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(54) **HEARING DEVICE**

(57) The invention relates to a transducer system for a hearing device, the transducer system comprising an electromechanical component with a movable mass and a circuit (5) configured to switch the transducer system

between a first state, in which the transducer system is configured as an acoustic element, and a second state, in which the receiver unit is configured as a vibration source.

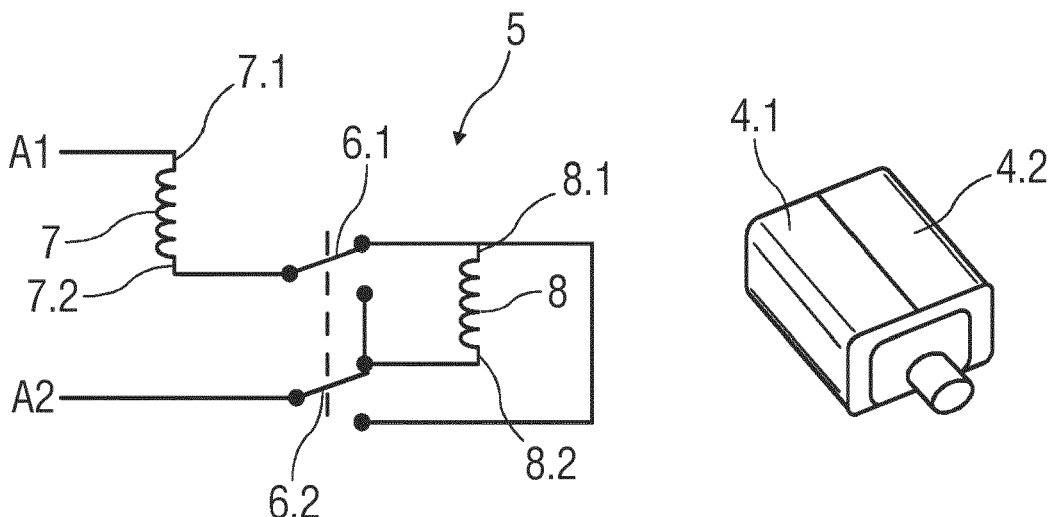


FIG 5

Description

Technical Field

[0001] The invention relates to a transducer system for a hearing device.

Background of the Invention

[0002] Hearing devices such as hearing aids may comprise receivers to notify users about issues such as low battery, program change, volume control, phone calls etc. with acoustic events such as beep tones, ring tones, voice messages etc.

[0003] As is known from smartphones, there are occasions though, where an acoustic notification is not appropriate and other means to notify a user are sought for. Vibration motors or actuators may provide the means to do so.

[0004] On the other hand, conventional vibration actuators are comparatively large for the volume of a hearing aid and require significant amounts of current to vibrate. Thus, a solution is sought which uses significantly less space and less current to operate than known solutions, while still providing a similar haptic effect.

Summary of the Invention

[0005] It is an object of the present invention to provide an improved transducer system, in particular for a hearing device.

[0006] The object is achieved by a transducer system according to claim 1.

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

[0008] In the field of hearing devices, the term receiver is used to refer to a loud speaker.

[0009] According to the invention, a transducer system for a hearing device comprises an electromechanical component with a movable mass and a circuit configured to switch the transducer system between a first state, in which the transducer system is configured as an acoustic element, and a second state, in which the transducer system is configured as a vibration source. In the first state, the transducer system may be configured to have a small or minimal vibration output and to primarily output audio signals. In the second state, the transducer system may be configured to have a high or maximum vibration output while still being capable of outputting audio signals.

[0010] In an exemplary embodiment, the electromechanical component is at least one receiver comprising the movable mass, in particular a membrane of said receiver.

[0011] In an exemplary embodiment, the electromechanical component is an active vent and the movable mass is a closure member of the said active vent.

[0012] Active vents are electrically controllable me-

chanical vents to open and close a venting canal in a hearing aid to either provide reduced occlusion effect while talking (opened vent) or improved noise isolation, feedback performance and superior sound quality for streaming e.g. music from other devices (closed vent). Thus, the vent is switched for different situations (e.g. talking, streaming music, being in noisy situations). In known solutions of such vents they may be integrated in the receiver of a hearing aid, e.g. in an elongate spout in front of the receiver.

[0013] In an exemplary embodiment, the transducer comprises two receivers configured as a dual receiver coupled to each other in a way to allow for mutually cancelling vibrational forces by mechanical compensation of inertial forces of the movable masses, wherein the circuit is configured to switch off or short one of the receivers or to change an electrical polarity of one of the receivers. An additional vibration device in the form of a second receiver is not needed, so that additional space in the earpiece is not required.

[0014] The proposed double function of a dual receiver enables many possibilities to improve wearing comfort during fitting and during daily use. In addition, vibration measurements are useful for several monitoring applications like seal control or hardware check.

[0015] Furthermore, a double receiver doesn't increase the volume of the earpiece as if a separate vibrator would be used.

[0016] In an exemplary embodiment, the circuit comprises at least one switch.

[0017] In an exemplary embodiment, the receivers are electrically connected to each other in series or in parallel.

[0018] In an exemplary embodiment, the circuit comprises two switches configured to be switched at the same time. The two switches may be coupled to each other to form a pole changeover switch to reverse a polarity.

[0019] In an exemplary embodiment, the at least one switch is an electronic switch or a mechanical switch.

[0020] In an exemplary embodiment, the circuit comprises:

- an inverter configured to invert an audio signal, e.g. a digital audio signal,
- two amplifiers configured to respectively drive one of the receivers, wherein an input of one of the amplifiers is fixedly connected to the audio signal, and
- wherein the switch is a selector switch configured to couple an input of the other amplifier either to the audio signal or to an output of the inverter. The amplifiers may be configured as a H-bridge, a class D amplifier or a digital/analogue converter respectively.

[0021] According to an aspect of the invention, an earpiece for a hearing device comprises a shell or dome and a receiver configured to emit sound through a channel in the shell or dome into an ear canal, further comprising:

- a transducer system as described above, wherein the receiver is part of said transducer system, or
- a movable mass movably arranged within the channel by an actor so as to selectively open or close a vent opening which opens out into the channel, wherein the actor is configured to be operated to cause a vibration of the movable mass.

[0022] In an exemplary embodiment, a frequency of the vibration is in a range from 5 Hz to 150 Hz, in particular 10 Hz to 100 Hz, 10 Hz to 80 Hz, 10 Hz to 60 Hz or 10 Hz to 40 Hz.

[0023] In an exemplary embodiment, the frequency is adjustable.

[0024] In an exemplary embodiment, the ear piece is part of a hearing device.

[0025] In an exemplary embodiment, the hearing device is configured as a hearing aid.

[0026] According to an aspect of the invention, in a method of operating a transducer system or an earpiece as described above, a vibration is generated to:

- notify a user of an event, and/or
- detect a correct position and/or state of the earpiece in an ear canal of the user by means of an accelerometer arranged in the earpiece, and/or
- detect skin properties of the user by means of an accelerometer arranged in the earpiece, and/or
- detect health changes of the user by generating vibration in one ear, measuring it by means of an accelerometer arranged in an earpiece in the other ear and analyzing the propagation of the vibration.

[0027] In an exemplary embodiment, the event is at least one of: loss of connectivity or connectivity detected, a call, low battery, rapid health change, in particular breathing or blood sugar limit, an approaching car or person talking, an alarm, a diary schedule.

[0028] In an exemplary embodiment, the event is a talking person approaching, wherein the direction, from which the talking person is approaching, is determined by a sound localisation algorithm, wherein said direction is indicated by a vibrating burst in the respective ear.

[0029] Hearing aids may have integrated vibration sensors, either for health monitoring purposes or for voice sensing purposes. On the other hand, many diagnostic or monitoring applications based on vibrations and mechanical impedance quantities are possible. For example the interaction of ear piece and skin may be measured to detect a loose or a tight seal, to judge the correct softness of a dome or to determine the optimum softness of a shell.

[0030] 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.

5 Brief Description of the Drawings

[0031] 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 sectional view of an ear canal with an inserted earpiece of a hearing device, wherein the earpiece comprises a hard shell,

Figure 2 is a schematic sectional view of an ear canal with an inserted earpiece of a hearing device, wherein the earpiece comprises a soft shell,

Figure 3 is a schematic sectional view of an ear canal with an inserted earpiece of a hearing device, wherein the earpiece comprises a dome,

Figure 4 is a schematic view of a dual receiver,

Figure 5 is a schematic view of a circuit for changing the electrical polarity in a first state,

Figure 6 is a schematic view of the circuit of figure 5 switched into a second state,

Figure 7 is a schematic view of an alternative embodiment of a circuit for changing the electrical polarity,

Figure 8 is a schematic view of an alternative embodiment of a circuit for changing the electrical polarity,

Figure 9 is a schematic view of an alternative embodiment of a circuit, in which coils are connected in series and a single switch is arranged to selectively shorten one of the coils,

Figure 10 is a schematic view of an alternative embodiment of a circuit, in which coils are connected in parallel through a single switch,

Figure 11 is a schematic sectional view of an ear canal with an inserted earpiece of a hearing device,

Figure 12 is a schematic view of an exemplary sce-

nario in which a vibration may be utilised, and

Figure 13 is a schematic diagram showing a sound level envelope and a threshold.

[0032] Corresponding parts are marked with the same reference symbols in all figures.

Detailed Description of Preferred Embodiments

[0033] **Figure 1** is a schematic sectional view of an ear canal 1 with an inserted earpiece 2 of a hearing device, wherein the earpiece 2 comprises a hard shell 3.

[0034] **Figure 2** is a schematic sectional view of an ear canal 1 with an inserted earpiece 2 of a hearing device, wherein the earpiece 2 comprises a soft shell 3.

[0035] **Figure 3** is a schematic sectional view of an ear canal 1 with an inserted earpiece 2 of a hearing device, wherein the earpiece 2 comprises a shell 3 with a dome 3.1.

[0036] In the examples in Figures 1 to 3 a transducer system is shown in the form of a single receiver 4, i.e. a speaker, with normally unwanted vibrational force excitation.

[0037] For example the interaction of earpiece 2 and skin may be measured to detect a loose or a tight seal, to judge the correct softness of a dome 3.1 or to determine the optimum softness of a shell 3.

[0038] **Figure 4** is a schematic view of a dual receiver 4.1, 4.2. In alternative embodiments, hearing aids may have dual receivers 4.1, 4.2 implemented to reduce these vibrational forces by mechanical compensation of the mass forces. On the other hand, the forces can be doubled by changing the electrical polarity of one of the two receivers 4.1, 4.2.

[0039] **Figure 5** is a schematic view of a circuit 5 for changing the electrical polarity in a first state, wherein the receivers 4.1, 4.2 are connected in series. The same pair of receivers 4.1, 4.2 can be transformed from an acoustic source with minimal vibration output to a vibration source with maximum vibration output. This is performed by two switches 6.1, 6.2 as shown in Figure 5. The receivers 4.1, 4.2 are represented by a first coil 7 or inductivity and a second coil 8 or inductivity. The switches 6.1, 6.2 may be electronic switches, e.g. switching transistors like the output stage of the hearing device, or mechanical switches in the form of a relay. In the embodiment of figure 5, the switches 6.1, 6.2 are configured as a turn-over switch with both switches 6.1, 6.2 coupled to be switched at the same time. A first terminal 7.1 of the first coil 7 is connected to a first audio line A1 and a second terminal 7.2 thereof is connected to the switch 6.1. In the first state shown in figure 5 the switch 6.1 connects the first coil 7 to a first terminal 8.1 of the second coil 8, while the second terminal 8.2 of the second coil 8 is connected to a second audio line A2. The two coils 7, 8 are thus connected in series with the second terminal

7.2 of the first coil 7 connected to the first terminal 8.1 of the second coil 8.

[0040] **Figure 6** shows the circuit 5 of figure 5 switched into a second state. The switches 6.1, 6.2 have been switched so that the second terminal 7.2 of the first coil 7 is connected to the second terminal 8.2 of the second coil 8 by the switch 6.1, while the first terminal 8.1 of the second coil 8 is connected to the second audio line A2. The two coils 7, 8 are thus connected in series with the second terminal 7.2 of the first coil 7 connected to the second terminal 8.2 of the second coil 8.

[0041] The first state may represent a normal operation mode in which vibration forces are compensated by the receivers 4.1, 4.2 mutually cancelling the vibrations out. The second state may represent a vibration mode in which vibration forces of the receivers 4.1, 4.2 are superposed to double.

[0042] **Figure 7** is a schematic view of an alternative embodiment of a circuit 5 for changing the electrical polarity, wherein the receivers 4.1, 4.2 are connected in parallel. The same pair of receivers 4.1, 4.2 can be transformed from an acoustic source with minimal vibration output to a vibration source with maximum vibration output. This is performed by two switches 6.1, 6.2 as shown in Figure 7. The receivers 4.1, 4.2 are represented by a first coil 7 or inductivity and a second coil 8 or inductivity. The switches 6.1, 6.2 may be electronic switches, e.g. switching transistors like the output stage of the hearing device, or mechanical switches in the form of a relay. In the embodiment of figure 7, the switches 6.1, 6.2 are configured as a pole changeover switch with both switches 6.1, 6.2 coupled to be switched at the same time. A first terminal 7.1 of the first coil 7 is connected to a first audio line A1 and to the switch 6.1, whereas a second terminal 7.2 of the first coil 7 is connected to a second audio line A2 and to the switch 6.2. In the first state shown in figure 7 the switch 6.1 connects the first terminal 7.1 of the first coil 7 to a first terminal 8.1 of the second coil 8, while the switch 6.2 connects the second terminal 8.2 of the second coil 8 to the second audio line A2 and to the second terminal 7.2 of the first coil 7. The two coils 7, 8 are thus connected in parallel with the second terminal 7.2 of the first coil 7 connected to the second terminal 8.2 of the second coil 8. In order to change the polarity, the switches 6.1, 6.2 are switched into a second state (not shown), in which the switch 6.1 connects the first terminal 7.1 of the first coil 7 to the second terminal 8.2 of the second coil 8, while the switch 6.2 connects the first terminal 8.1 of the second coil 8 to the second audio line A2 and to the second terminal 7.2 of the first coil 7. The two coils 7, 8 are thus connected in parallel (or anti-parallel relative to the first state) with the second terminal 7.2 of the first coil 7 connected to the first terminal 8.1 of the second coil 8.

[0043] The first state may represent a normal operation mode in which vibration forces are compensated by the receivers 4.1, 4.2 mutually cancelling the vibrations out. The second state may represent a vibration mode in

which vibration forces of the receivers 4.1, 4.2 are superposed to double.

[0044] Figure 8 is a schematic view of an alternative embodiment of a circuit 5 for changing the electrical polarity, wherein the circuit 5 comprises an inverter 9 and two amplifiers 10, 11 and a selector switch 12. The same pair of receivers 4.1, 4.2 can be transformed from an acoustic source with minimal vibration output to a vibration source with maximum vibration output. The receivers 4.1, 4.2 are represented by a first coil 7 or inductivity and a second coil 8 or inductivity. The first coil 7 is controlled by the first amplifier 10 and the second coil 8 is controlled by the second amplifier 11, wherein the output of the first amplifier 10 may be connected to the first terminal 7.1 of the first coil 7 whose second terminal 7.2 is connected to ground G, wherein the output of the second amplifier 11 may be connected to the second terminal 8.2 of the second coil 8 whose first terminal 8.1 is connected to ground G. While the audio signal transmitted by the audio lines A1, A2 in figures 5 to 7 may be an analogue signal or a digital signal, the circuit 5 in figure 8 uses an audio signal D, e.g. a digital audio signal D, which is fixedly connected to the first amplifier 10 and to an input of the inverter 9 as well as to one input of the selector switch 12. In figure 8, the selector switch 12 is in a first state connecting the audio signal D to the second amplifier 11 so the coils 7, 8 may be in a normal operation mode in which vibration forces are compensated by the receivers 4.1, 4.2 mutually cancelling the vibrations out. When the selector switch 12 is switched over into a second state, it connects the output of the inverter 9 to the input of the second amplifier 11 so that the second coil 8 is fed with an inverse signal. The second state may represent a vibration mode in which vibration forces of the receivers 4.1, 4.2 are superposed to double. The circuit 5 may be modified by reversing the connections of one of the coils 7, 8 so that the first state, where the coils 7, 8 are in the normal operation mode in which vibration forces are compensated by the receivers 4.1, 4.2 mutually cancelling the vibrations out, would be when the selector switch 12 connects the output of the inverter 9 to the second amplifier 11, and the second state representing the vibration mode in which vibration forces of the receivers 4.1, 4.2 are superposed to double, would be when the selector switch 12 connects the audio signal D to the second amplifier 11. The amplifiers 10, 11 may be configured as a H-bridge, a class D amplifier or a digital/analogue converter respectively.

[0045] Furthermore, single switch solutions are also possible. There are solutions with one single switch which serve to simply add the vibrational part without switching off the acoustic component.

[0046] Figure 9 is a schematic view of an alternative embodiment of a circuit 5, in which the coils 7, 8 are connected in series and a single switch 12 is arranged to selectively shorten the second coil 8, so that the first coil 7 gets more current (depending on the output impedance of a power amplifier); the total sound output is more

or less constant. On the other hand, the remaining single receiver 4.1 produces vibrations which are no more compensated by the second receiver 4.2.

[0047] Figure 10 is a schematic view of an alternative embodiment of a circuit 5, in which the coils 7, 8 are connected in parallel through a single switch 12. In this configuration, the switch 12 operates to interrupt the connection to the second coil 8 which leads to a similar effect as in Figure 9.

[0048] In an exemplary embodiment, another single receiver could be used for vibration excitation only in addition to the dual receiver.

[0049] A dual receiver system capable of selectively emitting a vibration can have different applications:

In a notification system the vibration can be used to notify events or states such as loss of connectivity or connectivity detected. The vibration can also be used in an air plane mode to notify a user from a call, a connection lost with another device (an accessory or second earpiece device), a low battery, and when the user does not want to be disturbed acoustically by a signal, e.g. during a conversation, a conference, a restaurant situation, a concert, in a theatre, etc. The vibration may also be used to notify a user of rapid health change, e.g. breathing, sugar limit etc. Moreover, a user could be notified when something important is happening, e.g. when listening to music and a car is approaching, when listening to a third party audio input and an alarm is ringing like fire, gas etc. and the environment noise level is too loud. A vibration may also be used to notify a user of a diary schedule, e.g. an appointment.

[0050] Moreover, the vibrator may be used together with an accelerometer to detect the correct position of an earpiece 2 in an ear canal 1. A reference measurement with a good placement of the earpiece 2 may be done by an audiologist, and a "good placement test" could be triggered by the user when he is at home, to test if the earpieces 2 are well placed in the ear canal 1, or to ensure that the earpieces 2 are not mixed up between left and right ear.

[0051] In further embodiments, a vibrator may be used to detect skin properties, as skin behaviour may differ before, during and/or after the vibration or skin properties may change over time, e.g. dryer skin may be correlated with elevated blood glucose levels.

[0052] The vibration may be generated in one ear and measured in the other ear and the propagation of the vibration may be used to detect health changes.

[0053] Moreover, the vibration may be used to check if a component of the earpiece 2 shell 3 is loose, if there are problems with cerumen in a vent or in the shell 3 due to a change in the mass of the shell 3.

[0054] Figure 11 is a schematic sectional view of an ear canal 1 with an inserted earpiece 2 of a hearing device, wherein the earpiece 2 comprises a shell 3 or dome 3.1 and a receiver 4 configured to emit sound through a channel 13 in the shell 3 or dome 3.1 into the ear canal 1. A vent opening 14 opens out into the channel 13 so

as to bypass the receiver 4 through a ventilation path 15. A movable mass 16 is movably arranged within the channel 13 so as to selectively open or close the vent opening 14, e.g. by an electromagnetic actor (not shown).

[0055] The vent opening 14 and the movable mass 16 form a so called active vent. In order to provide an audible and/or haptic feeling such as a vibration in the ear canal 1 to notify the user of an event, the movable mass 16 may be switched forth and back at a relatively high rate of e.g. 5 Hz to 150 Hz, preferably 10 Hz to 100 Hz, 10 Hz to 80 Hz, 10 Hz to 60 Hz or 10 Hz to 40 Hz for a period of e.g. 1s to 3s.

[0056] The frequency to open and close the vent opening 14 depends upon multiple factors, such as e.g. the weight of the movable mass 16, the mechanical properties of any bearings of the active vent, the power consumption needed and interference generated by the vibration as well as subjective preferences. Thus it might even be adjustable or configurable either through the user, the health care professional or automatic depending on the use case.

[0057] Applications for such notification events are e.g. volume up/down, program change, incoming phone calls, low battery warnings etc., but also the 'translation' of acoustic events into haptic ones.

[0058] **Figure 12** is a schematic view of an exemplary scenario in which the vibration may be utilised. A hearing impaired person 17 is wearing a hearing device with an earpiece 2 placed in the right ear 18 which may be deaf or impaired. The earpiece 2 is capable of vibrating by being configured as in one of the above described embodiments. Another person 19 is approaching the hearing impaired person 17 from the right talking. The hearing impaired person 17 is not well able to locate sounds from different directions with their left ear 20 which may be healthy or less impaired, as human beings usually utilize the level differences and the different arrival times of a sound at both ears 18, 20 to determine an impinging sound direction. A sound localisation algorithm, e.g. as known from EP 1 307 761 B1, which is hereby incorporated by reference in its entirety, may be used by a control unit of the hearing device to determine if a sound originates from a certain direction, e.g. from the side of the right ear 18. If the direction of the sound from the talking person 19 has been identified, a short vibrating burst may be output indicating to the hearing impaired person 17 the impinging direction thus indicating in which direction they should turn their head.

[0059] Further, by modulating a vibration pattern with the sound level envelope L of a speech signal, a user gets a haptic input stimulus in addition to the acoustic one, which is correlated with and contains relevant information to understand speech. Modulating white noise with the sound level envelope L of a speech signal makes the white noise understandable as speech. Thus, the speech signal envelope is known to contain sufficient or at least highly helpful information to understand speech. Further, the switching frequency of the vibrator might get

synchronized with e.g. the pitch frequency of a speech signal, thus providing even further information. As the brain is highly adaptable, it can learn to interpret the haptic feedback and integrate it with the acoustic input into a better speech understanding.

[0060] Modulation might happen in the simplest case with a threshold T on the signal envelope as shown in **figure 13** over the time t, i.e. the vibration V may be generated once the sound signal exceeds the threshold T level. Further, the activation strength of the vent might get adapted according to the sound level envelope L in order to induce a stronger or weaker vibration. All these methods may be combined with each other.

[0061] Other haptic versions might use an e.g. pressure inducing actuator in contact with the skin or a conventional vibration actuator.

List of References

[0062]

1	ear canal
2	earpiece
3	shell
3.1	dome
4,4.1,4.2	receiver
5	circuit
6.1, 6.2	switch
7	first coil
7.1	first terminal
7.2	second terminal
8	second coil
8.1	first terminal
8.2	second terminal
9	inverter
10	first digital/analogue converter
11	second digital/analogue converter
12	switch
13	channel
14	vent opening
15	ventilation path
16	movable mass
17	hearing impaired person
18	right ear
19	person
20	left ear
A1	first audio line
A2	second audio line
D	audio signal
G	ground
L	sound level envelope
t	time
T	threshold

Claims

1. A transducer system for a hearing device, the trans-

- ducer system comprising an electromechanical component with a movable mass and a circuit (5) configured to switch the transducer system between a first state, in which the transducer system is configured as an acoustic element, and a second state, in which the transducer system is configured as a vibration source.
2. The transducer system of claim 1, wherein the electromechanical component is at least one receiver comprising the movable mass, in particular a membrane of said receiver.
 3. The transducer system of claim 1, wherein the electromechanical component is an active vent and the movable mass is a closure member of the said active vent.
 4. The transducer system of claim 2, comprising two receivers (4.1, 4.2) configured as a dual receiver coupled to each other in a way to allow for mutually cancelling vibrational forces by mechanical compensation of inertial forces of the movable masses, wherein the circuit (5) is configured to switch off or short one of the receivers (4.1, 4.2) or to change an electrical polarity of one of the receivers (4.1, 4.2).
 5. The transducer system of claim 4, wherein the circuit (5) comprises at least one switch (6.1, 6.2, 12).
 6. The transducer system of claim 4 or 5, wherein the receivers (4.1, 4.2) are electrically connected to each other in series or in parallel.
 7. The transducer system according to claim 5 or 6, wherein the circuit (5) comprises two switches (6.1, 6.2) configured to be switched at the same time.
 8. The transducer system according to any one of claims 5 to 7, wherein the at least one switch (6.1, 6.2, 12) is an electronic switch or a mechanical switch.
 9. The transducer system according to any one of claims 5 to 8, wherein the circuit (5) comprises:
 - an inverter (9) configured to invert an audio signal (D),
 - two amplifiers (10, 11) configured to respectively drive one of the receivers (4.1, 4.2), wherein an input of one of the amplifier (10, 11) is fixedly connected to the audio signal (D), and
 wherein the switch is a selector switch (12) configured to couple an input of the other amplifier (10, 11) either to the audio signal (D) or to an output of the inverter (9).
 10. An earpiece (2) for a hearing device, comprising a shell (3) or dome (3.1) and a receiver (4, 4.1, 4.2) configured to emit sound through a channel (13) in the shell (3) or dome (3.1) into an ear canal (1), further comprising:
 - a transducer system according to any one of the preceding claim, wherein the receiver (4, 4.1, 4.2) is part of said transducer system.
 11. The earpiece (2) of claim 10, wherein a frequency of the vibration is in a range from 5 Hz to 150 Hz, preferably in a range from 10 Hz to 100 Hz.
 12. A hearing aid comprising an earpiece according to claim 10 or 11.
 13. A method of operating a transducer system according to any one of the claims 1 to 9 or an earpiece (2) according to claim 10 or 11 or a hearing aid according to claim 12, wherein a vibration is generated to:
 - notify a user of an event, and/or
 - detect a correct position and/or state of the earpiece (2) in an ear canal (1) of the user by means of an accelerometer arranged in the earpiece (2), and/or
 - detect skin properties of the user by means of an accelerometer arranged in the earpiece (2), and/or
 - detect health changes of the user by generating vibration in one ear, measuring it by means of an accelerometer arranged in an earpiece (2) in the other ear and analyzing the propagation of the vibration.
 14. The method according to claim 13, wherein the event is at least one of: loss of connectivity or connectivity detected, a call, low battery, rapid health change, in particular breathing or blood sugar limit, an approaching car or person talking, an alarm, a diary schedule.
 15. The method of claim 14, wherein the event is a talking person (19) approaching, wherein the direction, from which the talking person (19) is approaching is determined by a sound localisation algorithm, wherein said direction is indicated by a vibrating burst in the respective ear.

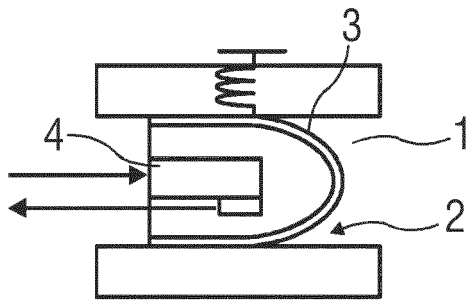


FIG 1

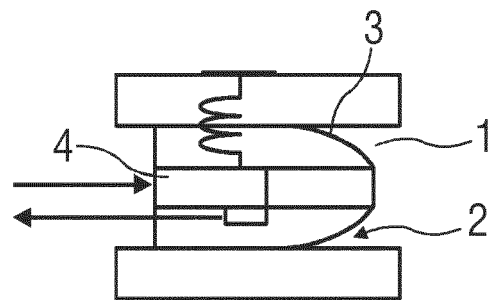


FIG 2

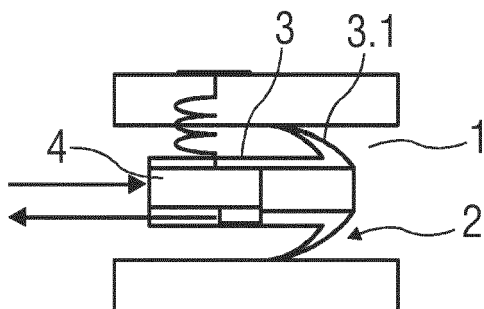


FIG 3

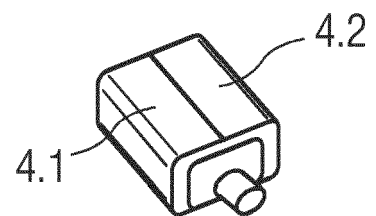


FIG 4

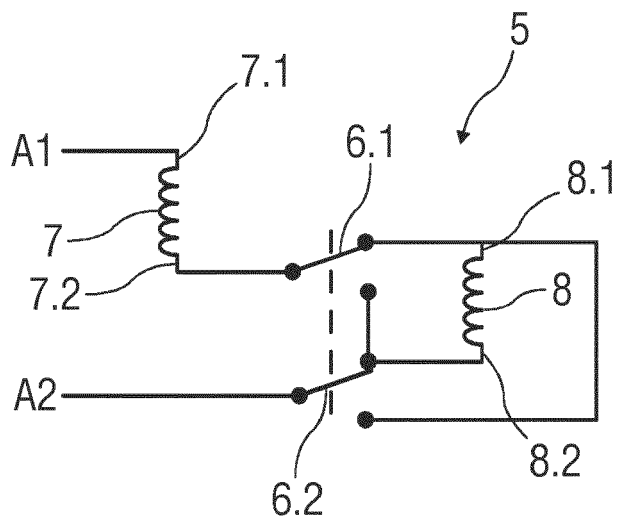


FIG 5

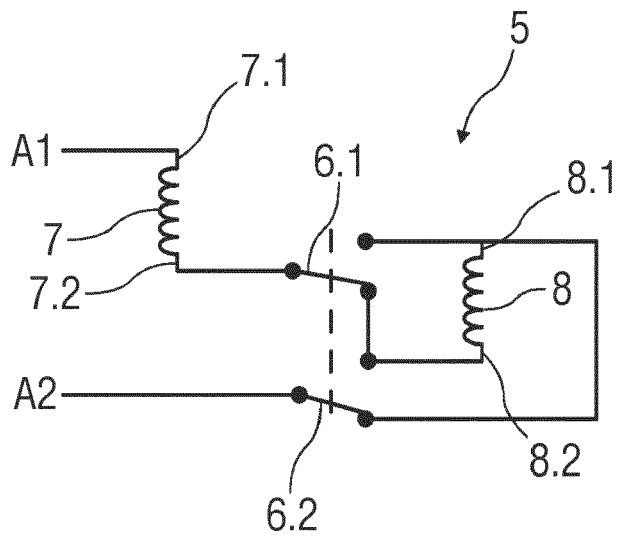
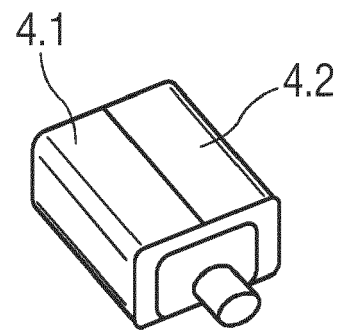
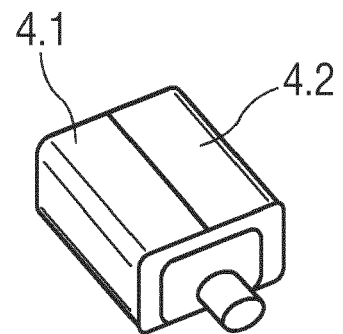


FIG 6



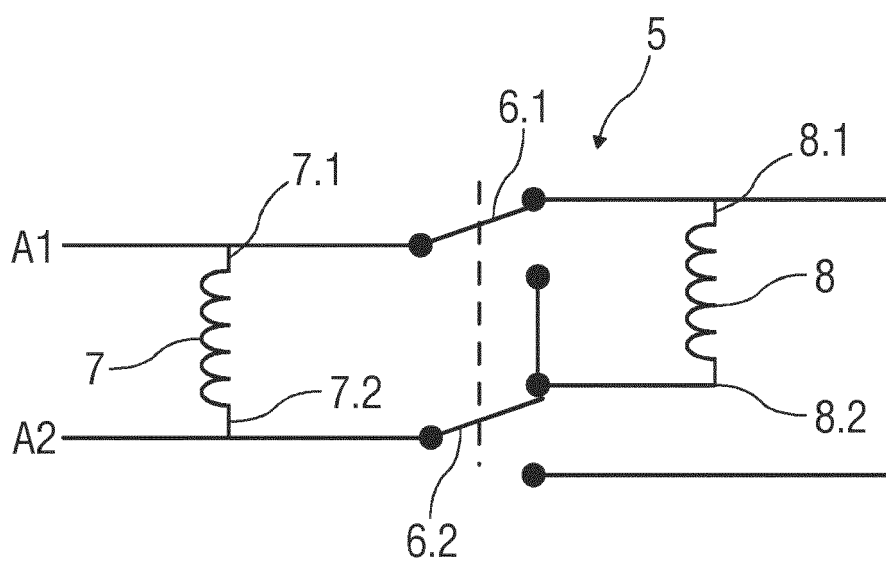


FIG 7

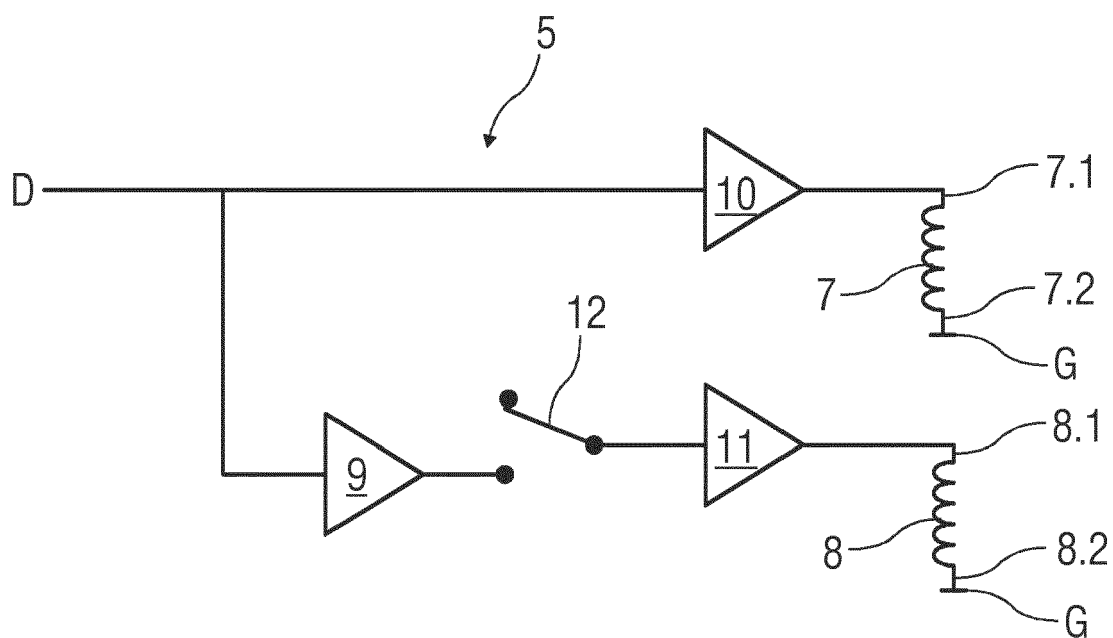


FIG 8

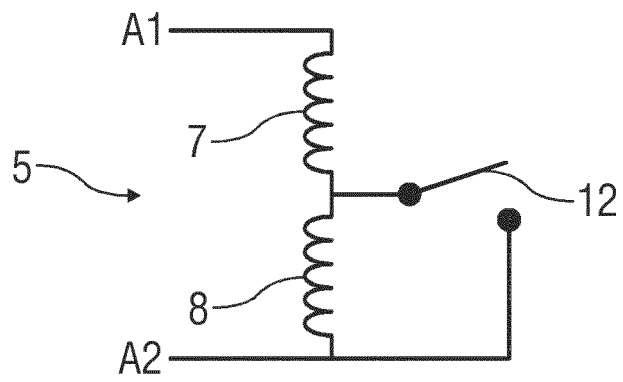


FIG 9

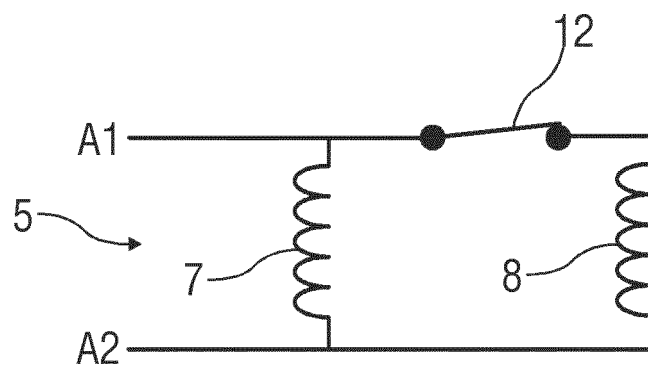


FIG 10

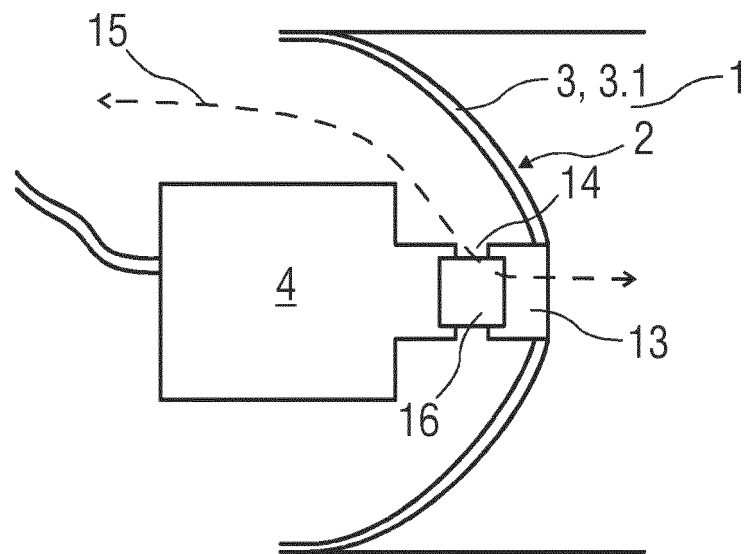


FIG 11

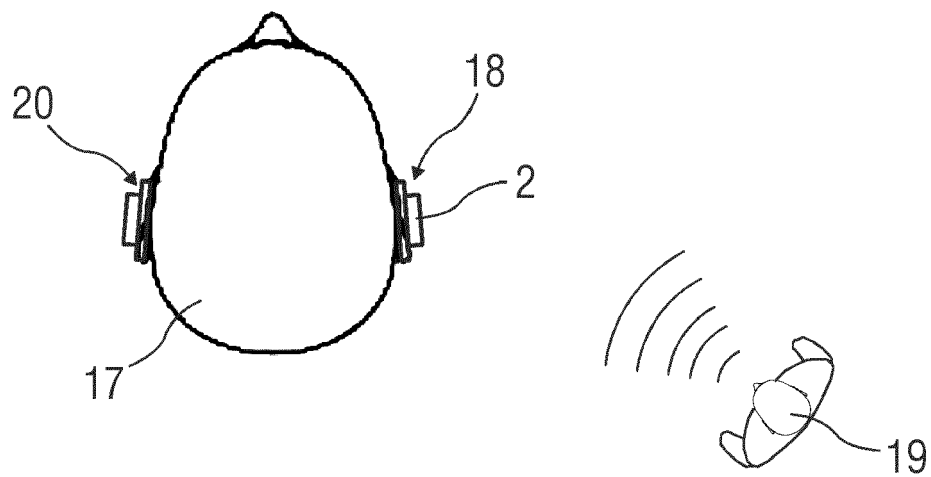


FIG 12

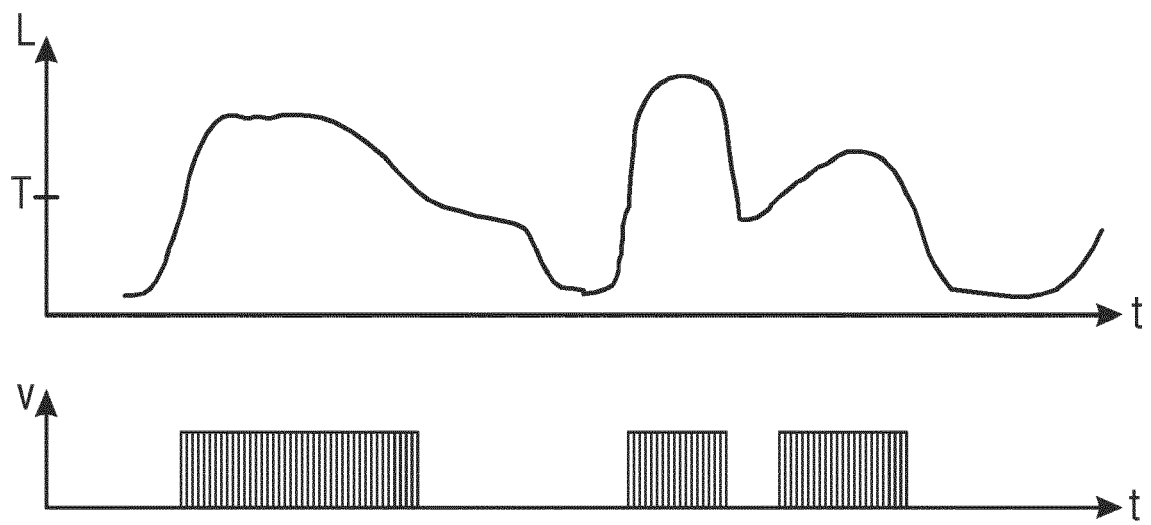


FIG 13



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