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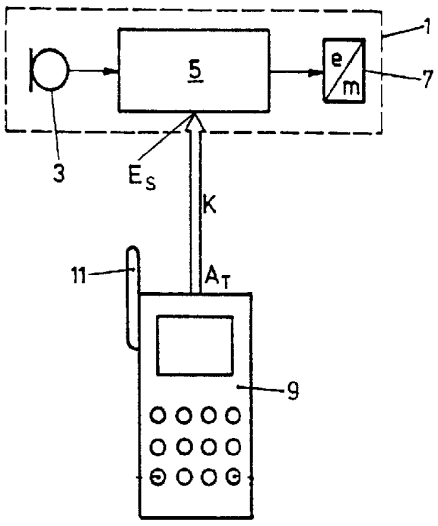
(54) Title: FITTING SYSTEM

(54) Bezeichnung: FITTING-ANLAGE



(57) Abstract: Disclosed is a fitting system for hearing devices (1), whereby the input device is a mobile telephone (9).

(57) Zusammenfassung: Es wird eine Fitting-Anlage für Hörgeräte (1) vorgeschlagen, bei der die Eingabeeinrichtung durch ein Mobiltelefongerät (9) realisiert ist.

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Fitting system

The present invention relates to a fitting system for the adjustment of a hearing device to the needs of an individual and comprising an adjuster unit with input device, which can be operatively connected by a line and/or wireless connection to a setting control input on the hearing device.

Since the introduction of programmable, digital hearing devices, computers, especially PCs, have - in addition to special, computer-aided fitting devices - assumed a dominant role as adjustment or fitting platforms for adjusting hearing devices to individual requirements. Such devices are operatively connected through a wireless or line connection to a setting control input on the hearing device, usually adjusted in situ, by means of known communications software. During the fitting or adjustment procedure, the signal transmission to the hearing device - between acoustic/electrical transducer on the input side and electrical/mechanical transducer on the output side - is modified on the basis of setting control signals to the aforementioned control input. This is generally done in accordance with hearing tests with or without hearing device and subjective hearing impressions on the part of the individual. The usually complex correlations between simple, subjective hearing impressions on the part of the individual and the adjustment of parameters on the hearing device signal transmission are usually compiled by a program on the adjuster device. An optimum, individual adjustment of digital hearing devices therefore makes it virtually essential to consult a specialist, who has the correspondingly programmed adjustment devices and who

through careful training is familiar with the complex operation and function of such devices.

This procedure, virtually indispensable with modern hearing devices, excludes large groups of people all over the world from using such hearing device technology, since in many places the infrastructure necessary for optimum adjustment is lacking with regard both to the devices and the necessary operating environments, and the training of specialists. For this reason the facility for adjusting hearing devices by means of trimmer and screwdriver is still widely preferred.

If the adjustment of hearing devices to the particular individual is limited to the latter procedure, however, the range of hearing devices that can be used for this purpose is limited, particularly when it comes to modern, digital hearing devices. Even if, in terms of hardware, a number of trimming facilities necessary for tuning are provided on such hearing devices and are of clearly identifiable design, this gives rise to high additional design costs for the hearing device and the mechanically moving parts lead to an increased susceptibility to malfunction, quite apart from the fact that it is scarcely possible to undertake the complex and interdependent parameter adjustment sometimes necessary for optimal hearing aids.

The object of the present invention is to solve this problem and to create a facility for also ensuring the widest possible distribution of modern hearing devices.

For this purpose, a fitting system of the aforementioned type is proposed, in which the input device is a mobile telephone. This approach proceeds primarily from the insight that, in contrast to PCs or other fitting-

specific equipment, mobile telephones are common all over the world and their operation is increasingly a part of everyday life. The widespread use of mobile telephones and the routine nature of their operation and menu control mean that the stated object is even achieved to the extent that the hearing device adjustment can, if necessary, be undertaken by the individuals themselves, especially where the corresponding on-line support for the mobile telephone is available, as is yet to be explained.

In a preferred embodiment of the fitting system according to the invention, the operative connection between mobile telephone and hearing device is achieved by way of a converter. This connection between mobile telephone on the one hand and converter on the other is achieved via an HF connection of the mobile telephone and/or via an infrared connection and/or via an acoustic connection. Between the converter and the hearing device, on the other hand, the said communications connection is via a line and/or wireless connection.

In this case a wireless communications connection between converter and hearing device may be acoustic or, if necessary, via a high-frequency connection adequate for the hearing device or via an IR connection. However, an acoustic communications connection may, where necessary, also be provided directly between mobile telephone and hearing device, without the intermediate connection of a converter.

The converter is furthermore preferably designed as an independent unit or is integrated into the hearing device or into the mobile telephone.

In a preferred embodiment, the mobile telephone used according to the invention is designed for communication with a communications network, preferably with the Internet and/or an Intranet. This creates the facility for fully exploiting the possibilities afforded by such networks including E-commerce, that is electronic ordering and electronic purchasing, not only for the hearing device adjustment, but also for the software configuration of the hearing device itself and for respective updates.

Due to the fact that the fitting system according to the invention further comprises a server and the mobile telephone is designed for communication with this server, and that at least one of the following types of data, viz.:

- fitting programs
- hearing device software
- updates for fitting programs and/or hearing device software

is transmitted between server and mobile telephone, the procedure according to the invention means that fitting programs, not necessarily memory-resident, can be used in the latest version from the mobile telephone and/or that the program configuration on the hearing device and updating of these programs can be inexpensively implemented. Whereas in the first case, that is the downloading of fitting programs from a server, these are filed in the mobile telephone, if only during the fitting procedure, and are used therefrom for the hearing device adjustment, in the second aforementioned case, that is the downloading of hearing device programs, the mobile telephone is only used as manual control panel and as transit station, where necessary together with said

converter, in order to transmit hearing device software supplied by the server finally to the hearing device.

In a further embodiment, in which the system according to the invention again comprises a server and the mobile telephone is designed for communication with this server, the following data are transmitted between them:

- hearing device - individual data from the mobile telephone to the server; and/or
- hearing device - individual control data from the server to the mobile telephone.

The facility is thereby created for filing the current settings of the individual hearing device on the server and handily storing updates and setting history thereof, so that, with a view to optimizing the subjective hearing impressions, the individual can transmit individual subjective hearing data to the server via the mobile telephone, and from the server can make modifications and adjustments directly to the hearing device via the mobile telephone, taking into account the subjective hearing data, the individual hearing device history and current settings of the hearing device. In this procedure the expert optimization of settings for the individual hearing device is shifted to the server, which is operated, for example, by a hearing device company or a group of hearing device companies.

As already mentioned, financial settlement for such additional services can be effected in the usual ways for E-commerce, whether this is done by subscription or by a specific single order and payment.

According to the present invention, the mobile telephone, released from its actual telephone function, can

therefore be used virtually in a minimal form on the fitting system according to the invention, as an electronic screwdriver, so to speak. A communications connection is established with the hearing device(s), preferably via said converter, and the mobile telephone, menu-driven, is switched by manual input and/or speech input to a hearing device adjustment mode. An individual wearing the hearing device himself or a specialist then adjusts transmission parameters on the hearing device by operating the input. Whether a specialist has to be employed for this purpose or whether the individual can perform these operations himself, largely depends on to what extent the adjustment or fitting program implemented on the hearing device is capable of converting simple subjective hearing inputs into complex parameter adjustment correlations for the hearing device.

It is proposed, particularly where it is the intention that the individual himself should be capable of making the adjustment or an adjustment to the hearing device, that it be possible to reset adjustments made to the hearing device to standard settings through simple manual input on the mobile telephone, whether such standard settings are settings that have been defined as such and preset by specialists, or settings undertaken at the factory. As stated, it is quite possible through appropriate programming of the hearing device to convert subjective hearing impressions of the individual defined through straight forward input on the hearing device into complex multi-parameter hearing device adjustments and to transmit these to the hearing device.

In a further development of the fitting system according to the invention it is also possible to have company-specific (Intranet), sector-specific (Intranet) or global

(Internet) access to data banks and computational services.

If these facilities are employed from the mobile telephone used according to the invention, the mobile telephone used according to the invention becomes ever further distanced from its function as electronic screwdriver and ultimately at this point becomes the interface between different transmissions, such as transmission protocols, and becomes the input keypad for the initiation of a server-hearing device connection.

It should be emphasized at this juncture that when speaking in this description and in the claims of a mobile telephone used according to the invention this includes telephones which, in addition to the actual mobile telephone function, also have other functions, as is becoming increasingly familiar, for example, from digital agendas, DPA etc.

A server forming part of the fitting system according to the invention can therefore not only provide information specific to a type of hearing device via the mobile telephone - the individual hearing device adjustments then continuing to be made through operation of the mobile telephone - but can also store on this server identification variables, which in addition to the type of hearing device also contain the individually adjusted parameters, the "settings history" of the hearing device(s) already mentioned. On calling and identification via the mobile telephone and the communication of outstanding subjective hearing deficiencies, this server can then, on the basis of the parameter constellation currently filed on the server and, where necessary, the previous history of reported subjective hearing deficiencies and the parameter changes

made, transmit a further optimization of the hearing device setting to the hearing device via mobile telephone. It is then possible both to retrieve information specific to the type of hearing device for actuation of the telephone computer unit, or to transfer the computational capacity from the mobile telephone to the server and, as stated, to actually use the mobile telephone more as input and transit station between hearing device on the one hand and server on the other. It will be appreciated that in this case the hearing device setting will very largely depend on who is making the settings and even more on how the individual wearing the hearing device perceives the hearing impressions.

The invention will now be explained with reference to examples in the figures, of which

Fig. 1 in the form of a simplified block diagram shows a first actual variant of a fitting system according to the invention,

Fig. 2 in the form of a simplified signal flow/block diagram shows a preferred embodiment of the invention according to figure 1,

Fig. 3 shows a schematic diagram of the concept of a fitting system according to the invention with server-support.

Figure 1 shows a diagram of a hearing device 1, with acoustic/electrical transducer 3 on the input side, digital signal transmission line 5 and electro/mechanical transducer 7 on the output side. Basic adjustment of the hearing device may initially be undertaken ex situ, for example in the laboratory on the basis of diagnostic

data, the fine adjustment, however, being undertaken in situ, that is to say on the individual.

The hearing device has an input E_S. Signals on this input E_S modify transmission parameters on the digital transmission line 5. The input E_S is in direct or indirect communications connection K with an output A_T of a mobile telephone 9. The connection K can be effected in various ways, possibly via the antenna 11 of the mobile telephone 9 or via a unit or interface converting high-frequency signals into digital control signals for the hearing device, via infrared link with corresponding interfaces, by line connection - optically or electrically - or acoustically. In any event, the corresponding interfaces are provided on the hearing device or on the mobile telephone depending on the connection variant.

In a preferred design variant according to figure 2, the communication K is between the mobile telephone 9 and the hearing device 1 but is achieved via a CODEC 13 converter, preferably as a separate unit acting virtually as relay and with an independent electrical supply. The connection K_1 between mobile telephone 9 and converter 13 on the one hand is via the mobile telephone's own high-frequency connection HF and/or via an infrared connection IR and/or via acoustic coupling AK. The communications connection K_2 between converter 13 and hearing device 1 on the other hand is, in a preferred embodiment, via an - electrical or optical - line connection, Ca, where necessary also (not shown) not line connected via a high-frequency connection of a type adapted to the hearing device 1, or via an IR link or acoustically. The converter 13 may be provided as an independent unit, as represented in Fig. 2, or can be incorporated into the mobile telephone 9 or the hearing device 1.

For adjustment of the hearing device, the mobile telephone 9, menu-driven, is switched to the adjustment or fitting mode through manual and/or voice input, for example by pressing a special combination of keys. Through further inputs, parameter modification signals are then fed via the communications connection K or K_1, K_2 to the hearing device control input E_S, and the hearing device is purposely adjusted in respect of its transmission behavior.

With the configuration of the fitting system according to the invention according to figure 1 or 2, it is readily possible to make simple, initial adjustments to the hearing device, such as reducing the high-frequency amplification, for example, or raising the low-frequency transmission etc. by means of a manual input or through voice input and the direct conversion of these to a single control parameter via the communications connection K or K_1, K_2. It is generally necessary, however, in response to simple subjective hearing impressions of the individual wearing the hearing device 1, such as the impression "too loud", "shrill" etc., to purposely adjust a multiplicity of parameters on the digital transmission line 5 of the hearing device 1 as a function of one another. In such a case, either the specialist, that is the hearing device acoustics expert, translates the verbally communicated hearing impressions into a plurality of transmission parameters to be modified and operates the inputs of the mobile telephone 9 to be used in accordance with the invention, or the fitting program loaded into the mobile telephone 9, through simple inputs on the mobile telephone 9, automatically converts the subjective hearing impressions identified into the necessary number of parameter modifications, where necessary taking account of existing complex dependencies.

Instead of manual inputs, voice inputs can in principle be made into the mobile telephone, by means of keypad, for example, provided that the mobile telephone 9 is suitably equipped.

By loading programs specific to the type of hearing device into the processor-controlled mobile telephone 9, therefore, control signals are transmitted to the hearing device 1 via the communications connection K or K_1, K_2, menu-driven by manual and/or voice inputs. These programs can be designed to activate more or less complex adjustment procedures on the hearing device on the basis of simple inputs corresponding to said simple hearing impressions. The programs specific to the hearing device are loaded into the mobile telephone 9, either by inserting a SIM card, for example, or by other external loading, as will be further explored.

In figure 3, the particular communications characteristics of the mobile telephone 9 are incorporated into the fitting system according to the invention on the basis of the explanations given with regard to figures 1 and 2. For example, the mobile telephone 9 provided for according to the invention communicates with a server 25 via the Internet I and/or a company and clientele-based Intranet Ia, for example. The adjustment facilities and algorithms or fitting programs 25_T assigned to the individual types of hearing device are filed on this server 25 which, for example, may be operated jointly or specifically by hearing device manufacturers or by third-party suppliers. By calling up the server 25 with the mobile telephone 9 in the adjustment menu, the necessary fitting programs are transmitted to the telephone 9 by the server 25. The necessary parameter modifications can thereby be transmitted from the telephone 9 to the hearing device 1

worn via the communications connection K or K_1, K_2. The fitting program is loaded on to the mobile telephone 9 via the network I, Ia, where appropriate limited only in terms of time, i.e. only for the duration of the adjustment procedure.

In a further use of the server 25, the telephone 9 transmits the current hearing device settings and modification requirements to the server 25. Filed on the server 25 are not only data specific to the type of hearing device, particularly adjustment programs, as represented diagrammatically in the storage unit 25_T, but also data specific to the individual hearing device as represented diagrammatically by the storage unit 25_T. Filed therein are data such as subjective hearing impressions and the resulting parameter modifications made, where necessary together with the history of changes to the settings for each individual hearing device. Through identification, the individual can now in each case activate a fresh optimization cycle via the mobile telephone 9 and by inputting further hearing impressions or desired corrections. By means of the server-resident computational capacity R, a fresh parameter modification is determined from the setting history for the individual hearing device 1, stored for a shorter or longer period, and the recently reported hearing impressions or desired corrections, in order to make the hearing device conform optimally to the requirements of the individual. These parameter modifications are translated via the mobile telephone 9 and the communications connection K or K_1, K_2 directly on the hearing device 1 in the individual's ear, preferably without any further intervention on the part of the individual.

It goes without saying that improved adjustment programs can also be transmitted to the telephone 9 at any time, particularly through the use of a transferred data bank, where necessary with the computational capacity as explained with reference to figure 3, provided that the telephone is to be used offline in the fitting menu, for example. In extreme cases, signal processing programs or software on the hearing device 1 can be ready loaded from the server 25 for the initial configuration and thereafter maintained or updated from the server 25.

The known commercial facilities afforded by E-commerce are preferably used for such services.

Subsequently, improved adjustments, updates of programs etc. can readily run in the background during normal operation of the mobile telephone, particularly where a direct, wireless connection exists between mobile telephone and hearing device.

It also goes without saying that the fitting system according to the invention, which has been explained as an example of the adjustment of a single hearing device, is equally suited to the adjustment of binaural hearing devices.

Claims

1. A fitting system for the adjustment of at least one hearing device (1) to the needs of an individual, having an input device, which can be operatively connected by a line and/or wireless connection to a setting control input (E_S) on the hearing device (9), characterized in that the input device is a mobile telephone (9).

2. The system as claimed in claim 1, characterized in that the operative connection (K, K_1, K_2) between mobile telephone (9) and hearing device (1) is achieved by way of a converter (13), an HF connection of the mobile telephone and/or an infrared connection (IR) and/or an acoustic connection existing between mobile telephone (9) and converter (13), and a line and/or wireless connection (Ca) between converter (13) and hearing device (1).

3. The system as claimed in claim 1, characterized in that an acoustic connection exists between mobile telephone and hearing device.

4. The system as claimed in claim 2, characterized in that the converter (13) is designed as an independent unit, or is integrated into the hearing device (1) or mobile telephone (9).

5. The system as claimed in one of claims 1 to 4, characterized in that the mobile telephone is designed for communication with a communications network, preferably with Internet and/or an Intranet.

6. The system as claimed in one of claims 1 to 5, characterized in that it comprises at least one server and the mobile telephone is designed for communication with this server, at least one of the following types of

data being transmitted between server and mobile telephone:

- fitting programs from the server to the mobile telephone
- hearing device software from the server via the mobile telephone to at least one hearing device assigned to the latter
- updates for fitting and/or hearing device software.

7. The system as claimed in one of claims 1 to 6, characterized in that it comprises at least one server and the mobile telephone is designed for communication with this server, the following data being transmitted between them:

- hearing device-individual data from the mobile telephone to the server and/or
- hearing device-individual control data from the server to the mobile telephone.

8. The system according to one of claims 1 to 7, characterized in that the mobile telephone is also hearing device remote control.

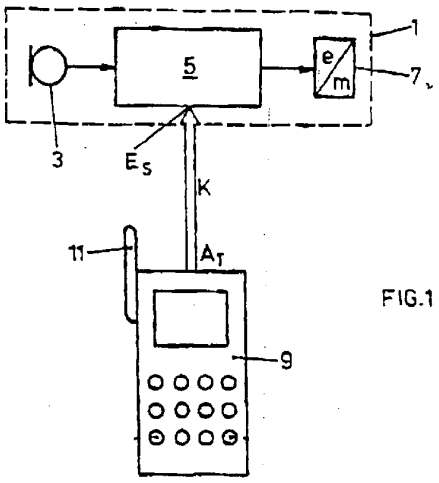

FIG.1

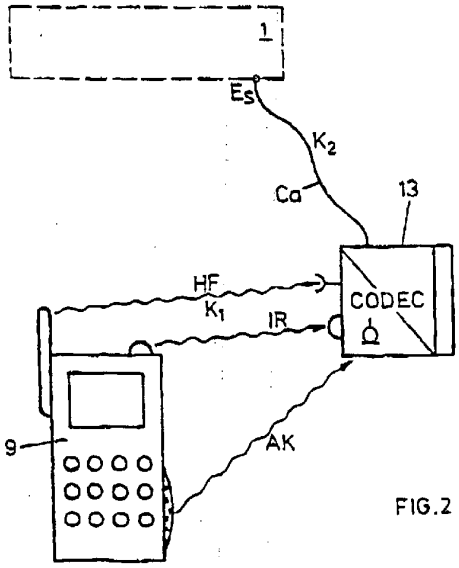

FIG.2

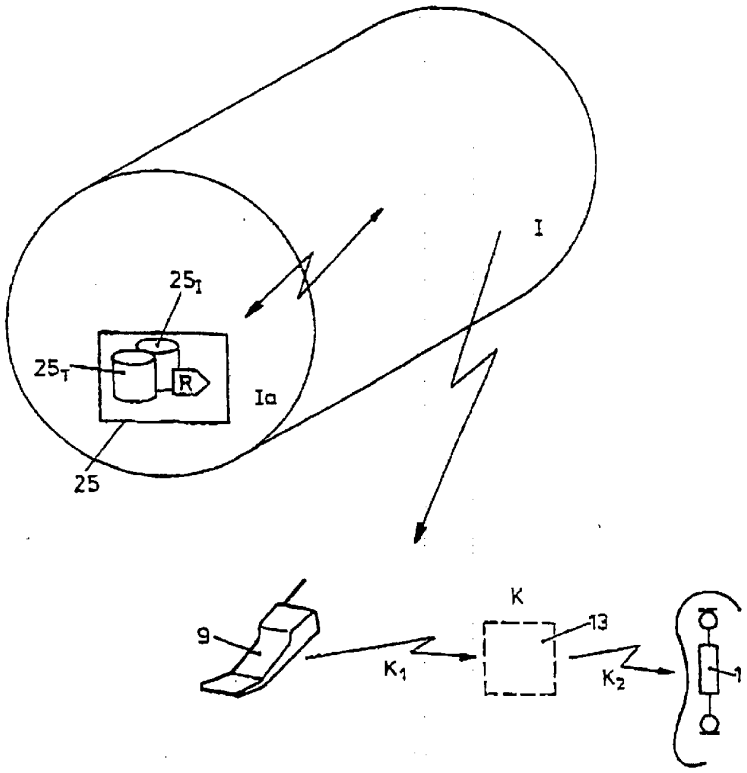

FIG. 3