing sounds known to the user from everyday life. Those sounds shall stem from the environment the user (or a typical user) lives in. Due to such "natural" (not artificial) sounds the user will be able to automatically adapt his hearing device in a way that the user will consider the overall sound as pleasant. Thus a significant part of a fine-tuning of the hearing device is readily achieved. Digitally sampled sounds may be comprised in the audio test signals.

[0026] The audio test signals may comprise speech signals. In particular, the speech signals can (also) be used for guiding the user in the fitting mode. This way, a comfortable guidance of the user during the fitting (prompting for user input) can be achieved.

[0027] Oftentimes, the signals to be perceived by the user in the fitting mode are acoustical sound. If, for example, the hearing device is (partially) implanted, the signals to be perceived by the user in the fitting mode can be electrical signals for stimulating a nerve.

[0028] Typically, the hearing device, or at least a part of it, is to be worn by the user in or near the user's ear.

[0029] The hearing device may comprise, in addition to an ear piece, which is a part of the hearing device to be worn by the user in or near the user's ear, a separable device. Such a separable device may be or comprise a remote control.

[0030] The hearing device may comprise a means for recording, during the listening mode, user input received through controls of the hearing device used in the listening mode. This is very advantageous for a further fine-tuning of the hearing device, which may be done with an external device for evaluating the recorded data, or within the hearing device. In one example, the hearing device comprises means for obtaining parameter settings from the user input recorded in the listening mode. In that case, an in-situ and autonomous fine-tuning of the acoustic properties of the hearing device can be performed. The means for obtaining parameter settings from the recorded user input can, e.g., be programmed such that, if the user of, e.g., a hearing aid has repeatedly reduced the volume (using, e.g., a volume dial) in some acoustical environments, in which a certain frequency band is predominant, the gain for that frequency band will be reduced.

[0031] In an exemplary aspect, a method for fitting a hearing device, which is operable in a fitting mode and in a listening mode, comprises, in the fitting mode, the steps of

- converting audio test signals stored or generatable in the hearing device into signals to be perceived by a user of the hearing device;
- receiving user input via a user interface of the hearing device in response to the signals perceived by the user;

- obtaining parameter settings from the user input, which parameter settings are to be used for correcting audio signals in the listening mode; and
- storing the parameter settings in the hearing device.

[0032] The method may comprise furthermore the step of choosing initial parameter settings, which may include at least one initial gain value and at least one initial compression value, upon a description of the user's hearing situation. Said initial parameter settings may, e.g., be chosen by manipulating at least one control of the user interface during a booting process (switching on) of the hearing device. Or said hearing devices are available with one of various pre-programmed parameter settings (presets), and on the hearing device itself or on a hearing device's package an indication or labelling identifying the initial parameter settings is provided, e.g., an imprinted "1" or "2" or "3", wherein, e.g., in the case of a hearing aid, "1" could indicate an initial parameter setting for a user with light hearing loss, "2" could indicate an initial parameter setting for a user with moderate hearing loss, and "3" could indicate an initial parameter setting for a user with severe hearing loss. Depending on the description of the user's hearing situation, a hearing aid with suitable preset initial parameter settings could be chosen. Said description of the user's hearing situation can, e.g., be provided orally or in writing by the user, who reports, e.g., in the case of a hearing aid, e.g., which kind of everyday-life sounds he perceives under which circumstances. And/or said description of the user's hearing situation can, e.g., be obtained by exposing the user (at that time not provided with the hearing device), with known acoustic stimuli (e.g., sounds from a musical instrument, or sounds played to the user via loudspeakers) and determine therefrom the user's hearing situation (degree of a possible hearing loss, possible problems with high frequencies, typical hearing situations the user is exposed to, and the like).

[0033] The audio test signals may comprise at least a first and a second test signal, the spectral contents of which, when converted into signals to be perceived by the user, are substantially representative of a first and a second spectral band, respectively, which first and a second spectral bands are substantially different, i.e., the spectral bands do not or only partially (to a small extent) overlap. This allows for an efficient way of finding suitable values for gains for different frequency bands.

[0034] In another example, in the fitting mode, firstly

- the first test signal is converted into a first signal to be perceived by the user; and
- the user input in response to the first signal comprises increasing or decreasing the perceived loudness of the first perceived signal;

and secondly

- the second test signal is converted into a second signal to be perceived by the user; and
- the user input in response to the second signal comprises increasing or decreasing the perceived loudness of the second perceived signal;

wherein

- from the user input in response to the first signal and from the user input in response to the second signal at least one gain value for the amplification of the first spectral band and at least one gain value for the amplification of the second spectral band is obtained.

[0035] The increasing or decreasing the perceived loudness of the (first and second) perceived signal will usually be accomplished by adjusting the volume control of the user interface appropriately. It is possible to foresee that the user, by manipulating a control of the user interface, e.g., pressing a switch, acknowledges to the hearing device that the correct volume setting is adjusted.

[0036] Advantages of methods correspond to the advantages of corresponding hearing devices and vice versa.

[0037] Further embodiments and advantages emerge from the dependent claims and the figures.

Brief Description of the Drawings

[0038] Below, the invention is illustrated in more detail by means of embodiments of the invention and the included drawings. The figures show:

Fig. 1 a schematic diagram of a hearing device;

Fig. 2 a block diagram of a method to operate a hearing device in the fitting mode;

Fig. 3 Real-Ear Insertion Gain for one frequency band in dependence of the input power and its changes with changes in the overall volume.

[0039] The reference symbols used in the figures and their meaning are summarized in the list of reference symbols. Generally, alike or alike-functioning parts are given the same or similar reference symbols. The described embodiments are meant as examples and shall not confine the invention.

Detailed Description of the Invention

[0040] Fig. 1 shows a schematic diagram of a hearing device 1, which is operable in a fitting mode and in a listening mode. The hearing device 1 can be considered a hearing aid. The listening mode is the normal mode of operation, in which incoming sound 5 is received by a microphone 3 of the hearing device 1, converted into audio signals 7, which can be processed and/or corrected

in a usually digital signal processor 4 (DSP) and, after amplification (not shown in Fig. 1), be converted, by means of a loudspeaker 2, into sound 6 to be perceived by a user of the hearing device 1.

[0041] In the fitting mode, parameter settings 17 shall be found, which are used in the DSP 4 during the listening mode, so that the signal 6 provided to the user is adapted to the user's hearing requirements. Such parameter settings may include, but are not limited to, one or more of the group consisting of overall amplification gain, gains for different frequency bands, compression ratios (at different input levels), expansion ratios, frequency values like sampling frequencies, filter crossover frequencies, time constants, output limiting threshold values.

[0042] The hearing device comprises an audio signal source 8, which contains or generates audio test signals 9, which can be, optionally after having been processed in the DSP 4, fed into the loudspeaker (transducer) 2 in order to generate signals 6 to be perceived by the user. Step 100 of the block diagram of Fig. 2, which depicts steps performed in the fitting mode, illustrates this.

[0043] Upon perceiving the signals 6, the user can respond to that by using a user interface 12 of the hearing device 1. In the hearing device of Fig. 1 the user interface 12 for use in the fitting mode is identical with the user interface, which the user uses in the listening mode. The user interface 12 comprises controls 13, 14, which are identical with a volume wheel 13 and a program change knob 14. If, e.g., the user perceives the sound 6 as too loud or too soft, he can manipulate the volume wheel 13 until the sound 6 is perceived in a pleasant volume. Step 110 of Fig. 2 depicts this step.

[0044] From the user's input 11 in response to one or several perceived signals 6 parameter settings 17 can be obtained through a means 15 for obtaining parameter settings from user input. The means 15 can, e.g., be integrated in a controller 18 of the hearing device 1. Step 120 of Fig. 2 depicts this step.

[0045] Parameter settings 17 can be stored in a parameter memory means 16 of the hearing device 1. Step 130 of Fig. 2 depicts this step. The (new) parameter settings 17 will then be used in the DSP 4 in the listening mode and, optionally, also in the fitting mode.

[0046] It will usually be sufficient to store one or two parameter settings 17 in the hearing device 1. If the hearing device has several hearing programs (usually for different incoming signals 5), storing one or two parameter settings 17 per hearing program in the hearing device will usually be sufficient.

[0047] At least a part of the audio test signals 9 stored in the audio signal source 8 can be sounds known to the user from everyday life. E.g., a triangle sound, some telephone speech and a ship horn could be suitable sounds. In one embodiment, at least part of the audio test signals 9 are digitally sampled sounds.

[0048] In an exemplary aspect at least a subset of the audio test signals 9 are sounds representative of a specific spectral band each, which spectral bands may be

partially overlapping or substantially not overlapping. Accordingly, the sounds are selected so as to contain sufficient spectral density within the appropriate frequency band. The three sounds mentioned above can be considered as a set of sounds representative for a high frequency band (triangle), a medium frequency band (telephone speech) and a low frequency band (ship horn), respectively. Their spectral bands are substantially not overlapping with the exception that the low frequency band of the ship horn partially overlaps with the medium frequency band.

Example for a relatively basic fitting procedure:

[0049] A long press on the program change button 14 may toggle between the listening mode and the fitting mode. Upon entering the fitting mode, the triangle sound is played to the user (possibly repeatedly). The user manipulates the control 13 (volume wheel) until a comfortable audibility of the sound is achieved. Pressing the control 14 (shortly) will change to the middle frequency band; the telephone speech sound will be played to the user. Again, the user will manipulate the control 13 (volume wheel) until a comfortable audibility of the sound is achieved. Another (short) press on the control 14 will initiate the same actions for the low frequency band. It may be foreseen that nother (short) press on the control 14 leads back to the high frequency sound. Finally, a long press on control 14 can initiate the calculation and storing of the new parameter settings 17, which in that case would at least comprise one gain value for each of the three frequency bands represented by the three sounds. The listening mode is engaged, and the new (improved) parameters are used.

[0050] It is also possible to calculate new parameter settings 17 immediately after each (short) press on the control 14 and to use the new parameter settings 17 from then on (already during the fitting).

[0051] In the invention, the audio signal source 8 comprises guiding speech signals 10, which also is depicted in Fig. 1. Such signals may be synthesized or be sound samples of the human voice. The guiding speech signals 10 can be used in the fitting mode and possibly also in the listening mode. In the fitting mode the user will be guided through the fitting procedure by instructions given through the guiding speech signals 10. E.g., "Please adjust the volume" or "If you want to terminate the fitting procedure, press and hold the button" or the like.

[0052] The guiding speech signals 10 (or a part of them) can, at the same time, be used as audio test signals 9.

[0053] Another feature is depicted in Fig. 1 in conjunction with the items 19 and 20. It is possible to foresee a recording means 19 in the hearing device 1 for recording, during the listening mode, user input received through controls 13, 14 of the hearing device 1 used in the listening mode. I.e., when in listening mode, the user will from time to time, usually depending on the acoustical environment

in which he is, make manipulations with controls of the hearing device, which are meant for such purposes. E.g., the user will reduce the volume by means of the volume wheel 13 when the perceived overall volume is too high. Such user input may be recorded constantly, periodically or upon request, in the recording means 19. Constantly, periodically or upon request, possibly also with the aid of an external computer or similar device, the recorded data can be evaluated, and through a means 20 for obtaining parameter settings from the user input recorded in the listening mode new parameter settings 17 can be obtained.

[0054] For example, the hearing device may record sound situations (e.g., in form of amplitude histograms over frequency) and the thereby performed volume changes as made by the user through the volume control. The recorded information may then be used to adapt gain settings or other parameters upon turning on the hearing device or upon changing into a certain hearing device program used in a respective sound situation.

[0055] "Intelligent" changes in parameter settings may be foreseen, like, e.g., turning on a beamformer for focused reception of sound 5 in a speech-in-noise environment instead of increasing a gain value, when the user repeatedly requests a higher volume via the volume wheel in such acoustical situations.

[0056] Thus the hearing device may learn from the actions (manipulations of the controls of the hearing device) of the user and takes his sound perception in real day-to-day situations into account.

[0057] In EP 1 414 271 A2 and US 2004/0190739 A1 it is described in great detail, how such information may be recorded and evaluated.

[0058] The means 15 and 20 may be identical. One or both of the means 15 and 20 may be part of the controller 18. The controller 18 may be partially or in full be integrated in the DSP 4. The parameter memory means 16 may partially or in full be integrated in the DSP 4 or in the controller 18.

[0059] The incoming signal 5 may be sound 5 or electromagnetic waves to be received by the hearing device 1 (e.g., wireless headphone, implanted hearing aid with wireless transmitter (wireless reception), or hearing aid in the respective mode).

[0060] Before the actual fitting and before the insertion of the hearing device 1 or a part of the hearing device 1 into the user's ear (if the hearing device 1 is designed accordingly), it is possible to add an inspection step, in which a fundamentally-educated person inspects the user's ear for obstructions.

[0061] Furthermore, it is possible to choose initial parameter settings, in particular initial gain settings, e.g., according to a user's self-described hearing problem (e.g., light loss, moderate loss, severe loss) by either choosing from a number of hearing devices a hearing device with pre-set parameter settings for the described hearing problem, which can, e.g. be labeled on a packaging of the hearing device, or set the parameter settings

through a (simple) selection procedure via the user interface.

[0062] It is possible to use the above-described fitting method (cf. Fig. 2) as the only audio-fitting to be done with the hearing device. In that case it is possible to use at no stage an additional device not belonging to the hearing device during fitting the hearing device. It is, alternatively, possible to use that method as a part of a more extensive fitting. In that case, it is possible to add more elaborate fitting steps, which, e.g., may make use of software on an external personal computer.

[0063] The use of "natural" sounds (sounds already known to the user) not only has the advantage that the user's acceptance of such sounds is great and that the user readily feels comfortable with such sounds (as opposed to sine waves or the like, which are often used in fitting procedures). Since such "natural" sounds are never extremely narrowband, e.g. sinusoidal, a certain interpolation over different frequency bands can automatically be achieved. Nevertheless, it is possible to interpolate or extrapolate parameter settings for additional (e.g., intermediate) frequency bands from the settings for a smaller number of actually tested frequency bands like the three bands discussed above. Known frequency relationships like known partial transfer functions like RECD (real-ear-to-coupler difference), MLE (microphone location effect), OEG (open ear gain) and others may be incorporated in the derivation of gain parameters. An MPO (maximum power output) may initially or generally be set to standard values for unimpaired persons (e.g., 100 dB) or may be automatically adapted according to the user-defined gain settings, or may be set by the user either explicitly (upon tests with appropriate test audio signals) or implicitly (through evaluation of the user's manipulations of the user interface during listening mode as described above).

[0064] Any or a group of the parameters knee-point levels, kneepoint gains, expansion slopes, compression slopes, maximum gain settings, maximum output values, and other parameters may be pre-configured or derived from the parameter settings obtained from the user input.

[0065] Fig. 3 schematically shows an example for a pre-configured REIG (real-ear insertion gain) (in dB), e.g., for one frequency band, dependent on the input power (in dB signal pressure level) and how it changes with changes in the overall volume as selected by the user. The solid curve depicts the MPO, which is used when the volume is set to maximum by means of the volume dial (thin dotted arrow). Upon reducing the volume somewhat (as indicated by the thick solid arrow), the REIG curve is changed to the uppermost dashed curve in Fig. 3. REIG curves for even lower chosen volumes are also shown.

55 List of Reference Symbols

[0066]

1 hearing device, hearing aid
 2 transducer, output transducer, loudspeaker,
 receiver
 3 transducer, input transducer, microphone
 4 signal processor, digital signal processor, DSP 5
 5 sound, incoming sound, incoming signal (lis-
 tening mode)
 6 signals to be perceived by the user (in the
 fitting mode or in the listening mode), sound, 10
 outgoing sound
 7 audio signals (listening mode)
 8 audio signal source
 9 audio test signals
 10 guiding speech signals 15
 11 user input
 12 user interface, set of controls
 13 control, volume wheel
 14 control, program change knob
 15 means for obtaining parameter settings from 20
 user input; part of controller
 16 parameter memory means, memory chip
 17 parameter settings, set of audio parameters
 18 controller
 19 recording means, means for recording, dur- 25
 ing the listening mode, user input received
 through controls of the hearing device used
 in the listening mode
 20 means for obtaining parameter settings from 30
 the user input recorded in the listening mode
 100-130 steps

Claims

1. Method for fitting a hearing device (1), which is op-
 erable in a fitting mode and in a listening mode and
 which is to be worn by a user in or near the user's
 ear, said method comprising, in the fitting mode, the
 steps of

- converting audio test signals (9) stored or gen-
 eratable in the hearing device (1) into signals (6)
 to be perceived by a user of the hearing device;
- receiving user input (11) via a user interface
 (12) of the hearing device (1) in response to the
 signals (6) perceived by the user;
- obtaining parameter settings (17) from the user
 input (11), which parameter settings are to be
 used for correcting audio signals (7) in the lis-
 tening mode; and
- storing the parameter settings (17) in the hear-
 ing device (1);

wherein the audio test signals (9) comprise speech
 signals (10) for guiding the user in the fitting mode,
 and wherein the audio test signals (9) comprise at
 least a first and a second test signal, the spectral

contents of which, when converted into signals (6)
 to be perceived by the user, are substantially repre-
 sentative of a first and a second spectral band, re-
 spectively, which first and second spectral bands are
 substantially different;
 wherein, in the fitting mode, firstly

- the first test signal is converted into a first signal
 to be perceived by the user; and
- the user input (11) in response to the first signal
 comprises increasing or decreasing the per-
 ceived loudness of the first perceived signal;

and secondly

- the second test signal is converted into a sec-
 ond signal to be perceived by the user;
- the user input (11) in response to the second
 signal comprises increasing or decreasing the
 perceived loudness of the second perceived sig-
 nal;

wherein said increasing or decreasing the perceived
 loudness of the first and second perceived signal,
 respectively, is accomplished by adjusting a control
 of a user interface (12) of said hearing device (1)
 identical with a volume control (13) of said user in-
 terface to be used by the user in the listening mode,
 and wherein

- from the user input (11) in response to the first
 signal and from the user input (11) in response
 to the second signal at least one gain value for
 the amplification of the first spectral band and
 at least one gain value for the amplification of
 the second spectral band is obtained.

2. Method according to claim 1, wherein said increasing
 or decreasing the perceived loudness of the first and
 second perceived signal, respectively, is carried out
 until a comfortable audibility of the respective sound
 is achieved.

3. Method according to claim 1, comprising the step of

- acknowledging to the hearing device (1) that
 the correct volume setting is adjusted by manip-
 ulating a control of said user interface.

4. Method according to claim 3, wherein said manipu-
 lating a control of said user interface is a pressing of
 a switch of said user interface.

5. Method according to one of the preceding claims,
 furthermore comprising the step of choosing initial
 parameter settings, which include at least one initial
 gain value and at least one initial compression value,
 upon a description of the user's hearing situation.

6. Method according to one of the preceding claims, wherein the audio test signals (9) comprise signals representing sounds known to the user from everyday life. 5
7. Method according to one of the preceding claims, wherein the audio test signals (9) comprise digitally sampled sounds. 10
8. Method according to one of the preceding claims, comprising the step of 15
- recording, during the listening mode, user input received through controls (13, 14) of the hearing device (1) used in the listening mode. 20
9. Method according to claim 8, comprising the step of
- obtaining parameter settings from the user input recorded in the listening mode. 25

Patentansprüche

1. Verfahren zum Anpassen eines Hörgeräts (1), welches sowohl in einem Anpassungsmodus als auch in einem Hörmodus betrieben werden kann und von einem Benutzer im Ohr oder nahe des Ohrs des Benutzers zu tragen ist, wobei das Verfahren im Anpassungsmodus folgende Schritte umfasst: 30
- das Umwandeln von im Hörgerät (1) gespeicherten oder generierten Audiotestsignalen (9) in Signale (6), welche vom Benutzer des Hörgeräts wahrgenommen werden sollen; 35
 - das Empfangen von Benutzereingabe/n (11) über eine Benutzeroberfläche (12) des Hörgeräts (1) als Antwort auf die vom Benutzer wahrgenommenen Signale (6); 40
 - das Erhalten von Parametereinstellungen (17) aus der/den Benutzereingabe/n (11), wobei die Parametereinstellungen zum Korrigieren von Audiosignalen (7) im Hörmodus verwendet werden sollen; und 45
 - das Speichern der Parametereinstellungen (17) im Hörgerät (1);

wobei die Audiotestsignale (9) Sprachsignale (10) zum Anleiten des Benutzers im Anpassungsmodus umfassen und wobei die Audiotestsignale (9) mindestens ein erstes und zweites Testsignal umfassen, deren spektrale Inhalte, wenn sie in Signale (6) umgewandelt werden, die vom Benutzer wahrgenommen werden, im Wesentlichen repräsentativ für ein erstes bzw. ein zweites Spektralband sind, wobei sich das erste und das zweite Spektralband wesentlich voneinander unterscheiden; wobei, im Anpassungsmodus, als erstes

- das erste Testsignal in ein erstes, vom Benutzer wahrgenommenes, Signal umgewandelt wird; und
- die Benutzereingabe/n (11) als Antwort auf das erste Signal das Erhöhen oder Reduzieren der wahrgenommenen Lautstärke des ersten wahrgenommenen Signals umfasst/umfassen;

und zweitens

- das zweite Testsignal in ein zweites, vom Benutzer wahrgenommenes, Signal umgewandelt wird;
- die Benutzereingabe/n (11) als Antwort auf das zweite Signal das Erhöhen oder Reduzieren der wahrgenommenen Lautstärke des zweiten wahrgenommenen Signals umfasst/umfassen;

wobei das besagte Erhöhen oder Reduzieren der wahrgenommenen Lautstärke des ersten bzw. des zweiten wahrgenommenen Signals erreicht wird, durch Einstellung eines Reglers der Benutzeroberfläche (12) des Hörgeräts (1), welcher identisch ist mit einem Lautstärkeregler (13) der Benutzeroberfläche, welche vom Benutzer im Hörmodus zu verwenden ist, und wobei

- aus der/den Benutzereingabe/n (11) als Antwort auf das erste Signal und aus der/den Benutzereingabe/n (11) als Antwort auf das zweite Signal mindestens ein Verstärkungswert für die Verstärkung des ersten Spektralbands und mindestens ein Verstärkungswert für die Verstärkung des zweiten Spektralbandes ermittelt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das besagte Erhöhen oder Reduzieren der wahrgenommenen Lautstärke des ersten bzw. des zweiten wahrgenommenen Signals ausgeführt wird, bis eine angenehme Hörbarkeit des entsprechenden Tons erreicht ist.
3. Verfahren nach Anspruch 1, umfassend den Schritt
- des Bestätigens gegenüber dem Hörgerät (1), dass die richtige Lautstärkeeinstellung eingestellt ist, durch Betätigen eines Reglers der Benutzeroberfläche.
4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** das Betätigen eines Reglers der Benutzeroberfläche ein Drücken eines Schalters der Benutzeroberfläche ist.
5. Verfahren nach einem der vorangehenden Ansprüche, zusätzlich umfassend den Schritt des Auswählens von Parameterstarteinstellungen, welche mindestens einen Verstärker-Startwert und mindestens

einen Kompressions-Startwert, nach der Beschreibung der Hörsituation des Benutzers, beinhalten.

6. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Audiotestsignale (9) Signale umfassen, welche Töne darstellen, die dem Benutzer aus dem täglichen Leben bekannt sind. 5
7. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Audiotestsignale (9) digital gesampelte Töne umfassen. 10
8. Verfahren nach einem der vorhergehenden Ansprüche, umfassend den Schritt 15
 - des, während des Hörmodus erfolgenden, Aufzeichnens von der/den Benutzereingabe/n, welche von Reglern (13, 14) des Hörgeräts (1), das im Hörmodus verwendet wird, empfangen wird/werden. 20
9. Verfahren nach Anspruch 8, umfassend den Schritt 25
 - des Erhalts von Parametereinstellungen aus der/den Benutzereingabe/n, welche im Hörmodus aufgezeichnet wurde/n. 25

Revendications 30

1. Procédé d'ajustement d'une prothèse auditive (1), qui peut fonctionner en mode ajustement et en mode écoute et qui est destinée à être portée par un utilisateur dans l'oreille de l'utilisateur ou à proximité de l'oreille de l'utilisateur, ledit procédé comprenant, en mode ajustement, les étapes de 35
 - conversion de signaux de test audio (9) stockés ou pouvant être générés dans la prothèse auditive (1) en signaux (6) à percevoir par un utilisateur de la prothèse auditive ; 40
 - réception d'une entrée utilisateur (11) via une interface utilisateur (12) de la prothèse auditive (1) en réponse aux signaux (6) perçus par l'utilisateur ; 45
 - obtention de réglages de paramètres (17) de l'entrée utilisateur (11), lesdits réglages de paramètres étant destinés à être utilisés pour corriger les signaux audio (7) en mode écoute ; et 50
 - stockage des réglages de paramètres (17) dans la prothèse auditive (1) ;

dans lequel les signaux de test audio (9) comprennent des signaux parole (10) pour guider l'utilisateur en mode ajustement, et dans lequel les signaux de test audio (9) comprennent au moins des premier et second signaux de test, dont les contenus spectraux, 55

lorsqu'ils sont convertis en signaux (6) destinés à être perçus par l'utilisateur, sont sensiblement représentatifs de première et seconde bandes spectrales, respectivement, lesdites première et seconde bandes spectrales étant sensiblement différentes ; dans lequel, en mode ajustement, premièrement

- le premier signal de test est converti en un premier signal destiné à être perçu par l'utilisateur ; et
- l'entrée utilisateur (11) en réponse au premier signal comprend l'augmentation ou la réduction de l'intensité sonore perçue du premier signal perçu ;

et deuxièmement

- le second signal de test est converti en un second signal destiné à être perçu par l'utilisateur ;
- l'entrée utilisateur (11) en réponse au second signal comprend l'augmentation ou la réduction de l'intensité sonore perçue du second signal perçu ;

dans lequel ladite augmentation ou ladite réduction de l'intensité sonore perçue des premier et second signaux perçus, respectivement, est réalisée par ajustement d'une commande d'une interface utilisateur (12) de ladite prothèse auditive (1) identique à une commande de volume (13) d'une interface utilisateur destinée à être utilisée par l'utilisateur en mode écoute, et dans lequel

- à partir de l'entrée utilisateur (11) en réponse au premier signal et à partir de l'entrée utilisateur (11) en réponse au second signal au moins une valeur de gain pour l'amplification de la première bande spectrale et au moins une valeur de gain pour l'amplification de la seconde bande spectrale sont obtenues.

2. Procédé selon la revendication 1, dans lequel ladite augmentation ou ladite réduction de l'intensité sonore perçue des premier et second signaux perçus, respectivement, est réalisée jusqu'à l'obtention d'une audibilité confortable du son respectif.
3. Procédé selon la revendication 1, comprenant l'étape de
 - confirmation à la prothèse auditive (1) que le réglage de volume correct est ajusté par manipulation d'une commande de ladite interface utilisateur.
4. Procédé selon la revendication 3, dans lequel ladite manipulation d'une commande de ladite interface utilisateur consiste à appuyer sur un commutateur

de ladite interface utilisateur.

5. Procédé selon l'une des revendications précédentes, comprenant en outre l'étape de choix des réglages de paramètres initiaux, qui comprend au moins une valeur de gain initiale et au moins une valeur de compression initiale, lors de la description de la situation auditive d'un utilisateur. 5
6. Procédé selon l'une des revendications précédentes, dans lequel les signaux de test audio (9) comprennent des signaux représentant des sons connus de l'utilisateur de la vie de tous les jours. 10
7. Procédé selon l'une des revendications précédentes, dans lequel les signaux de test audio (9) comprennent des sons numériquement échantillonnés. 15
8. Procédé selon l'une des revendications précédentes, comprenant l'étape de 20
 - enregistrement, en mode écoute, de l'entrée utilisateur reçue par les commandes (13, 14) de la prothèse auditive (1) utilisée en mode écoute. 25
9. Procédé selon la revendication 8, comprenant l'étape de
 - obtention des réglages de paramètres de l'entrée utilisateur enregistrée en mode écoute. 30

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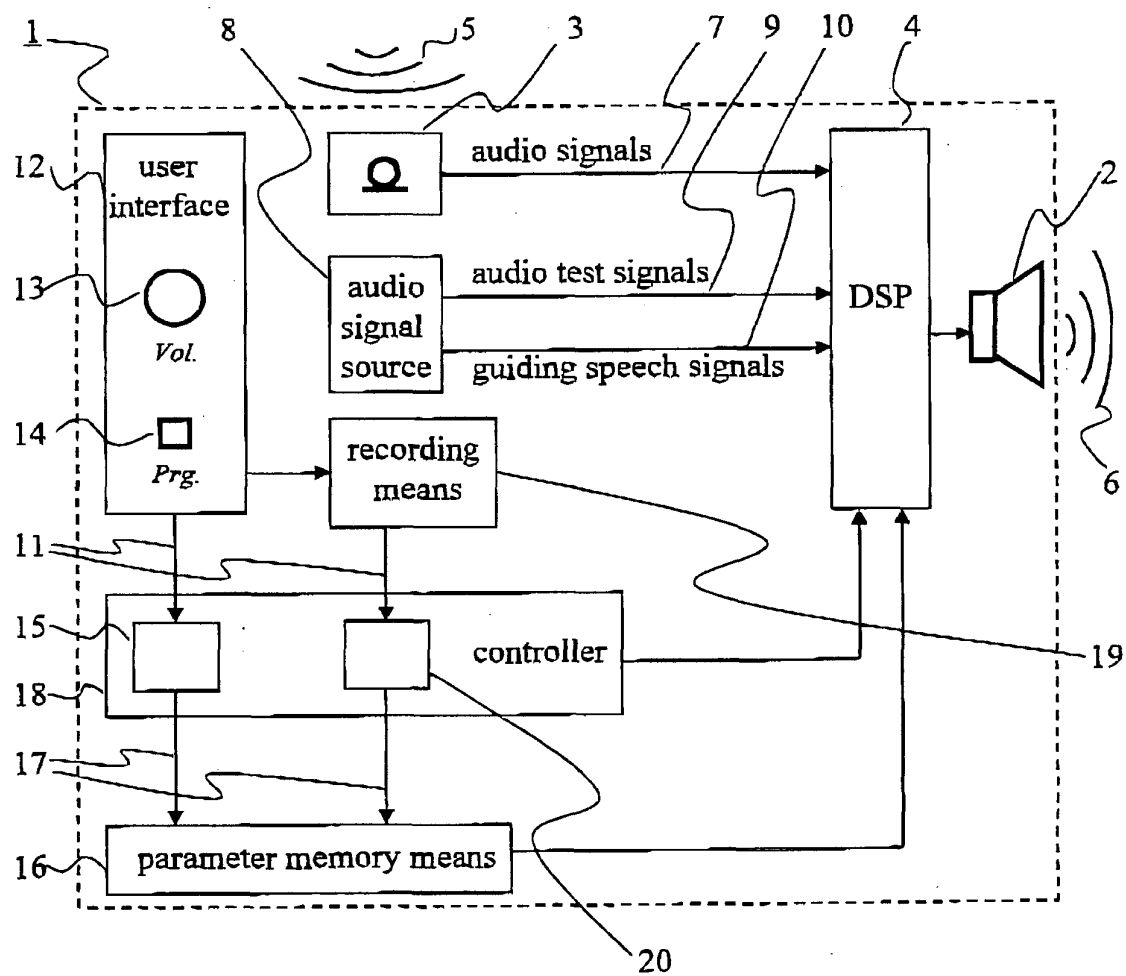
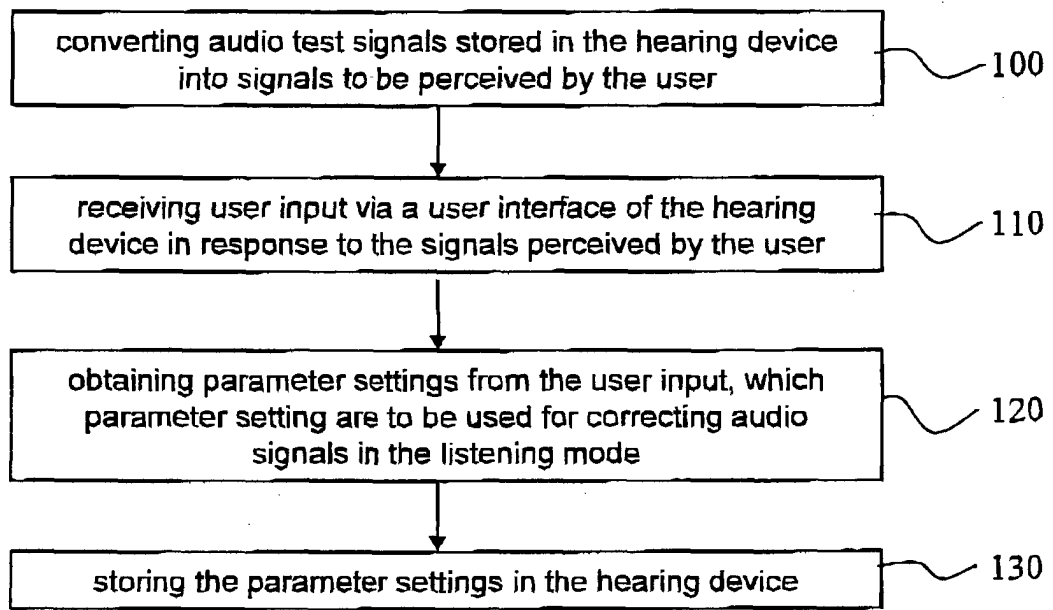
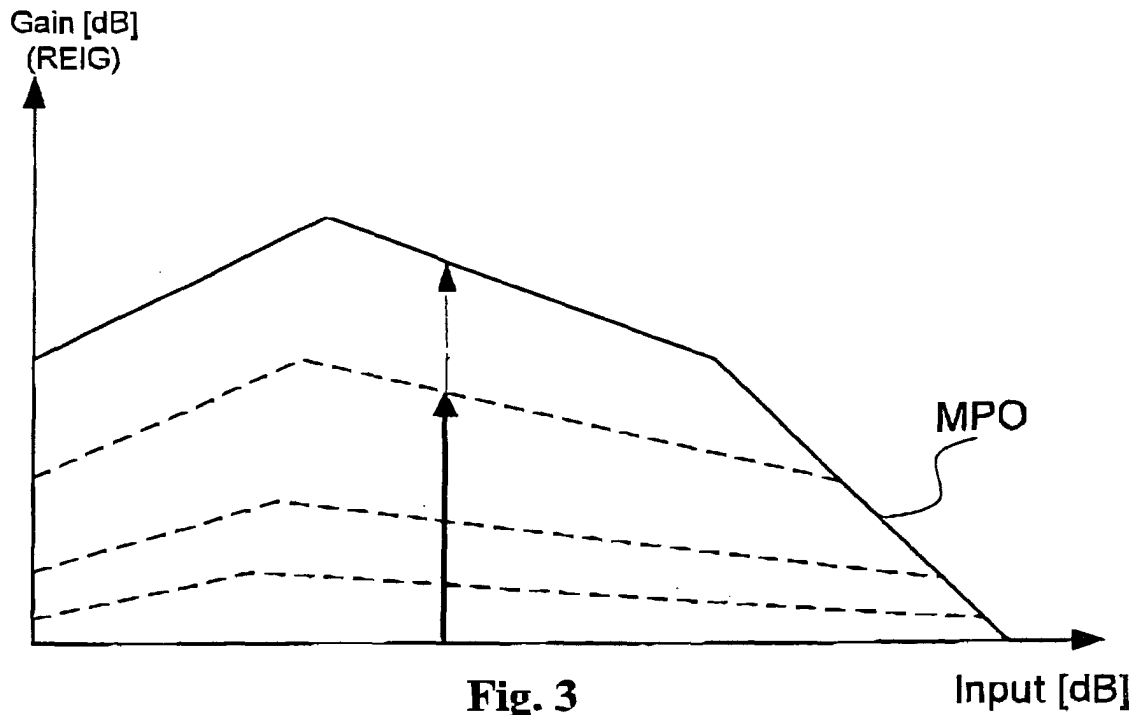


Fig. 1

**Fig. 2****Fig. 3**

REFERENCES CITED IN THE DESCRIPTION

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