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(71) Applicant: **Sonova AG**
8712 Stäfa (CH)

(72) Inventor: **FICHTL, Elmar**
8634 Hombrechtikon (CH)

(74) Representative: **Liedtke & Partner Patentanwälte**
Gerhart-Hauptmann-Straße 10/11
99096 Erfurt (DE)

(54) **HEARING DEVICE**

(57) The invention relates to a hearing device (1), comprising a processor (4), a time memory (6), a time counter (7) configured to count time units passed, and a communication interface (8) configured to communicate with an external device (2), wherein the hearing device (1) is configured to receive current time information from the external device (2) at a synchronization event and to

store the current time information in the time memory (6), wherein the time counter (7) is configured to be reset at the synchronization event, wherein the processor (4) is configured to calculate an actual time by adding the current time information stored in the time memory (6) and the passed time units.

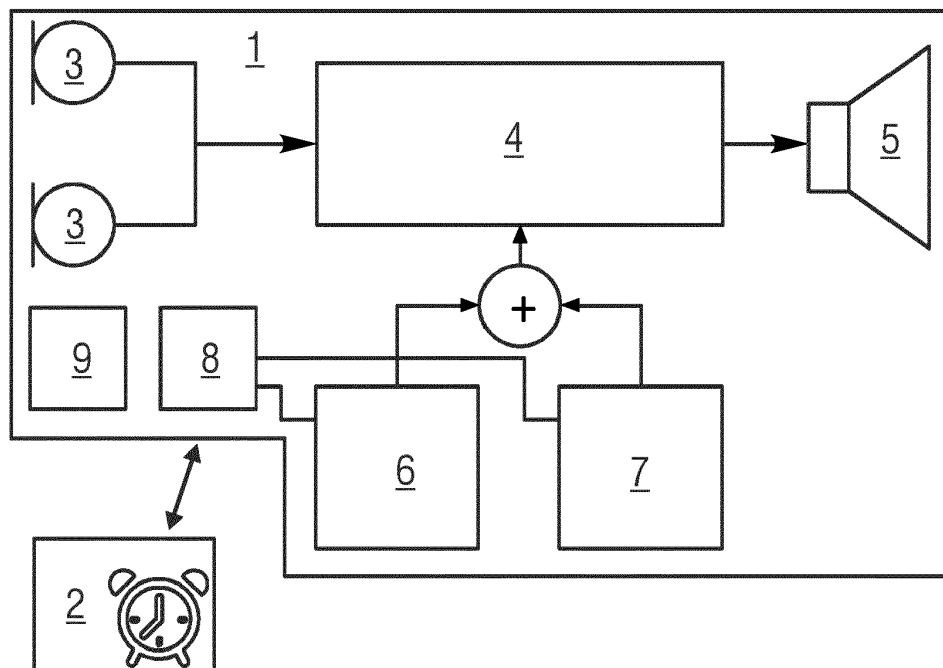


FIG 1

Description

Technical Field

[0001] The invention relates to a hearing device.

Background of the Invention

[0002] Conventional hearing aids do not have a clock, but normally use a counter which for example allows deriving a usage time.

[0003] Today it is not common to integrate a sufficiently accurate clock into hearing aids because a clock typically consumes a considerable amount of energy. Some applications claim frequent synchronization of time information of the hearing aid with the internet via e.g. smartphones or computers.

[0004] However, accurate current time information may be beneficial for some hearing aid functions in the case that the hearing aid is connected from time to time only to an external clock via e.g. a smartphone or a direct link to the internet.

Summary of the Invention

[0005] It is an object of the present invention to provide an improved hearing device.

[0006] The object is achieved by a hearing device according to claim 1.

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

[0008] According to the invention, a hearing device comprises a processor, a time memory, a time counter configured to count time units passed, and a communication interface configured to communicate with an external device, wherein the hearing device is configured to receive current time information from the external device at a synchronization event and to store the current time information in the time memory, wherein the time counter is configured to be reset at the synchronization event, wherein the processor is configured to calculate an actual time by adding the current time information stored in the time memory and the passed time units. The time memory may be a non-volatile memory.

[0009] In an exemplary embodiment, the hearing device further comprises a rechargeable battery.

[0010] In an exemplary embodiment, the communication interface comprises at least one electrical contact and/or a wireless connection.

[0011] In an exemplary embodiment, the time counter is configured to run in the background with a low power consumption even if the hearing device is switched off.

[0012] In an exemplary embodiment, the hearing device further comprises at least one microphone and a speaker or receiver for outputting audio data.

[0013] In an exemplary embodiment the hearing device is configured as a hearing aid. Since hearing aids are worn at the ear for an extended time it is desirable

to limit space requirements and weight of the device. Therefore hearing aids use only a small, lightweight battery. The invention is thus particularly beneficial for hearing aids.

[0014] In an exemplary embodiment, an external device is provided, comprising a clock or connected to a clock to obtain current time information and configured to communicate with a communication interface of a hearing device, preferably according to any one of the preceding claims, to submit the current time information at a synchronization event.

[0015] In an exemplary embodiment, the external device is configured as a charger for charging a rechargeable battery of a hearing device.

[0016] In an exemplary embodiment, a system may be provided, comprising at least one hearing device as described above and an external device as described above.

[0017] In an exemplary embodiment, the synchronizing event is at least one of:

- inserting the hearing device into the charger and starting a charging procedure,
- opening a cover of the charger,
- removing the hearing device from the charger,
- a time interval passed while the hearing device is connected to the charger,
- a manual request of a user operating a user interface on the hearing device or on the external device,
- switching on the hearing device.

[0018] In an exemplary embodiment, a method of operating a hearing device as described above comprises: receiving current time information from an external device, in particular as described above, at a synchronization event and storing the current time information in the time memory, wherein the time counter is configured to count time units passed and to be reset at the synchronization event, wherein the processor is configured to calculate an actual time by adding the current time information stored in the time memory and the passed time units.

[0019] In an exemplary embodiment, the synchronizing event is at least one of:

- inserting the hearing device into the charger and starting a charging procedure,
- opening a cover of the charger,
- removing the hearing device from the charger,
- a time interval passed while the hearing device is connected to the charger,
- a manual request of a user operating a user interface on the hearing device or on the external device ,
- switching on the hearing device.

[0020] In an exemplary embodiment, the actual time is used to operate at least one of:

- an alarm clock comprising an audible alarm,
- time specific logging of a state of the hearing device,
- time specific activation of functions or parameters of the hearing device.

[0021] In an exemplary embodiment, the audible alarm comprises an output of a voice message.

[0022] In an exemplary embodiment, information stored in a calendar linked to or comprised in the external device is used.

[0023] 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

[0024] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawing which is given by way of illustration only, and thus, is not limitative of the present invention, and wherein:

Figure 1 is a schematic view of a hearing device and a charger.

Detailed Description of Preferred Embodiments

[0025] Figure 1 shows a schematic view of a hearing device 1 and an external device 2, e.g. a charger. The hearing device 1, e.g. a hearing aid, comprises at least one microphone 3, e.g. two microphones 3, a signal processor 4 for processing audio data acquired from the at least one microphone 3, and a speaker 5 or receiver for outputting audio data from the signal processor 4. Further, the hearing device 1 comprises a time memory 6 and a time counter 7. The time memory may be a non-volatile memory.

[0026] The basic idea is to synchronize a time between the external device 2 and the hearing device 1 from time to time, or at certain events, while the external device 2 provides current time information.

[0027] This current time information may be obtained from the internet, to which the external device 2 may be connected, or from an accurate clock (e.g. a quartz clock) implemented in the external device 2.

[0028] The external device 2 can be a charger for a rechargeable hearing device 1, but also a remote control or a smartphone.

[0029] In an exemplary embodiment, an event at which the external device 2 provides current time information can be, that the hearing device 1 is inserted into the charger for charging a rechargeable battery 9 of the hear-

ing device 1 or that the user performs a user input to a remote control or a remote control app running on a smartphone, which establishes a wireless link to the hearing device 1 in order to modify settings of the hearing device 1.

[0030] At such events the time becomes synchronized between the external device 2 and the hearing device 1.

[0031] The hearing device 1 stores the received time information in the non-volatile memory 6.

[0032] The hearing device 1 contains the time counter 7, which counts certain time units, so called ticks (e.g. seconds).

[0033] Every synchronization event, i.e. as soon as the new current time information is stored to the memory 6, resets the counted ticks to Zero.

[0034] The hearing device 1 calculates the actual time by adding the synchronized and stored current time information and the counted ticks. Before this addition counted ticks may be converted into time units, e.g. seconds or minutes, using the number of ticks which have passed since the previous reset and the time between two ticks.

[0035] A link between the external device 2 and the hearing device 1 can be established as a permanent link or for each request of current time information - however if it is desirable to establish the link as seldom as possible, e.g. due to power saving reasons, a similar principle can be applied: the link is set up only once, e.g. just after switching on the hearing device 1, then the current time information is transferred to the hearing device 1. Then the time counter 7 counts the time units passed since the previous connection and subsequently the actual time information is calculated using the transferred current time information together with the counted time units.

[0036] The link between the hearing device 1 and the external device 2 can be set up by means of a communication interface 8, e.g. a mechanical/electrical contact or a wireless connection. If the external device 2 is a charger, the contact may be wireless and/or wired; the connection to a different external device 2, e.g. a smartphone is preferably wireless.

[0037] The event for initiating transfer of current time information may be at least one of:

- inserting the hearing device 1 into the charger and starting the charging procedure,
- opening a cover of the charger,
- removing the hearing device 1 from the charger (requires wireless data exchange),
- frequent exchange, while the hearing device 1 is connected to the charger (e.g. every hour and starting of the counter in the hearing aid as soon as the time information is transferred and after reset of the counter starting),
- manual request of the user (e.g. the user may press a user interface on the hearing device 1 or on the external device 2, preferably for a couple of seconds).

[0038] In order to prevent that time information is no longer in sync as soon as the hearing device 1 is switched off, the hearing device 1 may provide a functionality which runs the time counter 7 in the background with a low power consumption also when the hearing device 1 is switched off.

[0039] The time information implemented in the hearing device 1 may be applied to perform one or more of the following functions:

- Alarm clock, time specific notification: the charger may contain an interface allowing a user to set up certain time related events (e.g. alarms at specific times). Together with the current time information this additional information is transferred to the hearing device 1. A set up event triggers a notification or an alarm executed at the configured time by the hearing device 1. An alarm may comprise an alert signal (e.g. a beep) and/or a voice message (e.g. "now it's time to take your medicine"). The alert signal may be pre-defined or configurable (e.g. high/low tone, soft/loud tone). The voice message may be pre-configured and selectable by the user out of e.g. "time for medicine", "time for event", "time for visit" or can be acoustically entered via the interface (e.g. microphone) of the charger for setting up notifications.
- Time specific logging of a state of the hearing device 1: For certain reasons it may be recommend logging the state of the hearing device 1 at certain times, e.g. every day at 10:00, 12:00, 14:00, 16:00, 18:00. Such a logging pattern may allow investigating and analysing patterns of behaviour of the user over time. With current time information available, such logging patterns can also be applied without the need of having an additional external available.
- Time specific activation of functions or parameters of the hearing device 1, e.g. logging the state of the hearing device 1 at certain times and/or setting parameters of the hearing device 1 at a certain time. In addition to the time information, information from a calendar linked to the charger or entered manually by the user can be transferred by the charger. This additional information may contain information about certain events and actions (12:00 - 13:15 [lunch meeting with business partners in a restaurant] -> activate speech in noise program).

List of References

[0040]

- 1 hearing device
- 2 external device
- 3 microphone
- 4 processor
- 5 speaker
- 6 time memory

- 7 time counter
- 8 communication interface
- 9 battery

Claims

1. A hearing device (1), comprising a processor (4), a time memory (6), a time counter (7) configured to count time units passed, and a communication interface (8) configured to communicate with an external device (2), wherein the hearing device (1) is configured to receive current time information from the external device (2) at a synchronization event and to store the current time information in the time memory (6), wherein the time counter (7) is configured to be reset at the synchronization event, wherein the processor (4) is configured to calculate an actual time by adding the current time information stored in the time memory (6) and the passed time units.
2. The hearing device (1) of claim 1, further comprising a rechargeable battery (9).
3. The hearing device (1) of claim 1 or 2, wherein the communication interface (8) comprises at least one electrical contact and/or a wireless connection.
4. The hearing device (1) according to any one of claims 1 to 3, wherein the time counter (7) is configured to run in the background with a low power consumption even if the hearing device (1) is switched off.
5. The hearing device (1) according to any one of the preceding claims, further comprising at least one microphone (3) and a speaker (5) or receiver for outputting audio data.
6. The hearing device (1) according to any one of the preceding claims, configured as a hearing aid.
7. An external device (2) comprising a clock or connected to a clock to obtain current time information and configured to communicate with a communication interface (8) of a hearing device (1), preferably according to any one of the preceding claims, to submit the current time information at a synchronization event.
8. The external device (2) of claim 7, configured as a charger for charging a rechargeable battery (9) of a hearing device (1).
9. A system, comprising at least one hearing device (1) according to any one of the claims 1 to 6 and an external device (2) according to claim 7 or 8.
10. The system according to claim 9, wherein the syn-

chronizing event is at least one of:

- inserting the hearing device (1) into the charger and starting a charging procedure,
 - opening a cover of the charger, 5
 - removing the hearing device (1) from the charger,
 - a time interval passed while the hearing device (1) is connected to the charger,
 - a manual request of a user operating a user interface on the hearing device (1) or on the external device (2), 10
 - switching on the hearing device (1).
11. A method of operating a hearing device (1) according to any one of claims 1 to 6, the method comprising: receiving current time information from an external device (2), in particular according to claim 7 or 8, at a synchronization event and storing the current time information in the time memory (6), wherein the time counter (7) is configured to count time units passed and to be reset at the synchronization event, wherein the processor (4) is configured to calculate an actual time by adding the current time information stored in the time memory (6) and the passed time units. 15 20 25
12. The method according to claim 11, wherein the synchronizing event is at least one of:
- inserting the hearing device (1) into the charger and starting a charging procedure, 30
 - opening a cover of the charger,
 - removing the hearing device (1) from the charger,
 - a time interval passed while the hearing device (1) is connected to the charger, 35
 - a manual request of a user operating a user interface on the hearing device (1) or on the external device (2),
 - switching on the hearing device (1). 40
13. The method according to claim 11 or 12, wherein the actual time is used to operate at least one of:
- an alarm clock comprising an audible alarm, 45
 - time specific logging of a state of the hearing device (1),
 - time specific activation of functions or parameters of the hearing device (1). 50
14. The method according to claim 13, wherein the audible alarm comprises an output of a voice message.
15. The method according to claim 13 or 14, wherein information stored in a calendar linked to or comprised in the external device (2) is used. 55

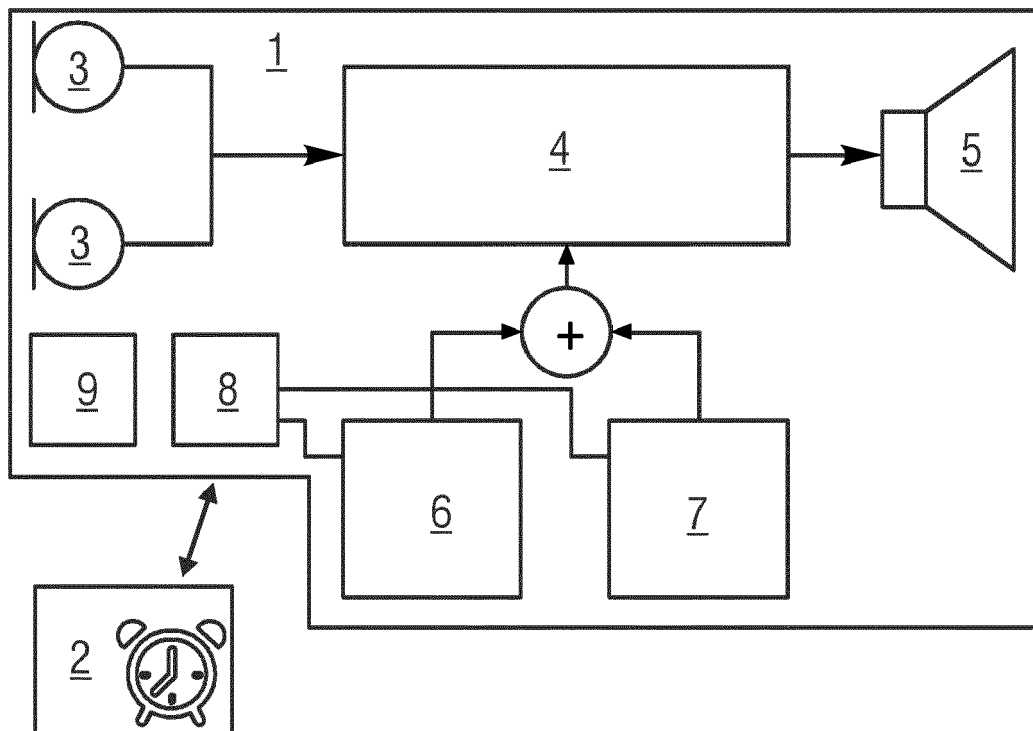


FIG 1



EUROPEAN SEARCH REPORT

Application Number
EP 20 16 3268

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 July 2020	Examiner Fülöp, István
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
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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