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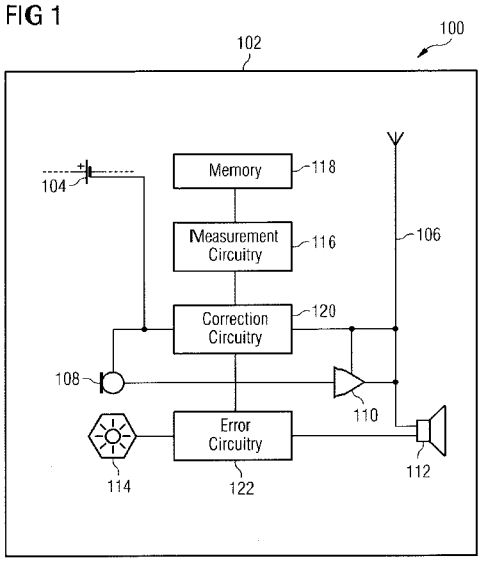
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(54) **Title**: HEARING AID WITH ENVIRONMENTAL COMPENSATING CIRCUITRY

FIG 1



(57) **Abstract**: Embodiments relate to a hearing aid with measurement, correction, and error circuitry. The measurement circuitry is configured to measure an environmental state and transmit environmental state data. The correction circuitry is configured to adjust a parameter of a hearing aid component at least partly based on the environmental state data. The error circuitry configured to receive the environment state data and provide an error signal to a hearing aid user if the environmental state data crosses a predetermined threshold.

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DESCRIPTION

HEARING AID WITH ENVIRONMENTAL COMPENSATING CIRCUITRY

Embodiments relate to a hearing aid with measurement, correction, and error circuitry.

Hearing aids are used throughout the world in varied environmental climates, most of which differ significantly from the factory conditions the hearing aids were manufactured and tested in. Performance of a hearing aid's components may vary significantly when exposed to environmental factors such as pressure, humidity, temperature, and electromagnetic radiation.

An embodiment of the invention provides a hearing aid that includes measurement circuitry, correction circuitry, and error circuitry. The measurement circuitry is configured to measure an environmental state, wherein the measurement circuitry is further configured to transmit environmental state data. The correction circuitry is configured to adjust a parameter of a hearing aid component, the adjustment being at least partly based on the environmental state data. The error circuitry is configured to receive the environment state data, wherein the error circuitry is further configured to provide an error signal to a hearing aid user if the environmental state data crosses a pre-determined threshold.

In some embodiments, the measurement circuitry is configured to transmit environmental state data if the measured environmental state crosses a pre-determined threshold. In some embodiments, the measurement circuitry is configured to transmit environmental state data if the measured environmental state crosses a pre-determined threshold for a pre-determined period of time.

In some embodiments, the measurement circuitry is configured to measure an environmental state of a hearing aid cavity. In some embodiments, the measurement circuitry is configured to measure an environmental state of a hearing aid component. In some embodiments, the measurement circuitry is located on the exterior of the hearing aid.

In some embodiments, the environmental state comprises humidity level, temperature level, pressure level, and/or electromagnetic radiation level.

In some embodiments, the hearing aid component comprises a transducer. In some embodiments, the transducer comprises a microphone. In some embodiments, the transducer comprises a loudspeaker. In some embodiments, the hearing aid component comprises an antenna.

In some embodiments the correction circuitry further comprises a signal processor. In some embodiments, the parameter comprises gain level. In some embodiments the parameter comprises signal output of the hearing aid component. In some embodiments, the parameter comprises signal input of the hearing aid component. In some embodiments, the parameter comprises resonant frequency. In some embodiments, the resonant frequency is adjusted at least partly by frequency shifting a signal.

In some embodiments, the correction circuitry is further adapted to independently adjust the gain level of two or more frequency bands.

In some embodiments, the hearing aid further includes a memory device configured to store the environmental state data generated by the measurement circuitry. In some embodiments, the hearing aid further includes a memory device configured to store hearing aid component compensation data. In some

embodiments, the hearing aid component compensation data comprises scalars.

In some embodiments, the error circuitry is coupled to a light emitter, the light emitter configured to provide a visual signal when the environmental state data crosses the pre-determined threshold. In some embodiments, the error circuitry is coupled to a loudspeaker, the loudspeaker configured to provide an audible signal when the environmental state data crosses the pre-determined threshold.

In some embodiments, the hearing aid includes wireless transmitting circuitry configured to transmit the environmental state data. In some embodiments, the wireless transmitting circuitry is further configured to receive a second hearing aid environmental state data.

Some embodiments of the invention provide a method for a hearing aid to communicate a warning to a hearing aid user. The method includes measuring an environmental state, generating environmental state data, adjusting a parameter of a hearing aid component, the adjustment being at least partly based on the environmental state data, and providing an error signal to a hearing aid user if the environmental state data crosses a pre-determined threshold.

In some embodiments, the method further comprises wirelessly transmitting the environmental state data to a second hearing aid, wherein the second hearing aid provides the error signal to the hearing aid user if the environmental state data crosses the pre-determined threshold.

The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various embodiments

of the invention are described with reference to the following drawings, in which:

Figure 1 is a block diagram of hearing aid circuitry in accordance with an embodiment of the invention;

Figure 2 is a graph showing for illustrative purposes only the change of sensitivity of a microphone as humidity increases;

Figure 3 is a block diagram of measurement circuitry in accordance with an embodiment of the invention;

Figure 4 is a flowchart of a process for adjusting a parameter of a hearing aid component in accordance with an embodiment of the invention;

Figure 5 is a flowchart of providing an error signal to a hearing aid user in accordance with an embodiment of the invention; and

Figure 6 is a flowchart of providing an error signal to a hearing aid user in accordance with an embodiment of the invention.

FIG. 1 is a block diagram of hearing aid circuitry in accordance with an embodiment of the invention. Hearing aid cavity 102 may be any enclosure or partial enclosure housing hearing aid components. Hearing aid cavity 102 of hearing aid 100 houses battery 104, antenna 106, microphone 108, amplifier 110, loudspeaker 112, light 114, measurement circuitry 116, memory 118, correction circuitry 120, and error circuitry 122.

Battery 104 provides power to the hearing aid components and may be housed in a battery compartment (not shown). Battery 104 may be a rechargeable battery.

Antenna 106 may be configured to communicate with a base unit placed, for example, in a user's pocket. Antenna 106 may also be used to communicate with other hearing aid devices. For example, antenna 106 may be a part of an e2e (ear-to-ear) wireless™ system made by Siemens.

Microphone 108 receives acoustic information which is amplified from a microphone level to a line level by amplifier 110. The amplified signal is transmitted to the user by loudspeaker 112.

Environmental factors such as pressure, humidity, temperature, and electromagnetic radiation may negatively affect the performance of hearing aid components, e.g., battery 104, antenna 106, microphone 108, amplifier 110, and loudspeaker 112. For example, high temperatures and/or humidity decrease microphone sensitivity by at least a few decibels (dB). High temperatures also increases noise received by an antenna, thus resulting in a lower signal-to-noise ratio. Other hearing aid components experience similar drifts in performance. In some cases, hearing aid components may cease functioning or be permanently damage if operated in extreme environments.

FIG. 2 is a graph 200 showing for illustrative purposes only the change of sensitivity of a microphone as humidity increases. Line 202 is the sensitivity curve of a microphone in an environment of 4 percent relative humidity. Line 204 is the sensitivity curve of a microphone in an environment of 96 percent relative humidity. It can be seen that sensitivity

increases as humidity increases. Sensitivity changes of 6 dB or more have been observed when comparing output of a microphone in a 0% relative humidity environment with output of a microphone in a 100% relative humidity environment. As humidity increases, it has also been observed that a microphone's resonance frequency lowers and damping increases.

As explained in further detail by FIG. 3, measurement circuitry 116 may include sensors configured to measure an environmental state. Environmental states include, but are not limited to, pressure, humidity, temperature, and electromagnetic radiation. When measurement circuitry 116 measures an environmental state, it may generate environmental state data.

Environmental state data may include, but is not limited to, pressure level, humidity level, temperature level, and electromagnetic radiation level. Environmental state data may be measured from a hearing aid component, a hearing aid cavity, or the exterior of a hearing aid. For example, measurement circuitry 116 may measure the temperature of battery 104, hearing aid cavity 102, or the exterior of hearing aid 100.

Measurement circuitry 116 may transmit environmental state data to correction circuitry 120. In some embodiments, measurement circuitry 116 may transmit environmental state data to correction circuitry 120, or elsewhere, only after a measurement crosses a threshold. Correction circuitry 120 may adjust a parameter of a hearing aid component based at least partially on environmental state data. In some embodiments, correction circuitry includes signal processor circuitry (not shown). In one example in accordance with an embodiment, correction circuitry 120 may increase the gain level, input

level, or output level for microphone 108 (or other hearing aid components) in response to a humidity level data transmitted by measurement circuitry 116.

In another example in accordance with an embodiment of the invention, the change of internal noise of amplifier 110 or speaker 112 due to humidity or temperature may be compensated by correction circuitry 120 adjusting or reducing the noise. Another example includes increasing the gain for antenna 106 due to high levels of electromagnetic radiation, humidity, and/or temperature.

Correction circuitry 120 may also adjust a parameter such as frequency response. For example, correction circuitry 120 may frequency shift an input or output signal of a hearing aid component in order to adjust the resonant frequency of the hearing aid component. A combination of both frequency and gain adjustments may be adjusted. The gain may also be adjusted independently in different frequency bands. For example, sensitivity curve 204 of FIG. 2 shows a large dip in the frequencies above 10 kHz. In some embodiments, correction circuitry 120 may adjust those frequencies differently than the frequencies below 10 kHz. For example, the frequencies above 10 kHz may be boosted in relation to the other frequencies to compensate for a roll-off in a microphone's frequency response. It is one aspect of the invention that the signal processing capability of correction circuitry 120 utilizes the environmental state data generated by measurement circuitry 116 to adjust relevant parameters in compensating for changes or drift in a component of a hearing aid.

In one embodiment of the invention, memory 118 stores hearing aid component compensation data. Hearing aid component

compensation data includes data pertaining to compensating for known hearing aid component characteristics (e.g., frequency response, noise levels, etc...) at certain pressure, humidity, temperature, and/or electromagnetic radiation levels. When measurement circuitry 116 records such levels, memory 118 may provide the data to correction circuitry 120. Correction circuitry 120 may then use the data to adjust a relevant parameter(s) of a hearing component(s). Thus, measurement circuitry 116 may adjust one or more parameters of one or more hearing aid components in response to one or more recorded levels by measurement circuitry 116. In one embodiment, a memory may be located within correction circuitry 120. The memory may store the hearing aid component compensation data. In one embodiment, the hearing aid component compensation data comprises scalars.

Measurement circuitry 116 may also transmit environmental state data to error circuitry 122. If environmental state data crosses a pre-determined threshold (e.g., humidity level), error circuitry 122 will provide an error signal to a hearing aid user. In some embodiments, an environmental state data must cross and stay above or below the pre-determined threshold over a pre-determiend period of time before error circuitry 122 will provide an error signal. The error signal includes, but is not limited to, light 114 flashing, an error tone played by loudspeaker 122, a combination of light and sound, or a vibration means (not shown).

Error signals may be specific to the type of environmental state data received. For example, an error signal for high humidity may include a certain color of light. A spoken warning may be played by loudspeaker 112, indicating performance may be less then optimum or to turn off the

hearing aid to prevent damage. Error signals may also indicated that the hearing aid is in need of servicing.

Measurement circuitry 116 may also transmit environmental state data to memory 118. This may be especially useful for a technician to evaluate when determining which hearing aid component may have failed.

It will be understood that the architecture shown in FIG. 1 is only one possible architecture for hearing aid 100, and that there may be many variation or additions to the architecture. For example, hearing aid 100 may include a digital-to-analog converter, and measurement circuitry 116 may be located on the exterior of hearing aid 100 or on individual components.

Figure 3 is a block diagram of measurement circuitry 116 in accordance with an embodiment of the invention. Measurement circuitry 116 includes pressure sensor 302, temperature sensor 304, humidity sensor 306, and electromagnetic sensor 308.

Pressure sensor 302 senses and may provide environmental state data pertaining to atmospheric pressure. Temperature sensor 304 senses and may provide environmental state data pertaining to temperature. Humidity sensor 306 senses and may provide environmental state data pertaining to humidity levels. Electromagnetic sensor 308 senses and may provide environmental state data pertaining to electromagnetic radiation 308.

Sensors may measure environmental state data for a hearing aid cavity, a hearing aid exterior, or an individual hearing aid component.

All sensors may work in parallel or separately in time. That is, one, several, or all sensors may be operating at any given time. In some embodiments, measurement circuitry 116 only transmits sensor measurements if the measurements cross a threshold.

It will be understood that the architecture shown in FIG. 3 is only one possible architecture for measurement circuitry 116, and that there may be many variation or additions to the architecture. For example, some sensors may be located on the exterior of a hearing aid (not shown).

Figure 4 is a flowchart of a process for adjusting a parameter of a hearing aid component in accordance with an embodiment of the invention. At 402, process 400 starts. At 404, measurement circuitry measures an environmental state. The environmental state may be measured from a hearing aid cavity, a hearing aid component, or an exterior surface of a hearing aid.

At 406, measurement circuitry transmits environmental state data to correction circuitry. At 408, correction circuitry receives environmental state data. At 410, correction circuitry adjusts a parameter of a hearing aid component. At 412, process 400 ends.

Figure 5 is a flowchart of providing an error signal to a hearing aid user in accordance with an embodiment of the invention. At 502, process 500 starts. At 504, measurement circuitry measures an environmental state.

At 506, measurement circuitry transmits environmental state data to error circuitry. At 508, error circuitry receives

environmental state data. At 510, error circuitry provides an error signal to a hearing aid user. At 512, process 500 ends.

Figure 6 is a flowchart of providing an error signal to a hearing aid user in accordance with an embodiment of the invention. At 602, process 600 starts. At 604, measurement circuitry measures an environmental state.

At 606, measurement circuitry transmits environmental state data to error circuitry. At 608, error circuitry A receives environmental state data. Error circuitry A may be located in a left hearing aid of a user; error circuitry B may be located in a right hearing aid of a user.

At 610, error circuitry A provides environmental state data to error circuitry B. In some embodiments, environmental state may be provided by transmitting the data over an antenna located in a left hearing aid and received by an antenna located in the right hearing aid. One advantage of process 500 is that if a left hearing aid is unable to produce an error signal due to a malfunction, a right hearing aid may be able to notify a user of the left hearing aid's status.

At 612, error circuitry B provides an error signal to a hearing aid user. At 614, process 600 ends.

While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning

and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

WHAT IS CLAIMED IS:

1. A hearing aid comprising:

measurement circuitry configured to measure an environmental state, wherein the measurement circuitry is further configured to transmit environmental state data;

correction circuitry configured to adjust a parameter of a hearing aid component, the adjustment being at least partly based on the environmental state data; and

error circuitry configured to receive the environment state data, wherein the error circuitry is further configured to provide an error signal to a hearing aid user if the environmental state data crosses a pre-determined threshold.

2. The hearing aid of claim 1, wherein the measurement circuitry is configured to transmit environmental state data if the measured environmental state crosses a pre-determined threshold.

3. The hearing aid of claim 1, wherein the measurement circuitry is configured to transmit environmental state data if the measured environmental state crosses a pre-determined threshold for a pre-determined period of time.

4. The hearing aid of claim 1, wherein the measurement circuitry is configured to measure an environmental state of a hearing aid cavity.

5. The hearing aid of claim 1, wherein the measurement circuitry is configured to measure an environmental state of a hearing aid component.

6. The hearing aid of claim 1, wherein the measurement circuitry is located on the exterior of the hearing aid.

7. The hearing aid of claim 1, wherein the environmental state comprises humidity level.

8. The hearing aid of claim 1, wherein the environmental state comprises temperature level.

9. The hearing aid of claim 1, wherein the environmental state comprises pressure level.

10. The hearing aid of claim 1, wherein the environmental state comprises electromagnetic radiation level.

11. The hearing aid of claim 1, wherein the hearing aid component comprises a transducer.

12. The hearing aid of claim 11, wherein the transducer comprises a microphone.

13. The hearing aid of claim 11, wherein the transducer comprises a loudspeaker.

14. The hearing aid of claim 1, wherein the hearing aid component comprises an antenna.

15. The hearing aid of claim 1, wherein the correction circuitry comprises a signal processor.

16. The hearing aid of claim 15, wherein the parameter comprises gain level.

17. The hearing aid of claim 15, wherein the parameter comprises signal output of the hearing aid component.

18. The hearing aid of claim 15, wherein the parameter comprises signal input of the hearing aid component.

19. The hearing aid of claim 15, wherein the parameter comprises resonant frequency.

20. The hearing aid of claim 16, wherein the correction circuitry is further adapted to independently adjust the gain level of two or more frequency bands.

21. The hearing aid of claim 19, wherein the resonant frequency is adjusted at least partly by frequency shifting a signal.

22. The hearing aid of claim 1, further comprising a memory device configured to store the environmental state data generated by the measurement circuitry.

23. The hearing aid of claim 1, further comprising a memory device configured to store hearing aid component compensation data.

24. The hearing aid of claim 23, wherein the hearing aid component compensation data comprises scalars.

25. The hearing aid of claim 1, wherein the error circuitry is coupled to a light emitter, the light emitter configured to provide a visual signal when the environmental state data crosses the pre-determined threshold.

26. The hearing aid of claim 1, wherein the error circuitry is coupled to a loudspeaker, the loudspeaker configured to provide an audible signal when the environmental state data crosses the pre-determined threshold.

27. The hearing aid of claim 1, further comprising wireless transmitting circuitry configured to transmit the environmental state data.

28. The hearing aid of claim 27, wherein the wireless transmitting circuitry is further configured to receive a second hearing aid environmental state data.

29. A method for a hearing aid to communicate a warning to a hearing aid user, the method comprising:

measuring an environmental state;

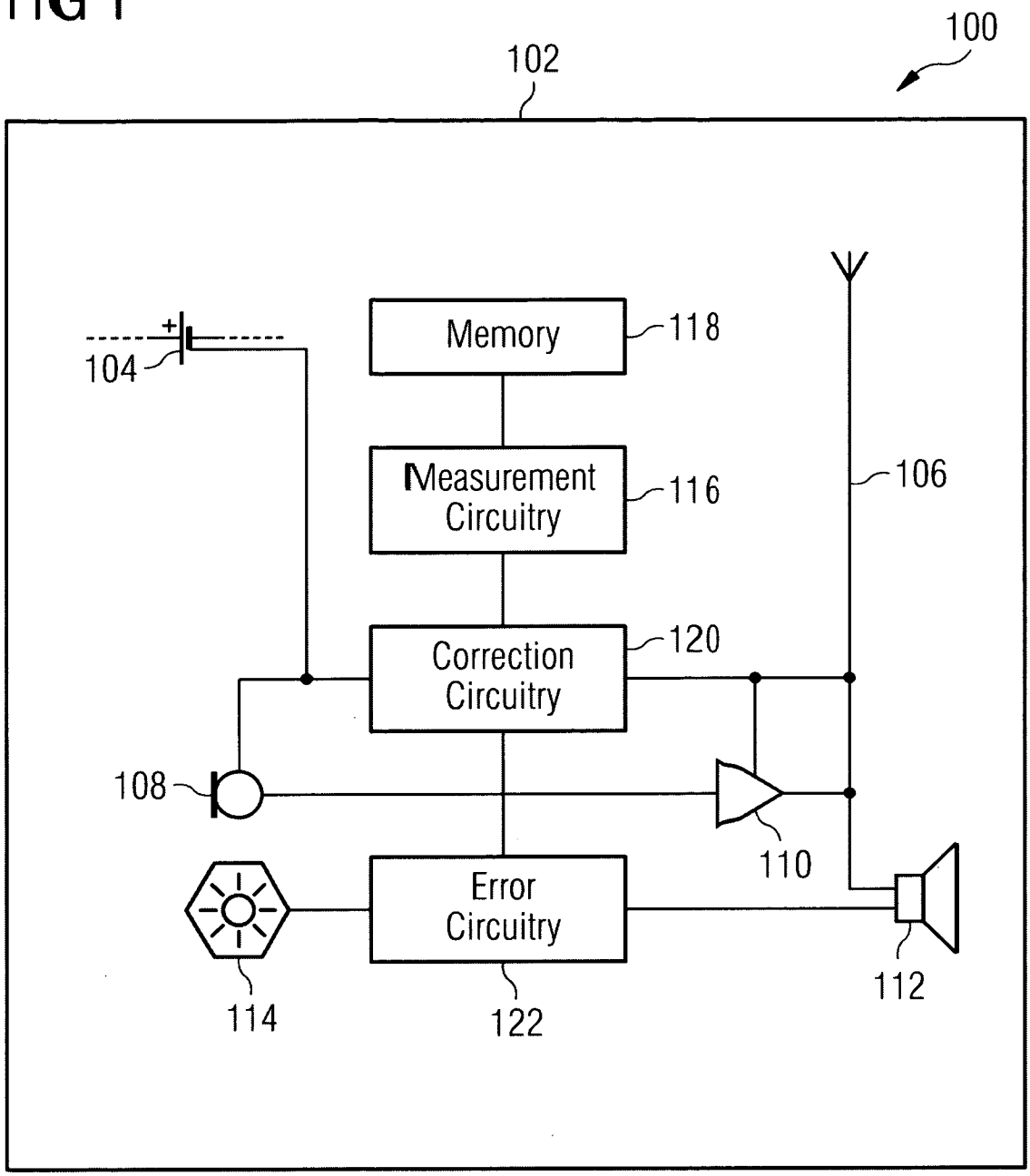
generating environmental state data;

adjusting a parameter of a hearing aid component, the adjustment being at least partly based on the environmental state data; and

providing an error signal to a hearing aid user if the environmental state data crosses a pre-determined threshold.

30. The method of claim 29, wherein the method further comprises wirelessly transmitting the environmental state data to a second hearing aid, wherein the second hearing aid provides the error signal to the hearing aid user if the environmental state data crosses the pre-determined threshold.

FIG 1


100
102
104
Memory
118
Measurement Circuitry
116
106
Correction Circuitry
120
108
110
Error Circuitry
112
114
122

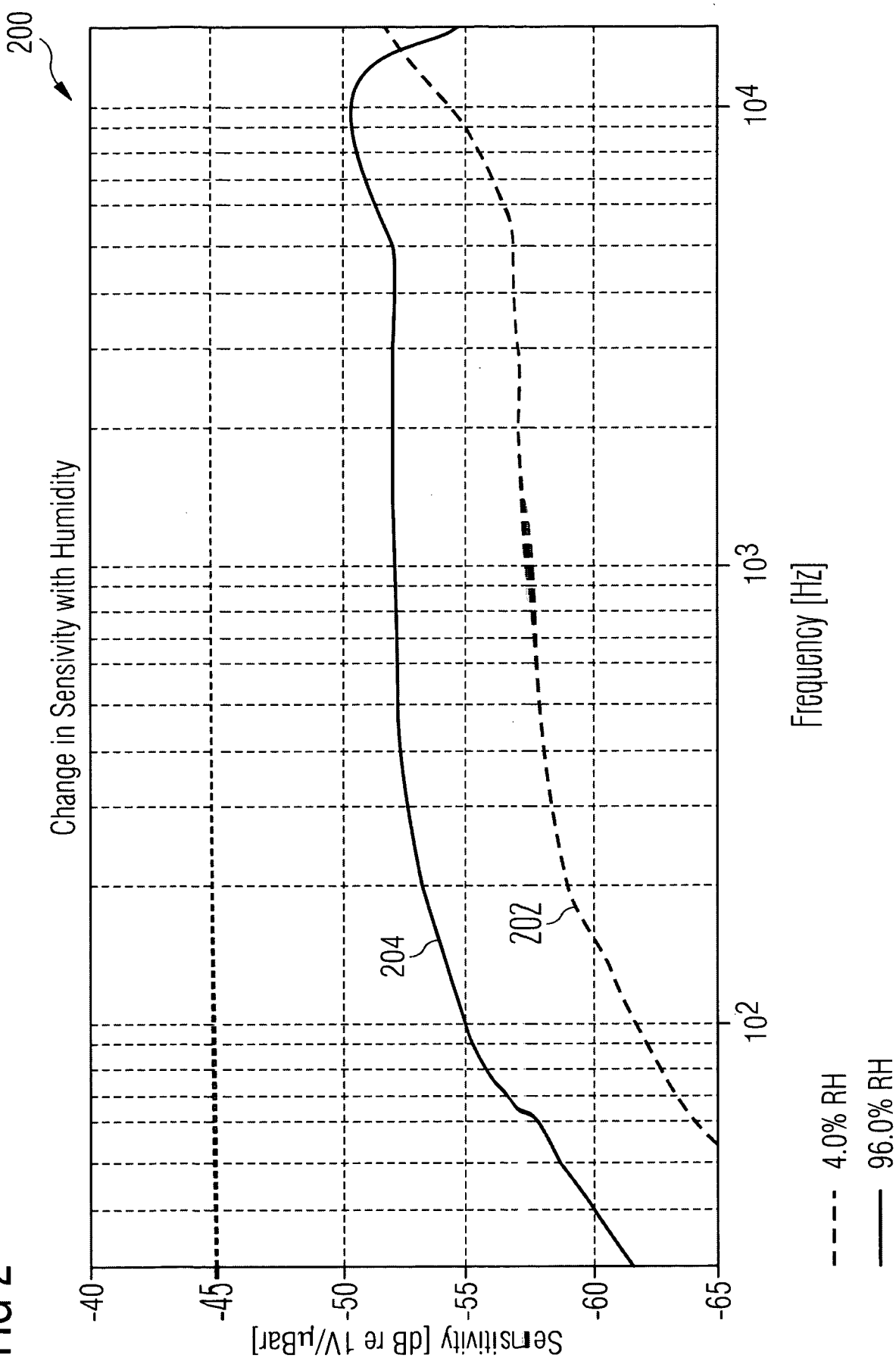

200
Change in Sensivity with Humidity
Sensitivity [dB re 1V/µBar]
-40
-45
-50
-55
-60
-65
Frequency [Hz]
10^2
10^3
10^4
202
204
4.0% RH
96.0% RH

FIG 2

FIG 3

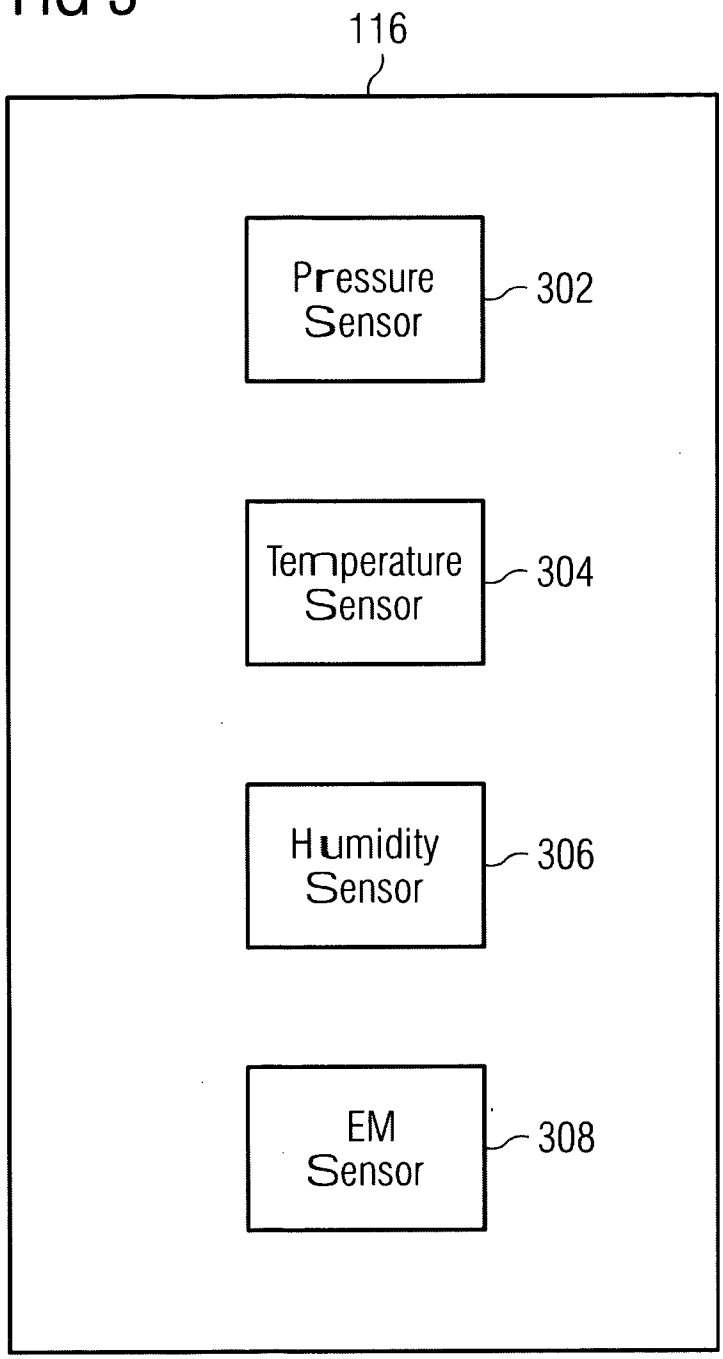

116
Pressure Sensor
302
Temperature Sensor
304
Humidity Sensor
306
EM Sensor
308

FIG 4

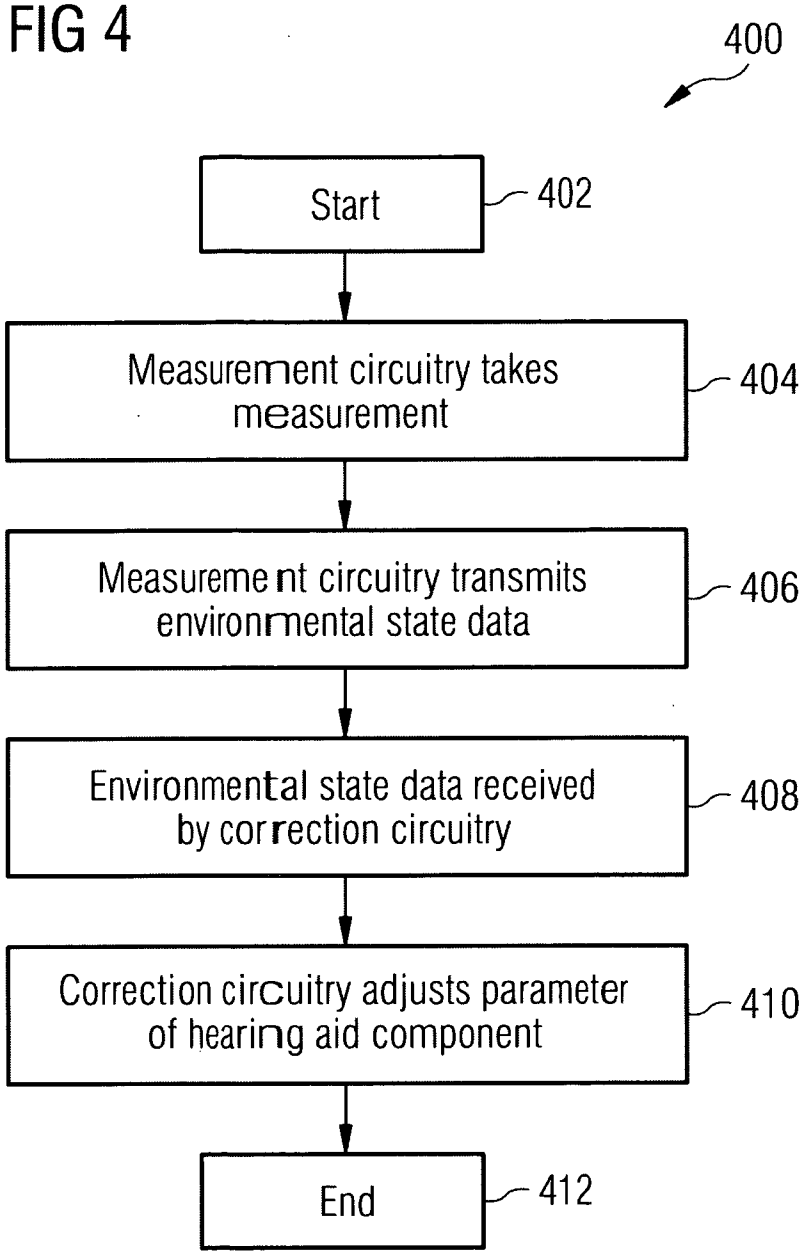

400
Start
402
Measurement circuitry takes measurement
404
Measurement circuitry transmits environmental state data
406
Environmental state data received by correction circuitry
408
Correction circuitry adjusts parameter of hearing aid component
410
End
412

FIG 5

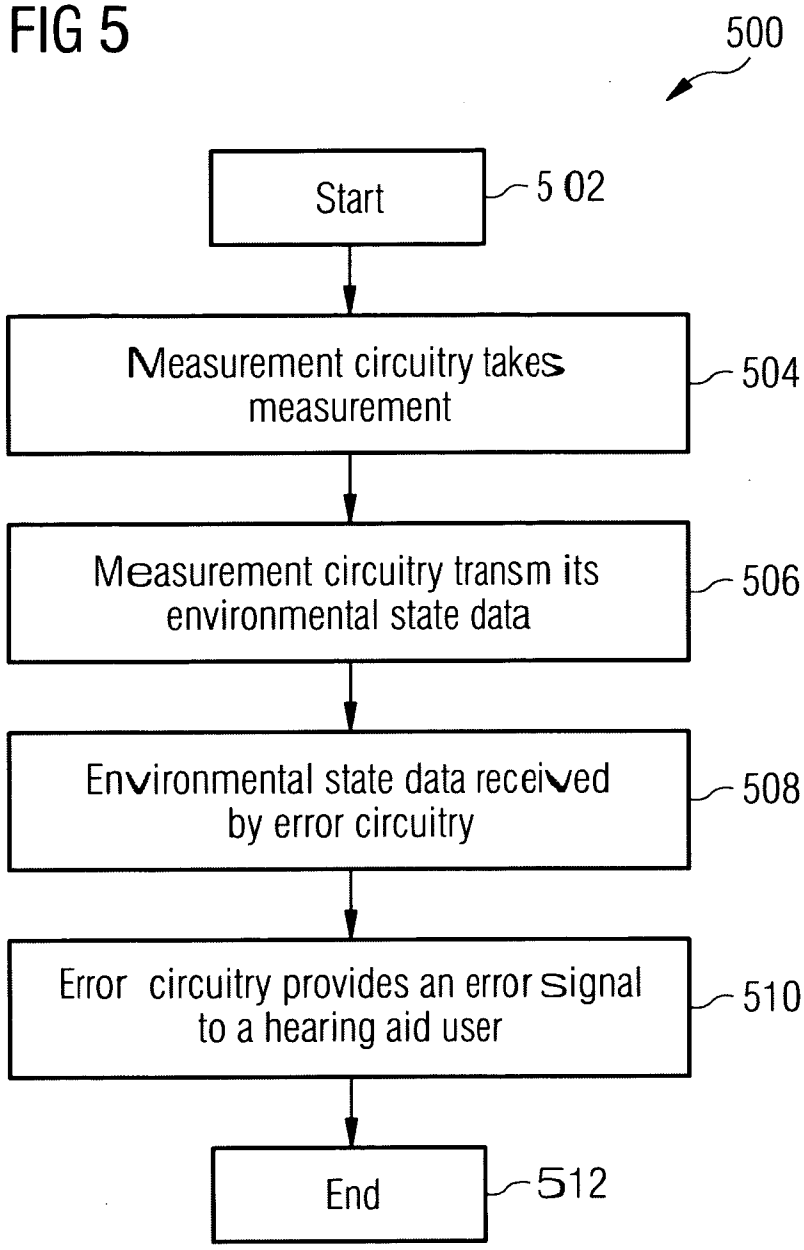
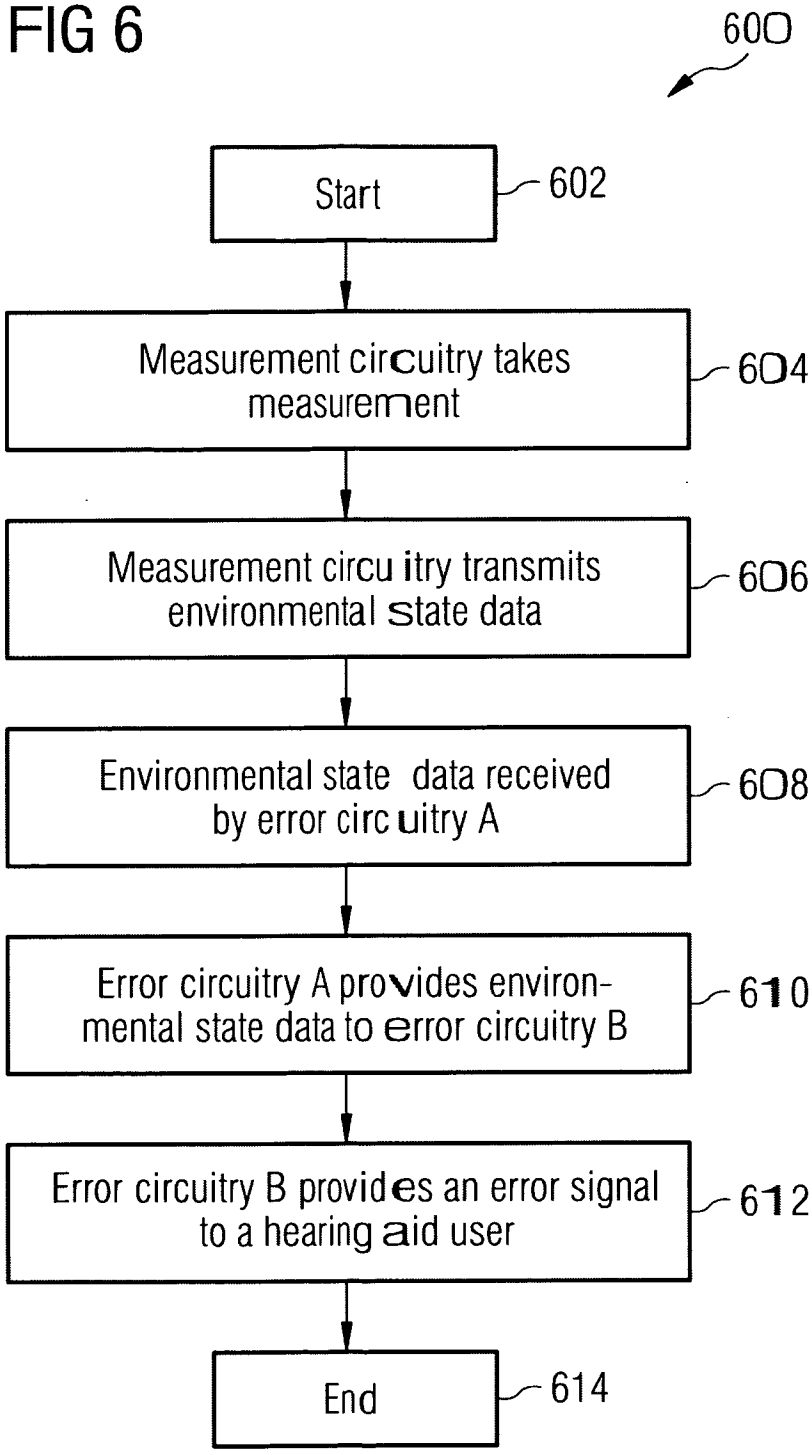

500
Start
502
Measurement circuitry takes measurement
504
Measurement circuitry transm its environmental state data
506
Environmental state data received by error circuitry
508
Error circuitry provides an error signal to a hearing aid user
510
End
512

FIG 6


600
Start
602
Measurement circuitry takes measurement
604
Measurement circuitry transmits environmental state data
606
Environmental state data received by error circuitry A
608
Error circuitry A provides environmental state data to error circuitry B
610
Error circuitry B provides an error signal to a hearing aid user
612
End
614

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG 2009/000141

A. CLASSIFICATION OF SUBJECT MATTER
IPC[8]: H04R 25/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[8]: H04R 25/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1467595 A2 (Czermak et al.) 13 October 2004 (13.10.2004) *Abstract; Fig. 1, vlaims 1 and 2*	1, 19
A	WO 2000/028783 A1 (Westermann et al.) 18 May 2000 (18.05.2000) *Abstract; claim 1*	1, 19
A	DE 102006020833 B3 (Steinbuss) 28 June 2007 (28.06.2007) *Abstract; claim 1*	1, 19

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 October 2009 (06.10.2009)	23 October 2009 (23.10.2009)
Name and mailing address of the ISA/ AT **Austrian Patent Office** Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24 / 535	Authorized officer GRÖSSING G. Telephone No. +43 / 1 / 534 24 / 386

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SG 2009/000141

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
EP	A	1467595		DK	T3	1467595T	2008-09-29
				AT	T	397368T	2008-06-15
				EP	A2	1467595	2004-10-13
				CA	A1	2463195	2004-10-08
				US	A1	2004202333	2004-10-14
WO	A	2000028783				none	
DE	A	102006020833		AU	A1	2007201974	2007-11-22
				US	A1	2007258609	2007-11-08
				EP	A2	1853090	2007-11-07
				DE	B3	102006020833	2007-06-28