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(54) **Title:** METHOD FOR MONITORING A LINK BETWEEN A HEARING DEVICE AND A FURTHER DEVICE AS WELL AS A HEARING SYSTEM

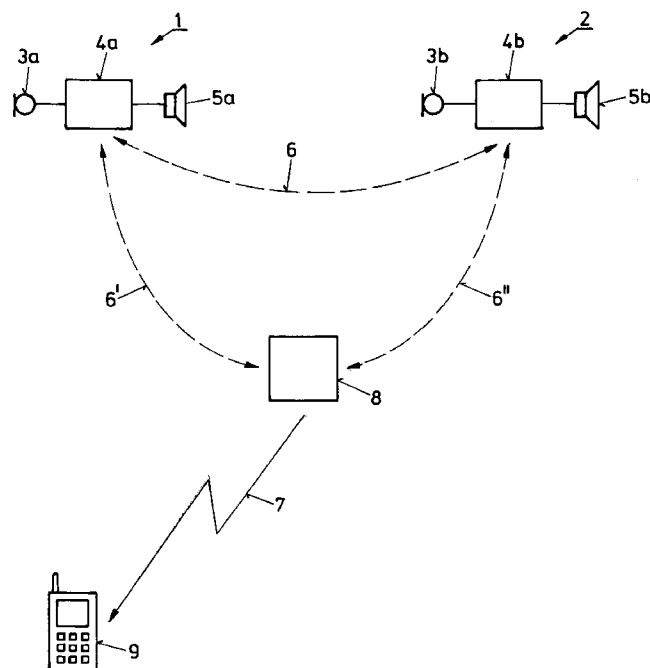


FIG. 3

(57) **Abstract:** A method is described for monitoring a link (6; 6', 6'') between a hearing device (1; 2) and at least one further device (2; 8; 9). The method comprises the step of monitoring the link (6; 6', 6'') between the hearing device (1; 2) and the at least one further device (2; 8; 9) and the step of indicating an interruption of the link (6; 6', 6'') to a user of the hearing device (1; 2) as soon as the link (6; 6', 6'') is interrupted. An interruption of the link (6; 6', 6'') means that at least one of the hearing device (1; 2) and the least one further device (8; 9) is lost if the battery status for all the devices is high enough. Furthermore, a hearing system is also described.

**METHOD FOR MONITORING A LINK BETWEEN A HEARING DEVICE AND A  
FURTHER DEVICE AS WELL AS A HEARING SYSTEM**

5 TECHNICAL FIELD

The present invention is related to a method for detecting a loss of a hearing device as well as to a hearing system.

10 BACKGROUND OF THE INVENTION

Hearing devices may be provided to a user either individually or as a pair. Some hearing device reside fully within the ear canal, while other hearing devices are held  
15 behind the ears and have an extension tube for aural communication between the ear canal and the electronic circuitry contained within the hearing device. Unfortunately, hearing devices can inadvertently fall from the ear and become damaged or lost.

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In order to prevent a loss of a hearing device, it has been proposed to use a hearing device retainer that would keep the hearing devices together or attached to an accessory, e.g. to a piece of jewellery. Reference is made to US-  
25 2002/0029438-A1, US-2006/0251280-A1 and US-5 327 499.

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The known solutions have the disadvantage that an additional part is needed, as for example a chain or a wire. The additional part is clearly visible which is not desired by the hearing device users.

Therefore, it is one object of the present invention to provide a method for detecting a loss of a hearing device, which method does not have the above-mentioned  
5 disadvantages.

#### SUMMARY OF THE INVENTION

The present invention is defined by the steps of claim 1.

10 Further embodiments as well as a hearing system are defined in further claims.

A method is described for monitoring a link between a hearing device and at least one further device. The method  
15 according to the present invention comprises the steps of:

- monitoring the link while the hearing device is worn by a user, and
- indicating an interruption of the link to a user of the hearing device as soon as the link is interrupted.

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In an embodiment of the present invention, a loss of at least one of the hearing device and the at least one further device is indicated to the user as soon as an interruption of the link is detected.

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Therewith, the user of a hearing device is immediately informed about a loss of his hearing device. Appropriate action can be taken without delay substantially increasing the chance of finding the lost hearing device again. This  
30 is particularly important for open fitted products which

have a very comfortable but loose fit to the ear. In addition, they are very often used to adjust a mild hearing loss. Therefore, losing such an open fit hearing device is even more difficult to detect for the hearing device user.

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In an embodiment of the present invention, the at least one further device comprises a second hearing device, the two hearing devices forming a binaural hearing device.

10 In further embodiments of the present invention, the step of indicating a loss is performed in at least one of the hearing device and the second hearing device.

15 In further embodiments of the present invention, the at least one further device comprises a relay device that is operationally connected to a mobile device via a further link.

20 In further embodiments of the present invention, the step of indicating a loss comprises at least one of the following:

- generating a warning beep in at least one of the hearing device and the at least one further device,
- generating a vibration in at least one of the hearing device and the at least one further device,
- 25 - sending a message from at least one hearing device to the at least one further device.

30 In further embodiments of the present invention, the link is wirelessly operated.

Further embodiments of the present invention comprise the steps of:

- checking the battery status of the hearing device  
5 before indicating an interruption of the link to the user, and
- indicating a battery low to the user if the interruption occurred due to a low battery.

10 An interruption of the link between the hearing device and a further device may have other reasons than a loss of one of the devices. For example, a low battery status may also result in an interruption of the link. A faulty diagnosis due to a low battery can be prevented by checking the  
15 battery status of the hearing device or the at least one further device as soon as an interruption occurred.

Furthermore, a hearing system is disclosed that comprises

- a hearing device,
- 20 - at least one further device that is operationally connectable to the hearing device via a link,
- means for monitoring the link between the hearing device and the at least one further device,
- means for indicating an interruption of the link to a  
25 user of the hearing device as soon as the link is interrupted.

In an embodiment of the present invention, a loss of at least one of the hearing device and the at least one

further device is indicated-able to the user as soon as an interruption of the link is detected.

5 In an embodiment of the present invention, the at least one further device is a second hearing device, the two hearing devices forming a binaural hearing device.

10 In further embodiments of the present invention, the hearing system further comprises a relay device that is operationally connected to at least one of the hearing devices, the relay device being operationally connected to a mobile device, such as a mobile telephone or a personal assistant, via a further link.

15 In further embodiments of the present invention, the means for indicating an interruption are contained in at least one of the hearing device and the at least one further device.

20 In further embodiments of the present invention, the means for indicating an interruption generate at least one of the following indication signals:

- a warning beep in at least one of the hearing device and the at least one further device,
- 25 - a vibration in at least one of the hearing device and the at least one further device,
- a message from the at least one hearing device to the at least one further device.

In further embodiments of the present invention, the link is wireless.

It is pointed out that the present invention is directed to every possible combination of the above-mentioned embodiments. Only those combinations are excluded which would result in a contradiction.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further described in the following by referring to drawings showing exemplified embodiments of the present invention.

Fig. 1 shows a block diagram of a first embodiment of the present invention,

Fig. 2 shows a block diagram of a second embodiment of the present invention, and

Fig. 3 shows a block diagram of a third embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 shows a schematic block diagram of a first embodiment of the present invention comprising two hearing devices 1 and 2 that are linked together via a link 6. The hearing devices 1 and 2 each comprise a microphone 3a, 3b, a signal processing unit 4a, 4b and a loudspeaker 5a, 5b,

respectively. The loudspeakers 5a and 5b are also called receivers in the field of hearing devices. For example, the block diagram of Fig. 1 can also be seen as a block diagram of a binaural hearing device, one hearing device 1 being  
5 inserted into the left ear of a user, the other hearing device 2 being inserted into the right ear of the user. The link 6 between the hearing devices 1 and 2 is a wireless link. For example, the link 6 is a near field link, assuring a proper connection only if the distance between  
10 the hearing devices 1 and 2 is rather short, for example below 50 cm.

According to the present invention, the link 6 between the hearing devices 1 and 2 is monitored in that the function  
15 of the link 6 is checked continuously or at a predefined rate. As soon as an interruption - or a higher dropout rate - of the link 6 is detected, it is concluded that one of the hearing devices 1, 2 has fallen out of the ear of the hearing device user. This is indicated to the user by  
20 generating an indication signal yet to be described.

Because the user very often does not realize that a hearing device is fallen out of his ear, the chances of finding the lost hearing device 1, 2 again is rather low. If, as it is  
25 proposed by the present invention, the hearing device user is informed about the loss of a hearing device 1, 2 as soon as the hearing device 1, 2 has fallen out of the ear, the chances of finding it again are high. If the link 6 is based on a near field connection, the change of success is

even higher because a loss can immediately be detected and indicated to the user.

Fig. 2 shows a schematic block diagram of a further embodiment of the present invention. It is noted that the same reference signs have been used in Fig. 2 as in Fig. 1 for the same or similar components.

Apart from the embodiment depicted in Fig. 1, the embodiment of Fig. 2 comprises only a single hearing device 1. Furthermore, a relay device 8 and a mobile device 9 are depicted in Fig. 2, the relay device 8 being operatively connected to the hearing device 1 via the link 6 as well as to the mobile device 9 via a further link 7. The link 6 may again be a near field connection, as described in connection with Fig. 1. The further link 7 may be based on a standard, as for example the Bluetooth standard or any WiFi standard. These standards are widely used in mobile or portable devices, as for example in mobile telephones or in personal assistants. Therefore, the term "mobile device" used throughout this description must be understood as one of these commercially available portable devices. However, the term "mobile device" may also mean a customized portable device, which has been developed only for the purpose of the present invention.

Fig. 3 again shows a schematic block diagram of a further embodiment of the present invention. It is noted that the same reference signs have been used in Fig. 3 as in Figs. 1 and 2 for the same or similar components.

As the embodiment depicted in Fig. 1, the embodiment of Fig. 3 again shows a binaural hearing device comprising the hearing devices 1 and 2. Furthermore, as the embodiment of Fig. 2, the embodiment depicted in Fig. 3 comprises a relay device 8 and a mobile device 9. Besides the further link 7 connecting the relay device 8 to the mobile device 9, the relay device 8 and the hearing devices 1 and 2 are linked together via the links 6, 6' and 6".

The structure shown in Fig. 3 opens up a number of monitoring schemes for monitoring the hearing devices 1 and 2:

First, the same monitoring can be performed as has been explained in connection with Fig. 1 in that only the link 6 is monitored. In case the link 6 is interrupted, an indication signal is generated in both hearing devices 1 and 2.

Second, the same scheme is applied as above, but an interruption of the link 6 is indicated to the relay device 8, and - as a third option - transmitted to the mobile device 9 via the further link 7.

Fourth, in addition to monitoring the link 6, both links 6' and 6" between the relay device 8 and the two hearing devices 1 and 2 are monitored. This opens up the possibility that the hearing device 1, 2 that is fallen out of the ear can be identified and appropriate action can be

taken, which means that the user can be given further information as to which hearing device 1, 2 has been lost.

It is pointed out that any combination of the above-mentioned embodiments can be implemented without leaving the scope of the present invention.

The indication of a loss of a hearing device 1, 2 can be implemented, for example, by generating a warning beep in at least one of the following devices:

- the hearing device 1;
- the hearing device 2;
- the relay device 8;
- mobile device 9.

15

Instead of generating a warning beep, generating a vibration in one or more than one of the devices is also feasible. In relation to the mobile device 9, in particular when it is a mobile telephone, a SMS-(Short Message Services) can be sent which can be even further transmitted to other user, if necessary.

20

In case that a battery of one of the devices is low, an interruption may also occur due to such a low battery status. In order that the hearing device user is not misled, it is proposed, in a further embodiment of the present invention, to check the battery status before an indication is made to the hearing device user that one of his devices is lost. If the battery has or had a low battery status, it is likely that the interruption of the

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link between the hearing device and the at least one further device is due to the low battery status. An indication to the hearing device user can then be made that he must exchange the old battery by a new battery in order  
5 that the hearing system and its monitoring procedure can work to its full satisfaction.

**CLAIMS**

1. A method for monitoring a link (6; 6', 6") between a  
5 hearing device (1; 2) and at least one further device (2;  
8; 9), the method comprising the steps of:
- monitoring the link (6; 6', 6") while the hearing  
device (1; 2) is worn by a user, and
  - indicating an interruption of the link (6; 6', 6") to  
10 the user of the hearing device (1; 2) as soon as the  
link (6; 6', 6") is interrupted.
2. The method of claim 1, wherein a loss of at least one of  
the hearing device (1; 2) and the at least one further  
15 device (2; 8; 9) is indicated to the user as soon as an  
interruption of the link (6; 6', 6") is detected.
3. The method of claim 1 or 2, wherein the at least one  
further device (2; 8; 9) comprises a second hearing device  
20 (2), the two hearing devices (1, 2) forming a binaural  
hearing device.
4. The method of claim 2, wherein the step of indicating a  
loss is performed in at least one of the hearing device (1)  
25 and the second hearing device (2).
5. The method of one of the claims 1 to 4, wherein the at  
least one further device (2; 8; 9) comprises a relay device  
(8) that is operationally connected to a mobile device (9)  
30 via a further link (7).

6. The method of one of the claims 1 to 6, wherein the step of indicating an interruption comprises at least one of the following:

- 5       - generating a warning beep in at least one of the hearing device (1; 2) and the at least one further device (2; 8; 9),
- generating a vibration in at least one of the hearing device (1; 2) and the at least one further device (2; 8; 9),
- 10       - sending a message from the hearing device (1) to the at least one further device (2; 8; 9).

7. The method of one of the claims 1 to 6, wherein the link (6; 6', 6'') is wirelessly operated.

8. The method of one of the claims 1 to 7, further comprising the steps of:

- 20       - checking battery status of the hearing device (1, 2) before indicating an interruption of the link (6; 6', 6'') to the user, and
- indicating a battery low to the user if the interruption occurred due to a low battery.

25 9. A hearing system comprising:

- a hearing device (1, 2),
- at least one further device (2; 8; 9) that is operationally connectable to the hearing device (1, 2) via a link (6; 6', 6''),

- means for monitoring the link (6; 6', 6'') between the hearing device (1; 2) and the at least one further device (2; 8; 9),
- means for indicating an interruption of the link (6; 6', 6'') to a user of the hearing device (1; 2) as soon as the link (6; 6', 6'') is interrupted.

10. The hearing system of claim 9, wherein a loss of at least one of the hearing device (1; 2) and the at least one further device (2; 8; 9) is indicate-able to the user as soon as an interruption of the link (6; 6', 6'') is detected.

11. The hearing system of claim 9 or 10, wherein the at least one further device (2; 8; 9) is a second hearing device (2), the two hearing devices (1, 2) forming a binaural hearing device.

12. The hearing system of one of the claims 9 to 11, further comprising a relay device (8) that is operationally connected to at least one of the hearing devices (1, 2), the relay device (8) being operationally connected to a mobile device (9), such as a mobile telephone or a personal assistant, via a further link (6', 6'').

13. The hearing system of one of the claims 9 to 12, wherein the means for indicating an interruption are contained in at least one of the hearing device (1, 2) and the at least one further device (2; 8; 9).

14. The hearing system of one of the claims 9 to 13,  
wherein the means for indicating an interruption generate  
at least one of the following indication signal:

- a warning beep in at least one of the hearing device  
5       (1; 2) and the at least one further device (2; 8; 9),
- a vibration in at least one of the hearing device (1;  
2) and the at least one further device (2; 8; 9),
- a message from the hearing device (1) to the at least  
one further device (2; 8; 9).

10

15. The hearing system of one of the claims 9 to 14,  
wherein the link (6; 6', 6'') is wireless.

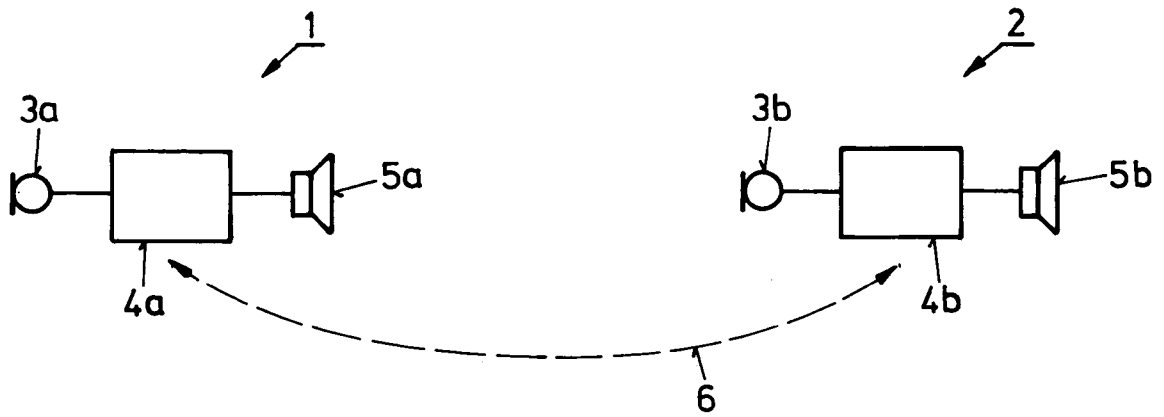


FIG.1

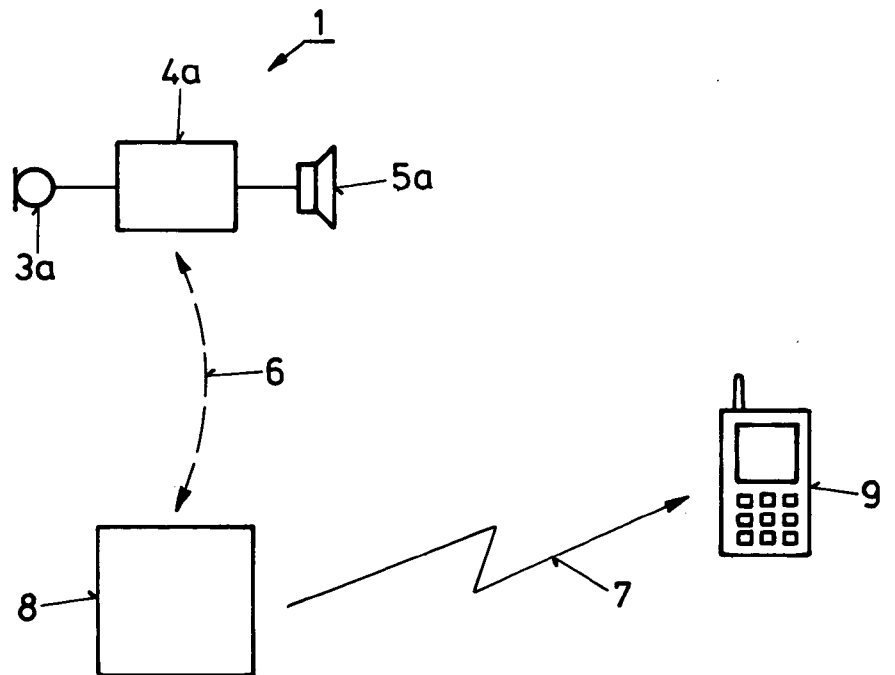


FIG.2

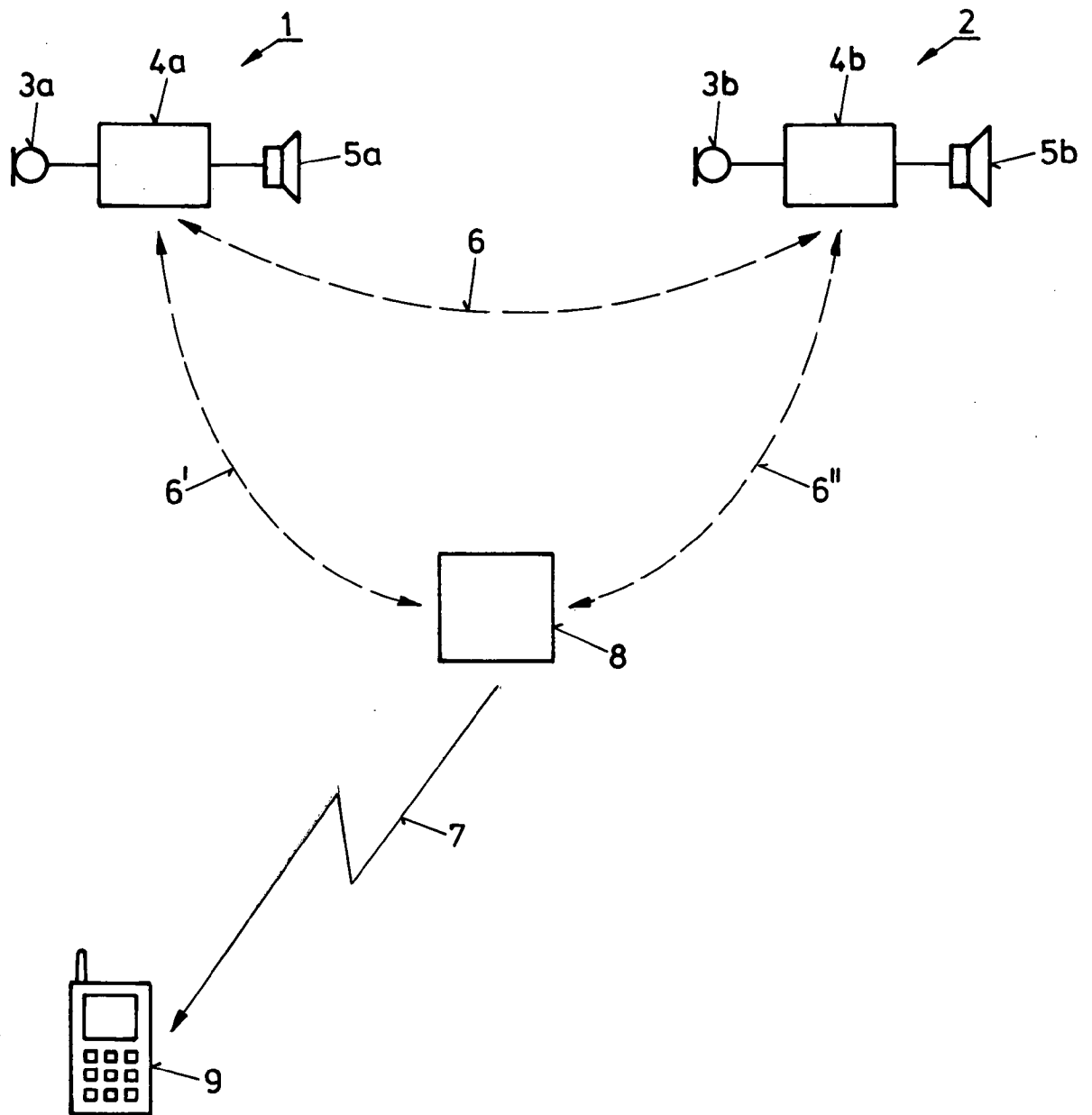


FIG.3