Title: A HEARING AID DEVICE

Abstract: A lock for a switch of a hearing aid device, said switch being operable to selectively enable and disenable a hearing aid device function, including means for selectively inhibiting operation of the switch to enable or to disenable the hearing aid device function.
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A HEARING AID DEVICE

Technical Field of the Invention

The present invention relates to a hearing aid device. The present invention also relates to a hearing aid switch arrangement for use in a hearing aid device having an electric circuit.

Background of the Invention

Behind-the-ear (BTE) and in-the-ear (ITE) hearing aids typically include operational features such as on/off control, volume control and noise filtration control.

The on/off control feature, for example, has previously been effected by physically connecting and disconnecting a battery to the electric circuit of the hearing aid. A battery compartment door of the hearing aid is typically used to secure the battery inside the hearing aid. When closed, the battery compartment door locates the terminals of the battery in position for electrical communication with the electric circuit, thereby turning the device on. Conversely, the battery compartment door physically remove the battery from the body of the hearing aid, thereby breaking the electrical connection to the circuit, when the door is opened. Otherwise, opening the battery compartment door may simply expose the battery for removal from the device. It may not always be convenient to close and open the battery compartment doors of a hearing aid to switch the device on and off.

A disadvantage of switching off the hearing aid device in the above-described manner is that the battery is exposed to the elements and may deteriorate faster than it would have done so if it was located within the device. In addition, there is a risk that the battery may be dislodged from the device and lost.

Hearing aid devices that include an on/off switch may be inadvertently switched on or off. A person's hearing may be temporarily impaired if the device is accidentally turned off
during use. Further, the battery may be unnecessarily depleted if the hearing aid is left on during a period of non-use.

It is generally desirable to overcome or ameliorate one or more of the above mentioned difficulties, or at least provide a useful alternative.

Summary of the Invention

In accordance with one aspect of the present invention, there is provided a hearing aid device, including:

(a) a switch being operable to open and close an electric circuit of the device;
(b) a battery locating means for selectively locating a battery within said device for electrical communication with said electric circuit; and
(c) means for selectively inhibiting operation of the switch to open the electric circuit, wherein the battery locating means inhibits the removal of the battery from electrical communication with said electric circuit when the switch is arranged to close the electric circuit.

Preferably, the battery locating means permits access to the battery for removal of the battery from the device when the switch is arranged to open the electric circuit.

Preferably, the battery locating means is adapted to move the battery with respect the electric circuit to thereby connect and isolate the battery to and from the electric circuit.

In accordance with another aspect of the present invention, there is provided a hearing aid switch arrangement for use in a hearing aid device having an electric circuit, the hearing aid switch arrangement including:

(a) an activation switch being operable to open and close the electric circuit of the device;
(b) a battery locating means for selectively locating a battery within said device for electrical communication with said electric circuit; and
(c) means for selectively inhibiting operation of the switch to open the electric circuit, wherein the battery locating means inhibits the removal of the battery from electrical communication with said electric circuit when the switch is arranged to close the electric circuit.

5 Preferably, the battery locating means permits access to the battery for removal of the battery from the device when the switch is arranged to open the electric circuit.

Preferably, the battery locating means is adapted to move the battery with respect the electric circuit to thereby connect and isolate the battery to and from the electric circuit.

In accordance with yet another aspect of the present invention, there is provided a lock for a switch of a hearing aid device, said switch being operable to selectively enable or to selectively disenable a hearing aid device function, including means for selectively inhibiting operation of the switch to enable or to disenable the hearing aid device function.

In accordance with yet another aspect of the present invention, there is provided, in combination, a lock and a switch for a hearing aid device, said switch being operable to selectively enable or to selectively disenable a hearing aid device function and said lock being adapted to selectively inhibit operation of the switch to enable or to disenable the hearing aid device function.

Brief Description of the Drawings

Preferred embodiments of the present invention are hereafter described, by way of non-limiting example only, with reference to the accompanying drawing in which:

Figure 1 is a perspective view of a hearing aid device in accordance with a preferred embodiment of the invention;

Figure 2 is a view of a section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;
Figure 3 is a view of another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 4 is a view of yet another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 5 is a perspective view of a part of the hearing aid shown in Figure 1;

Figure 6 is a view of yet another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 7 is a view of another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 8 is a perspective view of another part of the hearing aid shown in Figure 1;

Figure 9 is another perspective view of a part of the hearing aid device shown in Figure 8;

Figure 10 is a view of another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 11 is a view of an internal side of a part of the hearing aid shown in Figure 1;

Figure 12 is a view of yet another section of the hearing aid device shown in Figure 1 with part of the housing removed so as to show the internal parts of the device;

Figure 13 is a perspective view of the battery compartment of the hearing aid integrated with an audio device;

Figure 14 is a perspective view of a hearing aid device in accordance with a preferred embodiment of the invention arranged in a condition of use;

Figure 15 is a perspective view of a hearing aid device shown in Figure 13 arranged in another condition of use;

Figure 16 is a perspective view of a part hearing aid device shown in Figure 14;

Figure 17 is a perspective view of a hearing aid device in accordance with a preferred embodiment of the invention arranged in a condition of use;

Figure 18 is a perspective view of a hearing aid device shown in Figure 17 arranged in another condition of use;

Figure 19 is a perspective view of a hearing aid device in accordance with a preferred embodiment of the invention arranged in a condition of use;

Figure 20 is a perspective view of a hearing aid device shown in Figure 19 arranged in another condition of use;
Figure 21 is a perspective view of a hearing aid device in accordance with a preferred embodiment of the invention arranged in a condition of use;

Figure 22 is a perspective view of a hearing aid device shown in Figure 21 arranged in another condition of use;

Figure 23 is a plan view of lock connected to a hearing aid device, in accordance with a preferred embodiment of the invention;

Figure 24 is a bottom view of the lock shown in Figure 23;

Figure 25 is a view of a part of the lock shown in Figure 24; and

Figure 26 is a perspective view of the lock shown in Figure 23.

**Detailed Description of Preferred Embodiments of the Invention**

The behind-the-ear (BTE) hearing aid device 10 shown in Figure 1 includes a housing 12 coupled to a hook 14. The housing 12 is formed in two shells 15a, 15b (only 15a shown in Figure 1) that are fastened together by screws 17. The housing 12 is shaped to fit behind the ear of a person and encases many of the internal components of the hearing aid 12. The hook 14 is coupled to an end of the housing 12 and is shaped to extend into the ear of a person wearing the device 10. Preferred embodiments of the invention are hereafter described by way of reference to the BTE hearing aid 10. However, it would be understood by those skilled in the relevant art that the invention is applicable to any one of a number of different types of hearing aid devices.

The hearing aid device 10 includes a switch 16 that is used to turn the hearing aid 10 on and off. The switch 16 includes an on/off cover 18 mechanically coupled to a battery compartment door 20 in the manner shown in Figures 2 to 4. The on/off cover 18 is rotatable about an axle 26 so as to move between on and off positions that respectively complete and break, i.e. close and open, an electric circuit 22. The battery compartment door 20 is coupled to the housing 12 by a hinge that facilitates movement of the door 20 between open and closed positions with respect to the housing 12. The door 20 includes a cradle 23 that is shaped to receive a battery 24. The battery 24 can be loaded into, or removed from, the cradle 23 when the door 20 has been opened. The cradle 23 locates the
battery within the housing 12 for electrical connection with the electric circuit 22 when the door 20 is closed. The mechanical connection between the on/off cover 18 and the battery compartment door 20 prevents the door 20 from being opened when the on/off cover 18 is arranged in the on position. The on/off cover 18 thereby prevents the battery 24 from being removed from the device 10 when the cover 18 is arranged in the off position.

The on/off cover 18, also shown in Figure 5, is removably attached to the housing 12 by way of the axle 26. The axle 26 bridges a gap between opposed internal sidewalls of the two shells 15a,15b of the housing 12. The opposed internal sidewalls include recesses shaped to receive respective ends of the axle 26 and thereby hold the axle 26 in position. The on/off cover 18 is coupled to, and is adapted to rotate about an axle 26 by way of a clasp 28. The clasp 28 permits the on/off cover to be removably attached to the axle 26. The clasp 28 is made of a resilient material, such as Acrylonitrile Butadiene Styrene (ABS), that permits the clasp 28 to snapped onto the axle 26 with the application of a suitable force.

The switch 16 includes male and female electrically conductive contact elements 30,32 secured to the on/off cover 18 and the electric circuit 22 respectively in the manner shown in Figures 6 and 7. The female contact element 32 includes first and second parallel, spaced apart, resilient conductive lugs 32a,32b that project outwardly from the electric circuit 22. Distal ends of the contacts 32a,32b include opposed flanges that each extend towards the other lug 32a,32b. The flanges are spaced apart and define a socket that is shaped to receive the male contact element 30.

When a force is applied to the on/off cover in direction B, the on/off cover 18 rotates about the axle 26 and the male contact element 30 moves away from the female contact element 32. In doing so, the lugs 32a,32b of the female contact element 32 are electrically isolated and the electric circuit 22 is switched off. When so arranged the on/off cover 18 is in the off position. When a force is applied to the on/off cover 18 in direction A, the on/off cover 18 rotates about the axle 26 and the male contact element 30 moves towards the female contact element 32. In doing so the male contact element 30 is located between the
resilient lugs 32a,32b and bears against the respective flanges. The flanges resiliency deform and engage the male contact element 30. The flanges interlock with corresponding waisted sections of the male contact element 30 and thereby secure the on/off cover 18 in the on position. Alternatively, the flanges secure the male contact element therebetween by any other suitable means. The male contact element 30 thereby closes the circuit 22.

The battery compartment door 20, also shown in Figures 8 and 9, includes a hole 34 that is shaped to receive the axle 25. The axle 25 is thereby removably and rotatably couplable to the door 20 of the housing 12. As above described, the battery compartment door 20 includes a cradle 23 that is shaped to receive the battery 24 and the door 20 locates the battery 24 in position for electrical connection to the electric circuit 22 when the door 20 is closed. The electric circuit 22 includes first and second electrically conductive contacts 38 (only one of which is shown in the drawings) that are arranged to engage respective oppositely charged terminals of the battery 24. The battery is electrically coupled to the circuit 22 when the door 20 is closed. The battery compartment door 20 removes the battery 24 from electrical communication with the electric circuit 22 when the door 20 is opened.

As also above described, the on/off cover 18 and the battery compartment door 20 are mechanically coupled together such that the battery compartment door 20 cannot be readily opened unless the on/off cover 18 is first arranged in the off position. The battery compartment door 20 includes first and second grooves 40 (only one of which is shown in the drawings) located on opposite sides of the door 20 for receiving corresponding pins 42 of the on/off cover 18. The pins 42 extend inwardly from respective distal ends of arms 44 that extend from opposite sides of a common end of the on/off cover 18. A locking section 45 of the door 20 is arranged between the arms 44. The arms 44 straddle the locking section 45 and locate the inwardly extending pins 42 in the respective corresponding grooves 40 of the locking section 45.

The pins 42 slidably engage the grooves 40 such that when a force is applied to the on/off cover 18 in direction B, the on/off cover 18 rotates about the axle 26 and the pins 42 slide
along the grooves 40, as shown in Figure 6. Similarly, when a force is applied to the on/off cover 18 in direction A, the on/off cover 18 rotates about the axle 26 and the pins 42 slide along the groove 40, as shown in Figure 2.

Corresponding ends of the grooves 40 include openings 47 through which the corresponding pins 42 of the cover 18 can pass into and out of the grooves 40. For example, the on/off cover 18 can be disconnected from the battery compartment door 20 by arranging the on/off cover in the off position, as shown in Figure 6, and then drawing the pins 42 of the cover 18 through openings 47, as shown in Figure 4. In doing so, the battery compartment door 20 is free to rotate about the axle 25 away from the housing 12 towards an open position. The openings 47 of the grooves 40 are each narrowed by respective shoulders 49 which reduce the ease by which the pins 42 of the cover 18 can pass there through. The shoulders 49 prevent the battery compartment door 20 from freely rotating about the axle 25 when the cover 18 is arranged in the off position. With a little effort a person can force the pins 42 of the cover 18 through the openings 47 and thereby open the battery door 20.

The on/off cover 18 is coupled to the door 20 by locating the pins 42 in the grooves 40 by forcing the pins 42 through respective openings 47 in the manner shown in Figures 4 and 6. The diameter of the two openings 47 of the groove 40 is slightly narrower than the diameter of the pins 42 such that the pins 42 can only be fitted into and disengaged from the groove 40 if a suitable force is used. The on/off cover 18 and the door 20 are decoupled by arranging the on/off cover 18 in the off position and then forcing the pins 42 through the openings 47.

The following steps are performed to remove the battery from the device 10:

1. Arrange the on/off cover 18 in the off position;
2. Decouple the on/off cover 18 and the housing in the described manner;
3. Pivot the door 20 away from the housing 12; and
4. Remove the battery 24.
The above steps are performed in reverse order to locate the battery within the housing for electrical connection to the circuit 22.

The inner side of the one of each one of the shells 15a,15b of the housing 12 includes a stopper 46 in the form of a protruding ledge, shown in Figure 10 and 11. The stopper 46 is arranged to limit rotation of the on/off cover 18 in one direction. The housing 12 includes a further stopper 48 is arranged to limit rotation of the on/off cover 18 in the opposite direction.

The locking section 45 further includes chamfer surfaces 50, as shown in Figure 12, over which the pins 42 may also be located in the grooves 40. The chamfer surfaces 50 are located at an opposite ends of the grooves to the above described openings 47. The pins are located in the grooves 40 by arranging the on/off cover 18 in the closed position and forcing the pins 42 into the grooves 40 through the chamfer section 50. The chamfer surfaces 50 are tapered and thus help to guide the pins 42 into position. The internal side of both shells 15a,15b of the housing 12 are provided with respective recesses 52 to allow the pins 42 to flex outwards when they are fitted into the groove 40 in such a situation.

The battery compartment door 20 can be replaced with one that integrates an audio device 54 suitable for say FM frequency reception, as shown in Figure 13. The on/off cover 18 would still be compatible with the replacement battery compartment door 20.

The various components are injection moulded from plastic material such as Acrylonitrile Butadiene Styrene (ABS).

The on/off cover 18 shown in Figure 14 and 15 includes a lock 60 for preventing the hearing aid device from being inadvertently switched off. The lock functions by preventing the on/off cover 18 from rotating about the axle 26 towards the off position. The lock 60 is hereafter described with reference to the hearing aid device 10. However, it
would be understood by those skilled in the relevant art that the lock 60 is applicable to other hearing aid devices, such as the device disclosed in US 4,831,655.

The on/off cover 18 includes first and second recessed sections 62 disposed on opposite side walls for engagement with the lock 60, as shown in Figure 16 (only one of the side walls is shown in the drawings). The recessed sections 62 are aligned parallel to the axis of rotation of the on/off cover 18 and are located between said axis of rotation and the end of the cover 18 that is couplable to the battery compartment door 20. The recessed sections 62 are positioned so that they are externally accessible when the cover 18 is in the on position and are adjacent the internal walls of the housing 12 when the cover 18 is arranged in the off position.

When fitted to the cover 18, the lock 60 extends outwardly from each recessed section 62. As the cover 18 is moved from the on position towards the off position, the lock engages an upper surface of the walls of the housing 12 and thereby prevents the cover 18 from further rotating towards the off position. The lock 60 prevents the hearing aid device 10 from being turned off. In doing so, the lock 60 also prevents the battery 24 from being removed from the device 10.

The lock 60 is preferably an open ended ring 66 that can be resiliently expanded to bridge the recessed sections 62 of the cover 18, as shown in Figures 17 to 18. The ring 66 resiliently bears against the recessed sections 62 of the cover 18 and is thereby held in position. The ring 66 may take any one of a number of different shapes and configurations that facilitate the prevention of the cover 18 rotating from the on position towards the off position. Some other examples of preferred embodiments of the ring 66 are shown in Figures 19 to 22.

Alternatively, the lock 60 is a cap 68, as shown in Figure 24, that is shaped to fit over the on/off cover 18, in the manner shown in Figure 23, to thereby prevent the cover 18 from being arranged in the off position. The cap 68 includes two inwardly directed protrusions 70 that project from respective opposed side walls 72 of the cap 68, as shown in Figures 24
to 26. The protrusions 70 are positioned to extend into the recessed sections 62 of the cover 18 and, when so fitted, prevent the cover 18 from being arranged in the off position.

The cap 68 is made of any suitable material that is flexible, resilient so that the side walls 72 can bend resiliency as the cap 68 is being fitted to the cover 18. The cap 68 is fitted to the cover 18 by arranging the cap 68 over the cover 18 and aligning protrusions 70 along side the corresponding recessed sections 62 by locating the recessed sections 62 through the open viewing windows 74. The cap 68 is pressed into position so that the protrusions 70 extend into the recessed sections 62 of the cover 18. The cap 68 can be removed by bending one or more of the walls 72 away from the cover 18 to release the protrusions 70 from their respective recesses 62. Preferably, the cap 68 can be removed from the cover by hand.

While we have shown and described specific embodiments of the present invention, further modifications and improvements will occur to those skilled in the art. We desire it to be understood, therefore, that this invention is not limited to the particular forms shown and we intend in the append claims to cover all modifications that do not depart from the spirit and scope of this invention.
List of Parts

Hearing Aid 10
Housing 12

5 Hook 14
   Shells 15a, 15b
   Switch 16
   Screw 17
   On/Off Cover 18

10 Battery Compartment Door 20
   Electric Circuit 22
   Cradle 23
   Battery 24
   Axle 25, 26

15 Clasp 28
   Male Contact Element 30
   Female Contact Element 32
   Contact 32a, 32b
   Hole 34

20 Electrically Conductive Contact 38
   Groove 40
   Pin 42
   Arms 44
   Locking Section 45

25 Opening 47
   Stopper 46, 48
   Shoulder 49
   Chamfer 50
   Recess 52

30 Audio Device 54
   Lock 60
Recessed Section 62
Open Ended Ring 66
Cap 68
Protrusion 70

5  Side Wall 72
Viewing Window 74
Claims Defining the Invention are as Follows:-

1. A hearing aid device, including:
   (a) a switch being operable to open and close an electric circuit of the device;
   (b) a battery locating means for selectively locating a battery within said device
       for electrical communication with said electric circuit; and
   (c) means for selectively inhibiting operation of the switch to open the electric circuit,
wherein the battery locating means inhibits the removal of the battery from electrical communication with said electric circuit when the switch is arranged to close the electric circuit.

2. The hearing aid device claimed in claim 1, wherein the battery locating means permits access to the battery for removal of the battery from the device when the switch is arranged to open the electric circuit.

3. The hearing aid device claimed in claim 1, wherein the battery locating means is adapted to move the battery with respect the electric circuit to thereby connect and isolate the battery to and from the electric circuit.

4. The hearing aid device claimed in any one of the preceding claims, wherein said switch is in mechanically coupled to said battery locating means.

5. The hearing aid device claimed in any one of the preceding claims, wherein the switch is adapted to pivot about a body portion of the device to open and close the electric circuit.

6. The hearing aid device claimed in claim 4 or claim 5, wherein the switch is decouplable from the battery locating means when the switch is arranged to open the electric circuit.
7. The hearing aid device claimed in claim 6, wherein the switch includes first and second pins that are shaped to extend into corresponding grooves of the battery locating device, wherein the pins slidably engage the grooves in accordance with movement of the switch.

8. The hearing aid device claimed in claim 7, wherein the grooves include openings located at a common end that facilitate insertion and removal of the pins into and from the grooves.

9. The hearing aid device claimed in any one of the preceding claims, wherein the battery locating means is a battery compartment door.

10. The hearing aid device claimed in any one of claims 5 to 9, wherein the means for selectively inhibiting operation of the switch to open the electric circuit inhibits the rotation of the switch as the switch pivots to open the electric circuit.

11. A hearing aid switch arrangement for use in a hearing aid device having an electric circuit, the hearing aid switch arrangement including:

   (a) an activation switch being operable to open and close the electric circuit of the device;
   (b) a battery locating means for selectively locating a battery within said device for electrical communication with said electric circuit; and
   (c) means for selectively inhibiting operation of the switch to open the electric circuit,

wherein the battery locating means inhibits the removal of the battery from electrical communication with said electric circuit when the switch is arranged to close the electric circuit.

12. The hearing aid switch arrangement claimed in claim 11, wherein the battery locating means permits access to the battery for removal of the battery from the
device when the switch is arranged to open the electric circuit.

13. The hearing aid switch arrangement claimed in claim 11, wherein the battery locating means is adapted to move the battery with respect the electric circuit to thereby connect and isolate the battery to and from the electric circuit.

14. The hearing aid device claimed in any one claims 11 to 13, wherein said activation switch is in mechanically coupled to said battery locating means.

15. The hearing aid switch arrangement claimed in any one of claims 11 to 14, wherein the activation switch is adapted to pivot about a body portion of the device to open and close the electric circuit.

16. The hearing aid switch arrangement claimed in claim 13 or claim 14, wherein the activation switch is decouplable from the battery locating means when the activation switch is arranged to open the electric circuit.

17. The hearing aid switch arrangement claimed in claim 16, wherein the activation switch includes first and second pins that are shaped to extend into corresponding grooves of the battery locating device, wherein the pins slidably engage the grooves in accordance with movement of the switch.

18. The hearing aid switch arrangement claimed in claim 17, wherein the grooves include openings located at a common end that facilitate insertion and removal of the pins into and from the grooves.

19. The hearing aid switch arrangement claimed in any one of claims 11 to 18, wherein the battery locating means is a battery compartment door.

20. The hearing aid switch arrangement claimed in any one of claims 15 to 19, wherein the means for selectively inhibiting operation of the switch to open the electric
circuit inhibits the rotation of the switch as the switch pivots to open the electric circuit.

21. A lock for a switch of a hearing aid device, said switch being operable to selectively enable or to selectively disenable a hearing aid device function, including means for selectively inhibiting operation of the switch to enable or to disenable the hearing aid device function.

22. The lock claimed in claim 21, wherein the switch is operable to open and close an electric circuit of the device.

23. The lock claimed in claim 21, wherein said function is the operation of a battery compartment door of the hearing aid device.

24. The lock claimed in any one of claims 21 to 23, wherein the switch is hingedly coupled to the hearing aid device and is operable to enable the hearing aid device function by rotation in a first direction and is operable to disenable the hearing aid device function by rotation in a second direction.

25. The lock claimed in claim 24, wherein the means for selectively inhibiting limits rotation of the switch in the first direction to thereby inhibit enablement of said hearing aid device function.

26. The lock claimed in claim 24, wherein the means for selectively inhibiting limits rotation of the switch in the second direction to thereby inhibit disenablement of said hearing aid device function.

27. The lock claimed in any one of claims 21 to 26, wherein the switch is a cover hingedly coupled to the hearing aid device.

28. In combination, a lock and a switch for a hearing aid device, said switch being
operative to selectively enable or to selectively disable a hearing aid device function and said lock being adapted to selectively inhibit operation of the switch to enable or to disable the hearing aid device function.

29. The combination claimed in claim 28, wherein the switch is operable to open and close an electric circuit of the device.

30. The combination claimed in claim 28, wherein said function is the operation of a battery compartment door of the hearing aid device.

31. The combination claimed in claim 28 or claim 30, wherein the switch is hingedly coupleable to the hearing aid device and is operable to enable the hearing aid device function by rotation in a first direction and is operable to disable the hearing aid device function by rotation in a second direction.

32. The combination claimed in claim 31, wherein the means for selectively inhibiting limits rotation of the switch in the first direction to thereby inhibit enablement of said hearing aid device function.

33. The combination claimed in claim 32, wherein the means for selectively inhibiting limits rotation of the switch in the second direction to thereby inhibit disenablement of said hearing aid device function.

34. The combination claimed in any one of claims 28 to 33, wherein the switch is a cover hingedly coupleable to the hearing aid.
Figure 9
## DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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