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(54) **CHARGER FOR A HEARING DEVICE**

(57) The invention relates to a charger (2) for at least one hearing device (1), the charger (2) comprising a battery (14), a first wireless communication module (12) configured to establish a wireless link (WL) to a second wireless communication module (13) of the at least one hearing device (1), a user interface (3) configured to be operable in a search mode in which the first wireless communication module

(12) is configured to detect the second wireless communication module (13), wherein the user interface (3) comprises at least one indicator (5) configured to indicate one or more of a distance estimate to the at least one hearing device (1), a direction estimate to the at least one hearing device (1) and an approximate movement vector indicating if the charger (2) is being moved away or toward the at least one hearing device (1).

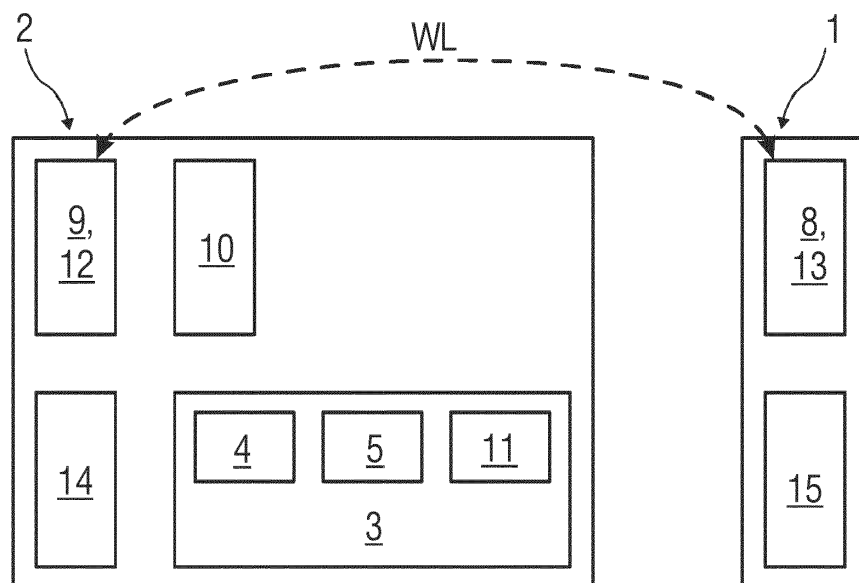


FIG 3

Description

Technical Field

[0001] The invention relates to a charger for at least one hearing device according to claim 1.

Background of the Invention

[0002] Functions to find lost hearing devices, e.g. based upon properties of a wireless network connection, are known in the art. They utilize the connection to a smartphone and a respective end user app as well as the signal strength properties of a wireless (e.g. Bluetooth®) connection to guide the user to his/her lost devices. The hearing devices go into a low energy usage mode when they themselves determine to have been lost and periodically listen on the wireless radio if a known transmitter searches for them. Additionally, they might issue a regular short loud acoustic tone, e.g. when they do not detect any micro-movement (which would still be detectable when the user falls asleep), and/or flash a LED in a regular pattern. Thus, they improve their chances to get found again. An end user app might then have a function to advertise its presence on the wireless connection network and listen, if a hearing device answers, thus opening up a connection, which in turn can get used to determine a signal strength and thus infer an approximate distance which is then shown to the user of the app.

[0003] In old age homes, the inhabitants do not have smartphones, neither do they use an end user app. But they lose their hearing devices. The support personnel does not have an end user app etc. available either, and in general have little time and interest (or talent) to fiddle with technical gadgets for all their inhabitants. In the best of all cases, the hearing devices are 'managed' by the support personnel such that the charger with the devices is placed in an office (and thus not the room of the inhabitants) and that the personnel ensures, that the devices get worn on a daily basis. If the inhabitant loses his/her devices during the day, the personnel start a search and rescue event some time later, often without success. Even in the case where the inhabitants are not allowed, less able to go outside the building alone.

[0004] A better solution to find a user's hearing devices is thus needed.

Summary of the Invention

[0005] It is an object of the present invention to provide a solution for locating a hearing device.

[0006] The object is achieved by a charger according to claim 1 and by a system according to claim 13.

[0007] Preferred embodiments of the invention are given in the dependent claims.

[0008] According to the invention, a charger for at least one hearing device comprises:

- a battery,
- a first wireless communication module configured to establish a wireless link to a second wireless communication module of the at least one hearing device,
- a user interface configured to be operable in a search mode in which the first wireless communication module is configured to detect the second wireless communication module, wherein the user interface comprises at least one indicator configured to indicate one or more of:
 - a distance estimate to the at least one hearing device,
 - a direction estimate to the at least one hearing device, and
 - an approximate movement vector indicating if the charger is being moved away or toward the at least one hearing device.

[0009] A wireless link between the charger and the hearing device may be established by means of their respective wireless communication modules. Detection of the second wireless communication module by the first wireless communication module may comprise wirelessly connecting the first and the second wireless communication module. Depending on the protocol, which may be used to establish a wireless link between two devices, which means to connect two devices wirelessly, a pairing step may be carried out. The charger may detect the hearing device without being paired to the hearing device or without being connected to the hearing device.

[0010] In an exemplary embodiment, the first wireless communication module is configured to establish the wireless link using one or more of Bluetooth®, RFID and IEEE 802.11.

[0011] In an exemplary embodiment, the user interface comprises a button configured to be depressed to put the user interface and the first wireless communication module into the search mode.

[0012] In an exemplary embodiment, the button has an associated label indicating the function of the button.

[0013] In an exemplary embodiment, the indicator comprises a visual indicator and/or an acoustical indicator and/or a vibrational indicator.

[0014] In an exemplary embodiment, the visual indicator comprises a LED and/or a display.

[0015] In an exemplary embodiment, the indicator comprises three or more visual indicators shaped as arrows pointing in three or more different directions to indicate a direction in which the at least one hearing device has been detected.

[0016] In an exemplary embodiment, the indicator comprises three or more visual indicators having respective labels to indicate how far the at least one detected hearing device is away.

[0017] In an exemplary embodiment, the first wireless communication module is configured to determine the distance to the at least one detected hearing device

based on signal strength and/or the time delay of the wireless link.

[0018] In an exemplary embodiment, the charger further comprises at least one directional antenna to determine a direction as to where the at least one hearing device is located.

[0019] In an exemplary embodiment, the charger is further configured to automatically terminate the search mode after a predetermined time period.

[0020] In an exemplary embodiment, the indicator comprises an acoustical indicator configured to indicate when the charger gets in a predetermined range of the at least one hearing device.

[0021] According to an aspect of the present invention, a system is provided, comprising the charger and one or more hearing devices respectively comprising a battery and a second wireless communication module.

[0022] In an exemplary embodiment, the second wireless communication module comprises a passive RFID tag, wherein the first wireless communication module comprises an RFID module configured to locate the RFID tag.

[0023] In an exemplary embodiment, the second wireless communication module is configured to advertise its presence over the wireless link.

[0024] In an exemplary embodiment, the charger does not have any remote control functionality with regard to the hearing devices so the charger is not capable of changing an operating state of the hearing devices when initializing the search mode.

[0025] Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

Brief Description of the Drawings

[0026] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus, are not limitative of the present invention, and wherein:

Figure 1 is a schematic view of a set of hearing devices and an exemplary embodiment of a charger for the hearing devices,

Figure 2 is a schematic view of a set of hearing devices and another exemplary embodiment of a charger for the hearing devices, and

Figure 3 is a schematic view of a hearing device and a charger.

[0027] Corresponding parts are marked with the same reference symbols in all figures.

Detailed Description of Preferred Embodiments

[0028] Figure 1 is a schematic view of a set of hearing devices 1 and an exemplary embodiment of a charger 2 for charging the hearing devices 1. Figure 2 is a schematic view of a set of hearing devices 1 and another exemplary embodiment of a charger 2 for charging the hearing devices 1. Figure 3 is a schematic view of a hearing device 1 and a charger 2.

[0029] The charger 2 may be available to support personnel, e.g. in an old age home. The charger 2 comprises a battery 14 and a wireless communication module 12 capable of establishing a wireless link WL, e.g. using technology such as Bluetooth®, RFID, IEEE 802.11, etc., to the hearing devices 1, which also comprise a respective battery 15 and wireless communication module 13. Moreover, the hearing devices 1 may respectively comprise a processor and a receiver or loudspeaker (not shown). The charger 2 is configured as a handheld search device for the hearing devices 1. The hearing devices 1 and the charger 2 may be 'paired' i.e. know the electronic ID of each other. Pairing is a procedure which can be established during manufacturing (pre-paired sales bundle) or later on through a hearing care professional or a layman through specific gestures on the charger 2 and the hearing devices 1 as described in e.g. a user manual. E.g. setting the hearing devices 1 into the charging cradle places them into a pairing mode for e.g. two minutes. Pressing afterwards the 'Start finding my Hearing devices' button for longer than two seconds sets the charger 2 into a pairing mode as well, causing the electronic ID's of hearing devices 1 in very close proximity of e.g. a few centimeters to get automatically exchanged with the charger 2. Pairing is automatically completed and acknowledged with a suitable visual or acoustic or vibrational actuator.

[0030] The invention combines a charger 2 having its own on board battery 14 for handheld use (in particular there is no connection to a wall charger or at least the charger 2 may be operatively separated from a wall charger or cable to be operated in a search mode), a Bluetooth®, RFID, IEEE 802.11 or other wireless connection capability to the paired hearing devices 1 and a simple, intuitive user interface 3 to search the device.

[0031] Intuitive function is important, as the personnel are changing often, and new personnel may not have been instructed in such technical details. Thus, the search function should be apparent to them when looking at the charger 2 and when placing the hearing devices 1 in the charger 2, e.g. in the evening, respectively when retracting the extract the hearing devices 1, e.g. in the morning.

[0032] The user interface 3 comprises a button 4, in particular a simple button 4, supposed to be pressed to start a search process. The button 4 may have a label 6

clarifying the function of the button 4. E.g. the label 6 may read "Find my HD START". Moreover, the user interface 3 comprises one or more indicators 5, e.g. visual indicators 5 or acoustical indicators 11, configured to indicate if the charger 2 is getting closer to the hearing devices 1 or rather further away. Visual indicators 5, e.g. one or more LED's and/or a display, may further be used to label the feedback to indicate how far the hearing devices 1 are away (e.g. 'HD not in distance', 'HD's <10m away', 'HD's <1m away') and/or to indicate a direction in which the hearing devices 1 have been detected. In figure 1, the user interface 3 comprises three visual indicators 5, e.g. LEDs, shaped as arrows pointing in different directions to indicate the direction in which the hearing devices 1 have been detected. In figure 2, the user interface 3 comprises three visual indicators 5, e.g. LEDs, having labels 7.1, 7.2, 7.3, e.g. reading "far", "medium" and "near", to indicate how far the hearing devices 1 are away. In another embodiment not shown in detail, the user interface 3 may comprise the visual indicators 5 of both embodiments of figures 1 and 2.

[0033] In order to search for lost hearing devices 1, a charging cable may be separated from the charger 2 if applicable, the button 4 may be pressed and the user, e.g. the support personnel or the owner of the hearing devices 1, may walk around in/around the location where a loss of the hearing devices 1 is assumed. Upon approximating the charger 2 to the lost hearing devices 1, the indicator 5 will indicate the distance to the hearing devices 1, e.g. based upon signal strength of the wireless link WL, and/or the direction in which the hearing devices 1 have been detected, and thus guide the user closer to the hearing devices 1.

[0034] In an exemplary embodiment, the hearing devices 1 communicate with the charger 2 by a Bluetooth® link to establish the wireless link WL. In an exemplary embodiment, a received signal strength indication (RSSI) and/or a time delay respectively phase shift of the radio frequency (RF) signals may be used to estimate a distance, e.g. with the levels far, medium, and near.

[0035] In an exemplary embodiment, as the hearing devices 1 might get switched off or run out of battery before they get found, a passive RFID tag 8 may be arranged in each of the hearing devices 1 and a sufficiently powerful/sensitive RFID module 9 may be arranged in the charger 2 to locate the RFID tag 8.

[0036] In an exemplary embodiment, the charger 2 may comprise at least one directional antenna 10 to provide directional information to the user as to where the hearing devices 1 might be located, e.g. similar to directional antennae as used in avalanche rescue devices.

[0037] The charger 2 and/or the user interface 3 may be configured to automatically terminate the search mode after a predetermined time period, e.g. 10 minutes, in order to keep the user interface 3 simple. Anyway, the search mode may get retriggered any time, e.g. by pressing the button 4 again.

[0038] In a further exemplary embodiment, the charger

2 or the user interface 3 thereof may contain an acoustical indicator 11, e.g. a loudspeaker, buzzer, etc., to indicate when the charger 2 gets in a certain range of the hearing devices 1. Thus, the charger 2 may be carried around, e.g. in a coat pocket by a user such as support personnel in an old age home while performing their normal duties. When the charger 2 detects the proximity of the hearing devices 1 (e.g. by the hearing devices 1 advertising their presence over the wireless link WL, the charger 2 scanning the channels of the wireless link WL to find and identify a valid advertisement packet), an acoustic notification sound may be played on the acoustical indicator 11 by the charger 2, prompting the support personnel to take out the charger 2 from the pocket and use the visual indicator 5 (or further acoustic notifications) to search in a close vicinity of the hearing devices 1 to finally find them. Alternatively, the charger 2 might also use a vibration module to indicate the proximity to a lost hearing device 1.

[0039] In an exemplary embodiment, the charger 2 having a wireless link WL to the hearing devices 1 might also contain further functions useful to the user, such as a remote microphone (for transmitting audio data from the charger 2 to the hearing devices 1), an IEEE 802.11 or cellular communication link (e.g. 4G and/or 5G) module to enable firmware updates, data uploading to a cloud for e.g. logging or alarm issuing purposes, high computational demand processing functions, environmental sensing and surveillance functions, etc.

[0040] While the drawings show two hearing devices 1, the skilled person readily understands that the present invention will likewise work with a different number of hearing devices 1, e.g. one, three or more hearing devices 1. In case more than one hearing device 1 shall be found and they happen to be in different locations, i.e. when the charger 2 detects concurrently more than one hearing device 1, directional or distance indicators might switch from one hearing device 1 to another, thus confuse the person searching the devices. To remedy such behaviour, the charger 2 might focus on the electronic ID of the initially stronger hearing device 1 signal and completely ignore the other. When thus the first hearing device 1 is found, it can get either switched off, placed in the charging cradle or get acknowledged with a suitable gesture, such that the charger 2 now can focus on the next strongest signal of a hearing device 1 with another electronic ID. Thus all paired hearing devices 1 can get found one after another.

List of References

[0041]

1	hearing device
2	charger
3	user interface
4	button
5	indicator, visual indicator

6	label
7.1, 7.2, 7.3	label
8	RFID tag
9	RFID module
10	directional antenna
11	acoustical indicator
12	wireless communication module
13	wireless communication module
14	battery
15	battery
WL	wireless link

Claims

1. A charger (2) for at least one hearing device (1),

the charger (2) comprising a battery (14), a first wireless communication module (12) configured to establish a wireless link (WL) to a second wireless communication module (13) of the at least one hearing device (1),
a user interface (3) configured to be operable in a search mode in which the first wireless communication module (12) is configured to detect the second wireless communication module (13), wherein the user interface (3) comprises at least one indicator (5) configured to indicate one or more of a distance estimate to the at least one hearing device (1), a direction estimate to the at least one hearing device (1) and an approximate movement vector indicating if the charger (2) is being moved away or toward the at least one hearing device (1).

2. The charger (2) according to claim 1, wherein the first wireless communication module (12) is configured to establish the wireless link (WL) using one or more of Bluetooth®, RFID and IEEE 802.11.

3. The charger (2) according to claim 1 or 2, wherein the user interface (3) comprises a button (4) configured to be depressed to put the user interface (3) and the first wireless communication module (12) into the search mode.

4. The charger (2) according to claim 3, wherein the button (4) has an associated label (6) indicating the function of the button (4).

5. The charger (2) according to any one of the preceding claims, wherein the indicator (5) comprises a visual indicator (5) and/or an acoustical indicator (11) and/or a vibrational indicator.

6. The charger (2) according to claim 5, wherein the visual indicator (5) comprises a LED and/or a display.

7. The charger (2) according to claim 5 or 6, wherein the indicator (5) comprises three or more visual indicators (5) shaped as arrows pointing in three or more different directions to indicate a direction in which the at least one hearing device (1) has been detected.

8. The charger (2) according to any one of claims 5 to 7, wherein the indicator (5) comprises three or more visual indicators (5) having respective labels (7.1, 7.2, 7.3) to indicate how far the at least one detected hearing device (1) is away.

9. The charger (2) according to any one of the preceding claims, wherein the first wireless communication module (12) is configured to determine the distance to the at least one detected hearing device (1) based on signal strength and/or the time delay of the wireless link (WL).

10. The charger (2) according to any one of the preceding claims, further comprising at least one directional antenna (10) to determine a direction as to where the at least one hearing device (1) is located.

11. The charger (2) according to any one of the preceding claims, further being configured to automatically terminate the search mode after a predetermined time period.

12. The charger (2) according to any one of the preceding claims, wherein the indicator (5) comprises an acoustical indicator (11) configured to indicate when the charger (2) gets in a predetermined range of the at least one hearing device (1).

13. A system comprising the charger (2) according to any one of the preceding claims and: one or more hearing devices (1) respectively comprising a battery (15) and a second wireless communication module (13).

14. The system of claim 13, wherein the second wireless communication module (13) comprises a passive RFID tag (8), wherein the first wireless communication module (12) comprises an RFID module (9) configured to locate the RFID tag (8).

15. The system of claim 13, wherein the second wireless communication module (13) is configured to advertise its presence over the wireless link (WL).

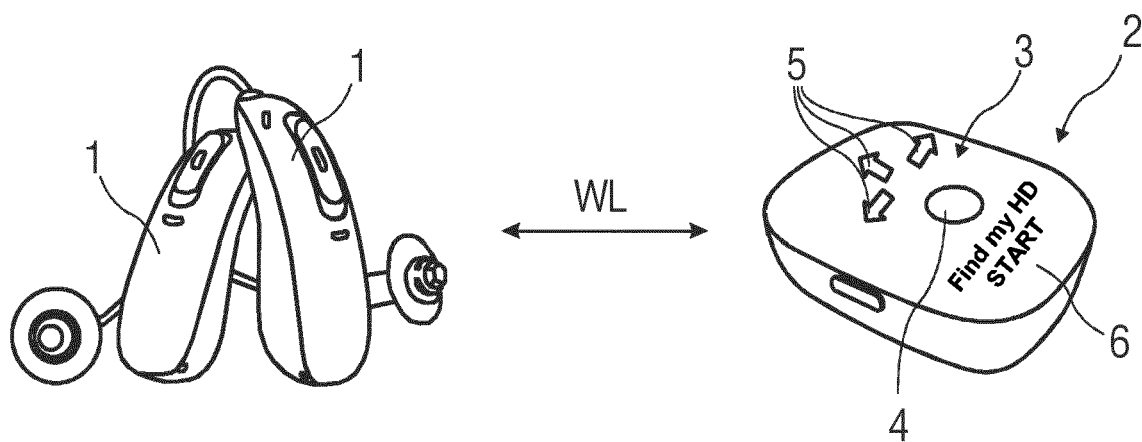


FIG 1

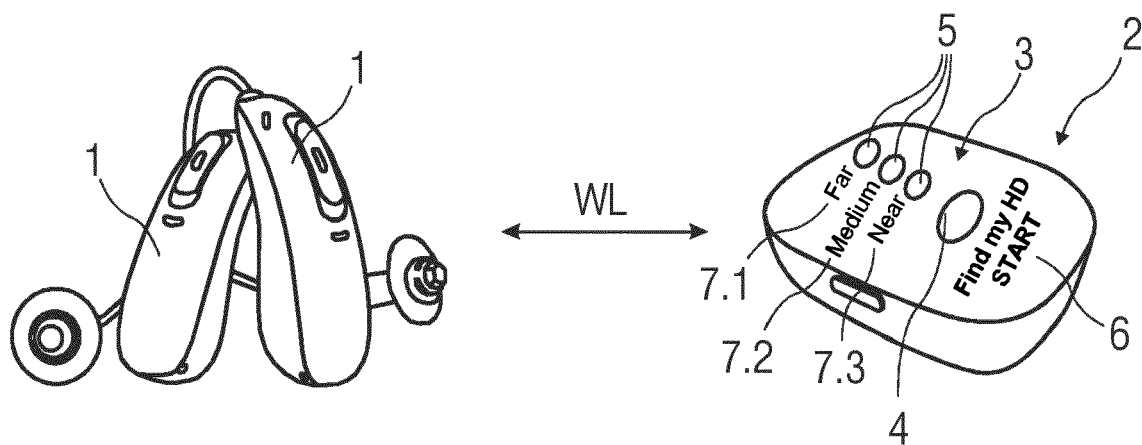


FIG 2

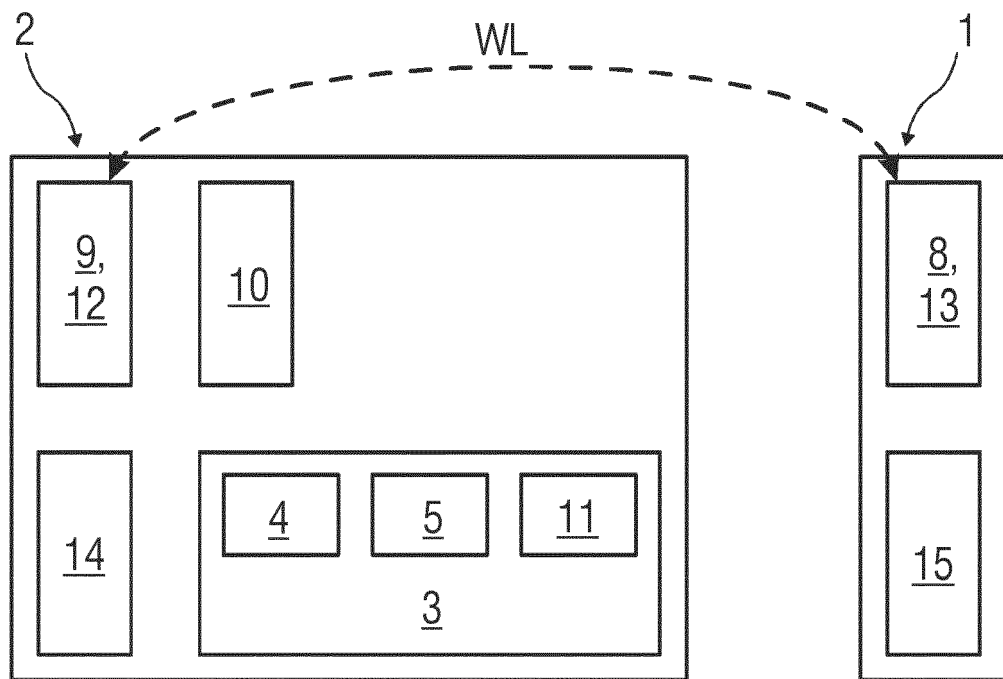


FIG 3



EUROPEAN SEARCH REPORT

Application Number

EP 21 19 6874

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EPO FORM 1503 03/82 (P04C01)

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Place of search Munich		Date of completion of the search 2 March 2022	Examiner Sucher, Ralph
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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