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(54) **EARPHONE, AND ELECTRONIC DEVICE**

(57) An earphone is provided that can be securely mounted in an ear and maintain a good tight fit. An auricle insert part (16) is provided on the outer periphery side face of the speaker housing (14) to accommodate a speaker unit (31) of the earphone. The auricle insert part (16) is continuously formed with the speaker housing (14)

and has a protrusion part (33) protruding from the outer periphery side face of the speaker housing (14) to the outside, as part of the auricle insert part (16). The auricle insert part (16) has a side face facing the earlet (114) or the antiragus (115) in the auricle (110) while the speaker housing (14) is arranged between the earlet (114) or the antiragus (115).

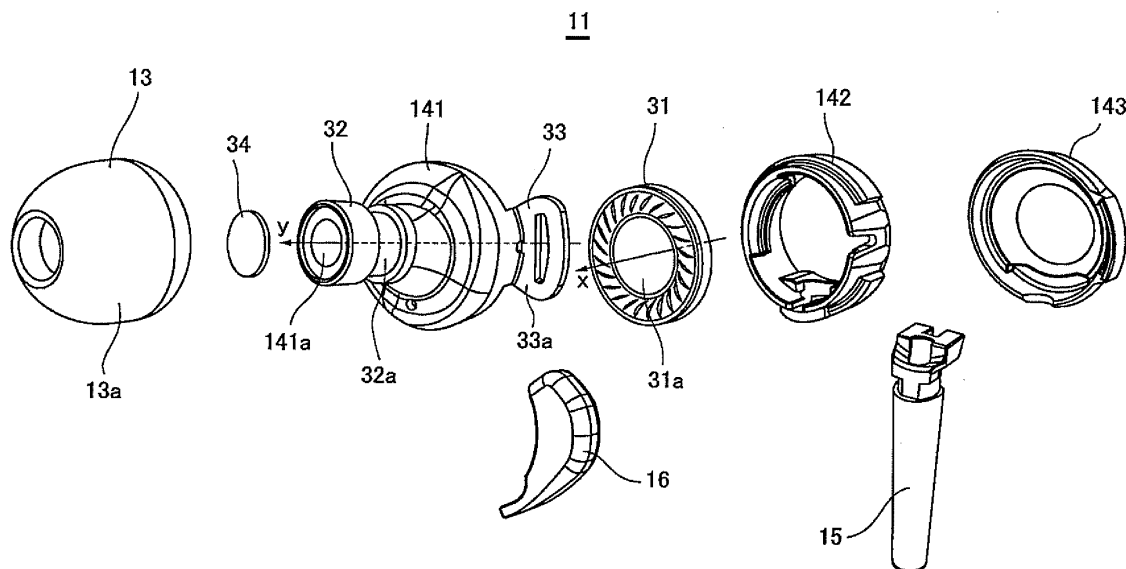


FIG.3

Description

Technical field

[0001] The present invention relates to an inner-ear earplug type earphone and an electronic device with the earphone.

Background art

[0002] Conventionally, a compact and light-weight inner-ear earplug type earphone, as well as a headphone, have been known. Such an earphone is inserted into an external acoustic meatus in use. FIG. 1 is a schematic diagram explaining a state in which a conventional inner-ear type earphone 120 is mounted in an auricle 110 of the user.

As shown in FIG. 1, the auricle 110 is generally characterized by convex and concave parts including an earring 111, an anthelix 112, a cavum conchae 113, an earlet 114, an antiragus 115, an incisura intertragica 116 (notch in the bottom end of the auricle 110), an earlobe 117 and crus helicis 118.

Generally, the housing of the main body of an inner-type earphone is disposed between the earlet 114 and the antiragus 115, and an earplug part integrally formed with the main body is inserted into the external acoustic meatus 119, and therefore the inner-type earphone can be held in the auricle 110. Then, this inserted earplug part flexibly transforms in the external acoustic meatus 119 to enhance contact between the earphone and the auricle and provide a good tight fit.

[0003] The stability of mounting such an inner-ear and earplug type earphone is greatly influenced by the size and the shape of the antiragus 115 and the thickness of the incisura intertragica 116 in the auricle 110 of each user who uses the earphone. In view of this, conventionally, a technology for earphones has been known to prevent an earphone from falling off by forming an auricle support member at the earphone body in which a speaker unit (SP unit) is accommodated.

[0004] For example, a technique has been disclosed for preventing an earphone from falling off the auricle when a housing in which a speaker unit is accommodated (speaker unit housing) is mounted in the auricle to use the earphone. With this technique, an auricle support part is provided, which is formed with a member with a loop elastic structure (loop support structure) in the housing (see, for example, Patent Literature 1).

The earphone disclosed in Patent Literature 1 has the auricle support part formed with a loop shaped and elastic support part (loop-support structure), which can freely and elastically contact the appropriate position in the auricle.

[0005] In addition, another technique for earphones has been disclosed that allows the width of a housing to increase without contact between the housing and an earlet, by extending a sound conduit along the direction

intersecting with the central axis of the housing at a certain angle of inclination (see, for example, Patent Literature 2).

The earphone disclosed in Patent Literature 2 is configured to be able to increase the diameter of a diaphragm in a driver unit accommodated in the housing, and is intended to provide a good tight fit.

Citation List

Patent Literature

[0006]

PTL1: Japanese Patent Application Laid-Open Publication JP-A-2006-203 420

PTL2: Japanese Patent Application Laid-Open Publication JP-A-2007-189 468

Summary of the Invention

Technical Problem

[0007] However, most conventional earphones may become loose or fall off due to the weight of the earphone body even if the user only just has a little exercise. In addition, the outer diameter of the earphone increases in order to prevent the earphone from becoming loose, and therefore the user feels an uncomfortable tight fit.

[0008] For example, with the conventional art disclosed in the above-described Patent Literature 1, it is necessary to form an elastic support part with a loop support structure by covering the speaker housing with a resin member. In this case, there is a problem that the earphone increases in size because the thickness of the resin member for the loop support structure is added to the outer diameter of the speaker housing in which the speaker unit is accommodated. Therefore, when external force applied to the earphone by, for example, pulling a cord after the user inserts the earphone into the auricle, the earphone may easily fall off.

[0009] Meanwhile, the conventional art described in Patent Literature 2 has a problem that an earphone easily falls off similarly by applying an external force to the earphone, for example, pulling a cord, because the earphone is only held by an elastic auricle mounting part formed in the sound conduit of the earphone.

[0010] The present invention was accomplished in view of the above-described circumstances. It is therefore an object of the present invention to provide an earphone being capable of solving the above-described problems.

Solution to the Problem

[0011] To solve the above-described problems, the earphone according to the invention includes: a speaker housing that accommodates a speaker body and has an

opening that allows an acoustic wave emitted from the speaker body to pass through; a sound conduit that guides the acoustic wave passing through the opening to a prescribed direction; and an earplug that includes a tubular portion mounted to the sound conduit to communicate with the sound conduit and has an outer periphery formed to be elastically transformable.

The speaker housing has an outer periphery side face, and an auricle insert part is arranged in the outer periphery side face. The auricle insert part includes a protrusion part as part of the auricle insert part.

The protrusion part is continuously formed with the speaker housing and protrudes from the outer periphery side face of the speaker housing to an outside. The auricle insert part includes a side face which faces one of an earlet and an antiragus in an auricle when the speaker housing is arranged between the earlet and the antiragus.

[0012] Moreover, to solve the above-described problems, an electric device according to claim 19 includes an earphone according to claim 1.

Brief Description of the Drawings

[0013]

- FIG. 1 is a schematic diagram explaining a state in which a conventional inner-ear type earplug earphone 120 is mounted in an auricle 120;
- FIG. 2 is a perspective view showing the appearance of the earphone according to an embodiment of the present invention;
- FIG. 3 is an exploded perspective view explaining in detail the structure of each component constituting the earphone according to the embodiment of present invention shown in FIG. 2;
- FIG. 4 is a perspective view explaining in detail an assembly arrangement of an auricle insert part 16 and a speaker unit 31 of the earphone according to the embodiment of the present invention shown in FIG. 2;
- FIG. 5 is a perspective view explaining in detail the structure of a cover part 141 of the speaker housing part 14 of the earphone according to the embodiment of the present invention shown in FIG. 3;
- FIG. 6 is a perspective view explaining in detail the structure of a tubular part 142 of the speaker housing part 14 of the earphone according to the embodiment of the present invention shown in FIG. 3;
- FIG. 7 is a perspective view explaining in detail the structure of a cord pulling part 15 engaged with the tubular part 142 of the speaker housing part 14 of the earphones according to the embodiment of the present invention shown in FIG. 3;

- FIG. 8 is a perspective view explaining in detail the structure of a bottom face part 143 of the speaker housing part 14 of the earphone according to the embodiment of the present invention shown in FIG. 3;
- FIG. 9 is a perspective view explaining in detail the structure of the auricle insert part 16 of the earphone according to the embodiment of the present invention shown in FIG. 3;
- FIG. 10 is a perspective view explaining in detail the structure of the auricle insert part 16 of the earphone according to the embodiment of the present invention shown in FIG. 9;
- FIG. 11 is an image drawing showing a state when the earphone according to the embodiment of the present invention shown in FIG. 2 is inserted in the auricle 110 of the user; and
- FIG. 12 is an external view showing a portable audio player 100 equipped with an earphone 150 according to an embodiment of the present invention.

Description of Embodiments

[0014] Now, a preferred embodiment of an earphone according to the present invention will be explained with reference to the drawings.

[0015] FIG. 2 is a perspective view showing the appearance of the earphone according to one embodiment of the present invention. Here, FIG. 2(a) is a perspective view showing the earphone according to one embodiment of the present invention, and FIG. 2(b) is a perspective view showing the earphone from a different angle from FIG. 2(a). In addition, each of FIG. 2(a) and in FIG. 2(b) shows a right earphone 11 and a left earphone 12.

[0016] As shown in FIG. 2, each earphone according to the present embodiment includes an earplug 13, a speaker housing part 14, a cord pulling part 15 and an auricle insert part 16. The earphone can be held in the auricle side by both the earplug 13 and the auricle insert part 16 shown in Fig.2, having a function as attachment body for the auricle, to prevent the earphone from easily falling off the auricle of the user without making the user uncomfortable.

In addition, the auricle insert part 16 includes a protrusion part (protrusion part 33 described later) protruding from the speaker housing part 14 toward the outside, which is covered with an elastic member.

[0017] Now, the structure of the earphone according to one embodiment of the present invention shown in FIG. 2, will be described in detail.

[0018] FIG. 3 is an exploded perspective view explaining in detail the structure of each component constituting the earphone according to one embodiment of the present invention shown in FIG. 2. As shown in FIG. 3, the speaker housing part 14 accommodates the speaker unit 31 as a speaker body, and is composed of three members, the cover part 141, the tubular part 142 and

the bottom face part 143.

As shown in FIG. 3, the cover part 141 constituting the speaker housing part 14 is arranged in the acoustic emission side of the speaker unit 31 (in X-direction which is the direction of the central axis of the speaker unit 31 shown in FIG. 3). In addition, the tubular part 142 surrounds the outer periphery part of the speaker unit 31 and the bottom face part 143 is arranged to face the cover part 141.

[0019] With the present embodiment, the speaker unit 31 has a diaphragm 31a shaped as a dome as shown in FIG. 3. A voice coil accommodating part, which is recessed in cross section, is annularly provided at the outer rim of the diaphragm 31a, and includes an edge integrally formed on the outer rim of the voice coil accommodating part. A voice coil is accommodated in this voice coil accommodating part.

Here, the speaker unit 31 having the structure as shown in FIG. 3 is merely an example of a speaker unit accommodated in the speaker housing part 14 of the earphone according to the present invention. The structure of the speaker unit is not limited to this as long as the speaker unit can be accommodated in the speaker housing part 14.

[0020] An opening (sound guide 141a described later) and a sound conduit 32 are formed in the cover part 141 of the speaker housing part 14. The opening allows an acoustic wave emitted from the speaker unit 31 to pass through, and the sound conduit 32 guides the acoustic wave passing through the opening (sound guide 141a) to a prescribed direction (y-axis direction which is the direction of the central axis of the sound conduit 32 shown in FIG. 3).

Here, the central axis of the tubular part 142 in the speaker housing part 14 is approximately the same as the above-described y-axis. In addition, with the present embodiment, the x-axis direction and the y-axis direction shown in FIG. 3 intersect with one another at a certain angle. The earplug 13 has a tubular portion (not shown) to communicate with the sound conduit 32 inside of the earplug and has an elastically transformable outer periphery portion 13a.

An elastic member such as silicone and rubber is used as the material of the earplug 13. A lip 32a is provided in the opening (sound guide 141a) of the sound conduit 32 in the earplug 13 side. The lip 32a is configured to engage with the tubular portion (not shown) provided in the earplug 13, which serves as a stopper.

[0021] An acoustic filter 34 is held between the earplug 13 and the sound conduit 32 to control tone and prevent dust and so forth from entering. The acoustic wave emitted from the speaker unit 31 is emitted to the outside through the acoustic filter 34. Here, although with the present embodiment, a configuration is employed where the acoustic filter 34 is provided in the sound conduit 32, the position of the acoustic filter 34 is not particularly limited to the front edge of the sound conduit 32, but may be provided at the rear edge or the intermediate part in

the sound conduit 32.

[0022] The protrusion part 33 is integrally formed with a part of the outer periphery side face of the cover part 141, the protrusion part forms the auricle insert part 16 formed with an elastic member. As shown in FIG. 3, the protrusion part 33 is formed in a tubular shape having an approximately trapezoidal plane portion 33a whose width increases in the direction from the speaker housing part 14 to the outside.

By these means, when the protrusion part 33 is embedded in an opening (opening 165 described later) formed in the auricle insert part 16 to connect with the auricle inset part 16, it is possible to firmly fit a protrusion (protrusion part 166 in the auricle insert part 16 described later) formed in the opening 165 of the auricle insert part 16 into the opening 33c in the protrusion part 33 to prevent the earphone from falling off the auricle of the user.

[0023] FIG. 4 is a perspective view explaining in detail an assembly arrangement of the auricle insert part 16 and the speaker unit 31 of the earphone according to one embodiment of the present invention shown in FIG. 3. FIG. 4(a) shows a part of the cover part 141 and the tubular part 142 before the auricle insert part 16 and the speaker unit 31 are mounted. Here, the earplug 13 is positioned in the front side (acoustic emission side) in each of FIG. 4(a) and FIG. 4(b).

With the present embodiment, the auricle insert part 16 is integrally formed with the speaker housing part 14 by insert molding such that the protrusion part 33 of the speaker housing part 14 is disposed in advance in the mold of the auricle insert part 16, for example, in a space provided in the mold, and the space is filled with an elastic member.

In FIG. 4(a) shows a state that the auricle insert part 16 is formed by insert molding to a state in FIG. 4(b). In addition, FIG. 4(c) shows a state the speaker unit 31 is held (fixed) with adhesion to a state in FIG. 4(b).

As shown in FIG. 3 and FIG. 4, the speaker unit 31 according to the present embodiment is arranged at the edge of a tubular opening part formed with an end part of the cover part 141 and the tubular part 142 of the speaker housing part 14.

[0024] As shown in FIG. 2 and FIG. 3, the auricle insert part 16 is continuously and integrally formed by insert molding with the speaker housing part 14 and embeds therein the protrusion part 33 formed to protrude from the outer periphery side face of the speaker housing part 14 to the outside.

Then, the auricle insert part 16 is configured to have a face facing the side faces of the anthelix 112 and the antiragus 115 in the auricle 110 when the speaker housing part 14 is arranged between the earlet 114 and the antiragus 115 in the auricle 110.

[0025] FIG. 5 is a perspective view explaining in detail the structure of the cover part 141 of the speaker housing part 14 of the earphone according to one embodiment of the present invention shown in FIG. 3. FIG. 5(a) is a perspective view showing the cover part 141 of the speaker

housing part 14, and FIG. 5(b) is a perspective view showing the cover part 141 from a different angle from FIG. 5(a). Here, each of FIG. 5(a) and FIG. 5(b) shows the cover part 141 of the speaker housing part 14 of the right earphone 11.

[0026] As shown in FIG. 5(a), the sound guide 141a as an opening, which allows an acoustic wave emitted from the speaker unit 31 to pass through and radiate to the outside is formed in the cover part 141. Also, the sound conduit 32 to guide the acoustic wave passing through the opening (sound guide 141a) to a prescribed direction is integrally formed with cover part 141.

With the present embodiment, the sound conduit 32 extends in the direction (y-axis direction shown in FIG. 3) intersecting with the central axis (x-axis direction in FIG. 2) of the speaker housing part 14 at a certain angle. By these means, it is possible to arrange the speaker housing part 14 outside the earlet 114, and therefor prevent the speaker housing part 14 from getting in the way of mounting the earphone.

[0027] In addition, with the above-described configuration, it is possible to arrange the speaker housing part 14 between the earlet 114 and the antiragus 115, and comparatively increase the speaker housing part 14 in size. This allows the outer diameter of the speaker unit 31 to increase, and it is possible to improve the output sound pressure level of the speaker.

[0028] As shown in FIG. 5, two acoustic hole parts (a first acoustic hole part 141b and a second acoustic hole part 141c) are formed in the cover part 141. The first acoustic hole part 141b is formed in the front face of the cover part 141 (in the earplug 13 side) to open the space between the speaker unit 31 and the cover part 141 in the acoustic emission side.

The first acoustic hole part 141b is configured to control the air pressure applied to the diaphragm 31a by allowing the space in the acoustic emission side, which is surrounded by the diaphragm 31a in the speaker unit 31 and the cover part 141b to communicate with the outside.

Here, although with the present embodiment, the first acoustic hole part 141b is formed in a part of the cover part 141 near the connecting portion of the first acoustic hole part and the cord pulling part 15 described later as shown in FIG. 5 and so forth, the position of the first acoustic hole part 141b is not limited to this.

[0029] Meanwhile, the second acoustic hole part 141c is formed between the speaker unit 31 and the cover part 141, and allows the space in the speaker unit 31 in the opposite side of the acoustic emission side to communicate with the outside. When the speaker unit 31 is accommodated in the cover part 141, this second acoustic hole part 141c is formed at the outer periphery side face of the cover part 141 on the bottom face part 143 side of the speaker housing part 14.

The second acoustic hole part 141c is configured to control the air pressure (back pressure) applied to the back face (in the opposite side of the acoustic emission side) of the diaphragm 31a by allowing communication be-

tween the outside and the space which is surrounded by the speaker unit 31 and the outer periphery side face of the cover part 141 and located in the opposite side of the acoustic emission side of the speaker unit 31,

Here, although with the present embodiment, the second acoustic hole part 141c is formed in a part of the speaker housing part 14 near the protrusion part 33 as shown in FIG. 5 and so forth, the position of the second acoustic hole part 141c is not limited to this.

[0030] As shown in FIG. 5, the earphone according to the present embodiment is configured to form the first acoustic hole 141b on the front face of the cover part 141 in the acoustic emission side, and also form the second acoustic hole part 141c on the outer periphery side face of the cover part 141 near the protrusion part 33.

By this means, it is possible to control the air pressure in the space in the acoustic emission side of the speaker unit 31 and the space in the opposite side of the acoustic emission side, and therefore obtain a desired acoustic characteristic.

[0031] Here, as described above, the second acoustic hole part 141c is formed in the outer periphery side face of the speaker housing part 14 near the protrusion part 33. By this means, it is possible to make molding easy, and reduce cost.

[0032] Positioning portions 141d projecting inwardly are formed on the inner side face of the cover part 141 to engage the tubular part 142 with the cover part 141 at a predetermined position. In addition, the width of the cross section of each positioning portion 141d reduces in the direction of acoustic emission in the inner side face 141f of the protrusion part 33.

Here, although a case is shown in the figure as an example where two positioning portions 141d are formed, it is by no means limiting and the number of the positioning portions may be changed according to need. The second acoustic hole part 141c is provided between the positioning portions 141d. In addition, step portions 141e are formed in the inner side face 141f of the cover part 141 between the positioning portions 141d and the second acoustic hole part 141c.

By forming these step portions 141e, an inner side face 141g in which the second acoustic hole part 141c is formed, protrudes outward with respect to the inner side face 141f in which the positioning portions 141d are formed. As a result of this, a predetermined space surrounded by the step portions 141e is formed.

[0033] When the speaker unit 31 is mounted in the cover part 141, the outer periphery side face of the speaker unit 31 contacts the inner periphery side face 141f in which the positioning portions 141d are formed while a prescribed interval is formed between the speaker unit 31 and the inner periphery side face 141g in which the second acoustic hole part 141c is formed.

This interval is a space surrounded by the step portions 141e and communicates with the space in the back face side (opposite side to the acoustic emission side) of the speaker unit 31. In addition, the second acoustic hole

part 141c communicates with the outside, and therefore allows communication between the space in the back face side of the speaker unit 31 and the outside to control the air pressure.

[0034] FIG. 6 is a perspective view explaining in detail the structure of the tubular part 142 in the speaker housing part 14 of the earphone according to one embodiment of the present invention shown in FIG. 3. FIG. 6(a) is a perspective view showing the tubular part 142 in the speaker housing part 14, and FIG. 6(b) is a perspective view showing the tubular part 142 from a different angle from FIG. 6(a). Each of FIG. 6(a) and FIG. 6(b) shows the tubular part 142 in the speaker housing part 14 of the right earphone 11.

In addition, as shown in FIG. 6, in order to prevent the earphone body from increasing in size by reducing the outer diameter of the speaker housing part 14 to the extent that the speaker housing part 14 at least can accommodate the speaker unit 31, and in order to ensure a certain strength of tubular part 142, the thickness of the tubular part 142 is substantially approximately uniform in its circumferential direction.

[0035] As shown in FIG. 6, the counter-positioning portions 142a corresponding to the above-described positioning portions 141d formed in the cover part 141, are formed with a recessed shape in the outer periphery side face of the tubular part 142. These counter-positioning portions 142a position the tubular part 142 with respect to the cover part 141 integrally formed with the protrusion part 33.

With the present embodiment, two recessed portions, as the counter-positioning portions 142a, are formed in the outer periphery side face of the tubular part 142. Here, with the present embodiment, two protruding portions and two recessed portions are formed as the positioning portions 141d in the cover part 141 and the counter-positioning portion 142a in the tubular part 142, respectively.

However, the number of these portions is not limited to two, but one, or three or more is possible. In addition, with the present embodiment, the protruding positioning portions 141d are formed in the cover part 141 and the recessed counter-positioning portions 142a are formed in the tubular part 142. However, another embodiment is possible where recessed counter-positioning portions are formed in the cover part 141 and protruding positioning portions are formed in the tubular part 142.

[0036] In order to prevent reduction in thickness of the outer periphery side face of the tubular part 142 in which the counter-positioning portions 142a are formed, protrusions which protrude inward may be formed in the positions corresponding to the shape of the counter-positioning portions 142a. Here, with the present embodiment, protrusions 142g are formed in the outer periphery side face of the tubular part 142.

[0037] As described above, the counter-positioning portions 142a corresponding to the positioning portions 141d in the cover part 141, are formed in the outer pe-

riphery side face of the tubular part 142. By this means, the cover part 141 is easily connected with the tubular part 142, while the protrusion part 33 is positioned with respect to the tubular part 142.

[0038] A cutout portion 142e is formed in the outer periphery side face of the tubular part 142. In addition, this cutout portion 142e is provided between the counter-positioning portions 142a. When the cover part 141 is connected with the tubular part 142, the second acoustic hole part 141c is arranged at a position facing the cutout portion 142e.

By this means, the tubular part 142 does not block the airflow exiting outside from the space in the back face side of the speaker unit 31 and entering the space in the back face side of the speaker unit 31 from outside, and the second acoustic hole part 141c allows communication between the outside and the space in the back face side of the speaker unit 31.

Here, with this illustrated embodiment, the cutout portion 142e is formed, however, the present invention is not limited to this as long as the second acoustic hole part 141c allows communication between the space in the back face side of the speaker unit 31 and the outside. In addition, for example, a channel such as a through-hole that allows the air to pass through may be formed in the outer periphery side face or the inside of the tubular part 142.

[0039] In addition, as shown in FIG. 6, a coupling portion 142b to engage with the end of the cord pulling part 15 described later to be connected with the tubular part 142, is formed in the outer periphery side face of the tubular part 142. FIG. 7 is a perspective view explaining in detail the structure of the cord pulling part 15 engaged with the tubular part 142 in the speaker housing part 14 of the earphone according to one embodiment of the present invention shown in FIG. 3.

[0040] The cord pulling part 15 according to the present embodiment includes a main body 15a having an approximately cylindrical shape and a connecting end portion 15b which is integrally formed with the main body 15a and engaged with the tubular part 142.

In addition, a cord slot 15c to insert a cord (wire) electrically connected to the speaker unit 31, is formed in the connecting end portion 15b. The cord pulling part 15 is hollow to allow the cord from the speaker unit 31 to pass through interior portion of the connecting end portion 15b and the main body 15a via the cord slot 15c to electrically connect the outside.

[0041] Here, with the present embodiment, in order to form the cord pulling part 15 in the speaker housing part 14, the connecting part 142b having the opening part 142f is formed in the tubular part 142. As another example, an opening part, which is a connecting part to the cord pulling part 15, may be formed from the tubular part 142 to the bottom face part 143.

When the opening is formed across the tubular part 142 and the bottom face part 143, there is a case that the strength (rigidity) and joint strength of the connecting part

between the tubular part 142 and the bottom face part 143 decrease. With the present embodiment, the opening part 142f is provided in the tubular part 142, and a reinforcement portion 142c which is located in the bottom face part 143 side, is provided near the opening part 142f of the tubular part 142.

This reinforcement portion 142c is provided in the bottom face part 143 side to cover the opening part 142f of the tubular part 142. Though the rigidity of a part of the tubular part 142 reduces because of forming the opening 142f, this reinforcement portion 142c enhances the strength (rigidity) of the part the tubular part and also enhance the joint strength.

[0042] Moreover, as shown in FIG. 6, a support portion 142d is formed in a shape protruding inward in the inner periphery side part of the tubular part 142 to support the bottom face part (the face of the speaker housing part 14 on the bottom face part 143 side) of the speaker unit 31 is formed.

[0043] In addition, by providing this support portion 142d, it is possible to enhance the rigidity of the tubular part 142 and also enhance the rigidity of the whole earphone 11, and prevent the earphone 11 from deforming.

[0044] FIG. 8 is a perspective view explaining in detail the structure of the bottom face part 143 of the speaker housing part 14 of the earphone according to one embodiment of the present invention shown in FIG. 3. FIG. 8(a) is a perspective view showing the bottom face part 143 of the speaker housing part 14, and FIG. 8(b) is a perspective view showing the bottom face part 143 from the back face side. Here, each drawing in FIG. 8 shows the bottom face part 143 of the speaker housing part 14 of the right earphone 11.

[0045] As shown in FIG. 8, a cutout portion 143a is formed in the bottom face part 143 to insert a cord (wire) passing through the above-described cord pulling part 15. The connecting end portion 15b of the cord pulling part 15 is sandwiched and fixed between the cutout part 143a and the connecting portion 142b in the tubular part 142. In addition, a recessed portion 143b, which is a step portion into which the reinforcement portion 142c of the tubular part 142 is inserted, is formed in the bottom face part 143.

By inserting the protruding shaped reinforcement portion 142c formed near the opening part of the tubular part 142 into the recessed portion 143c, it is possible to engage the tubular part 142 with the bottom face part 143 while enhancing the rigidity of the connecting part between the tubular part 142 and the bottom face part 143.

[0046] FIG. 9 is a perspective view explaining in detail the configuration of the auricle insert part 16 of the earphone according to one embodiment of the present invention shown in FIG. 3. FIG. 9(a) is a perspective view showing the auricle insert part 16 shown in FIG. 2, FIG. 3 and so forth, and FIG. 9(b) is a perspective view showing the auricle insert part 16 from another direction.

Here, with the present embodiment, the auricle insert part 16 is integrally formed with the speaker housing part 14

by forming an elastic member into the protrusion part 33 of the cover part 141 using insert molding.

[0047] As shown in FIG. 9, with the present embodiment, in the auricle insert part 16 one side face in the earplug 13 side (the acoustic emission side) and the side face in the bottom face part 143 side (the opposite side of the acoustic emission side) are formed in a tubular shape.

In addition, of side faces in the auricle insert part 16 an inner side face (inner side face 161) facing the speaker housing part 14 extends along the outer periphery side face of the speaker housing part 14 and is formed in a shape curved and protruding outward.

Moreover, of side faces in the auricle insert part 16, an outer side face (outer side face 162) facing the antiragus 115 is formed in a shape facing the inner side face 161, specially extending along the outer periphery side face of the speaker housing part 14 and curved and protruding outward.

That is, the auricle insert part 16 is provided along the outer periphery side face of the speaker housing part 14 and formed in an approximately crescent and tubular shape so as to extend to contact the anthelix 112 and the antiragus 115 in the auricle 110.

Then, the auricle insert part 16 is configured to have an auricle contact portion that contacts the side faces of the anthelix 112 and the antiragus 115 in the auricle 110 when the speaker housing part 14 is arranged between the earlet 114 and the antiragus 115.

[0048] In addition, the outer side face 162 has a curved cross-sectional shape, that is, the corners of the outer side face 162 are rounded taking into account reasons such as fitting the auricle of the user.

[0049] Moreover, the auricle insert part 16 includes a projecting part 163 having a smaller width than the width between the inner side face 161 connected with the speaker housing part 14 and the outer side face 162 as shown in FIG. 9. The projecting part 163 has a shape extending from the inner side face 161 side connected with the speaker housing part 14 toward the main body 15a of the cord pulling part 15 in the end part of the auricle insert part 16 in a plan view.

In addition, an inner side face 164 of the projecting part 163 is different from the inner side face 161 in a plan view. To be more specific, the inner side face 164 has a smaller curve radius than the inner side face 161 as shown in the figure. A prescribed interval between the end part of the projecting part 163 in the speaker housing part 14 side and, the speaker housing part 14 or the cord pulling part 15. In addition, the projecting part 163 is formed in a tubular shape.

[0050] Here, with the present embodiment, the inner side face 164 is provided, and therefore a recessed part curving toward the speaker housing part 14 is provided in the auricle insert part 16 as shown in FIG. 9. Therefore, it is possible to provide a predetermined distance between the auricle insert part 16 and the speaker housing part 14.

For example, in an example shown in FIG. 9, the thickness of the end part of the inner side face 164 having the recessed part is approximately half the thickness of the end part of the inner side face 161. Here, the thickness of the projecting part 163 shown in FIG. 9 is merely an example, and the thickness may be greater or smaller than that. Then, the auricle insert part 16 has elasticity. Therefore, when a part of the auricle insert part 16 contacts the earlet 114 and the antiragus 115, the projecting part 163 of the auricle insert part 16 can elastically transform to correspond to the shape of the earlet 114 and the antiragus 115 in the auricle 110 of the user wearing the earphone 11. Therefore, it is possible to keep a good fit between the earphone and the auricle.

[0051] FIG. 10 is a perspective view explaining in detail the structure of the auricle insert part 16 of the earphone according to one embodiment of the present invention shown in FIG. 9. As shown in FIG. 9, FIG. 10 and so forth, the auricle insert part 16 according to the present embodiment has a planar shape in which the width in the direction from the speaker housing part 14 toward the outside reduces in the direction from the speaker housing part 14 to the cord pulling part 15.

In the planar shape, the width of auricle insert part 16 in the direction from the speaker housing part 14 to the cord pulling part 15 increases in the direction from the outside to the speaker housing part 14,

[0052] A width 16a of a part in the vicinity of the outer periphery part of the auricle insert part 16 in the direction from the speaker housing part 14 to the cord pulling part 15 is greater than a width 33b of a part in the vicinity of the outer periphery part of the protrusion part 33.

The projecting part 163 which is formed with an elastic member and does not contain the protrusion part 33 is provided in the end part of the auricle insert part 16 as shown in FIG. 10. In addition, the earphone according to the present embodiment is configured to arrange the projecting part 163 near the speaker housing part 14.

[0053] As shown in FIG. 9, the opening part 165 is formed in the auricle insert part 16, and the protrusion part 33 formed in the cover part 141 of the speaker housing part 14 is arranged in the opening 165. This allows the auricle insert part 16 to be fixed to the cover part 141 of the speaker housing part 14.

Here, the protrusion part 33 is integrally formed with the cover part 141 to protrude continuously from the outer periphery side face of the cover part 141 as described above. The protrusion part 33 has a tabular shape of an approximately inverted trapezoid in which the width in the direction from the speaker housing part 14 to the cord pulling part 15 increases in the direction from the speaker housing part 14 to the outside.

In this way, the protrusion part 33 having a planar shape of an approximately inverted trapezoid is arranged in the opening part 165 in the auricle insert part 16, so that it is possible to firmly connect the auricle insert part 16 in which the protrusion part 33 is embedded, with the speaker housing part 14.

[0054] As described above, the earphone 11 according to the present embodiment includes the auricle insert part 16 formed to extend in the vicinity of the cord pulling part 15. In addition, the auricle insert part 16 is arranged between the earlet 114 and the antiragus 115.

To be more specific, when the earphone 11 is mounted in the auricle 110, the projecting part 163 which is a part of the auricle insert part 16 extends in the vicinity of the incisura intertragica 116. This allows increase in area in which the auricle insert part 16 contacts the earlet 114 or the antiragus 115, so that it is possible to keep a good fit between the earphone 11 and the auricle 110.

In addition, the earphone 11 according to the present embodiment is configured to enhance the rigidity of the auricle insert part 16 contacting the earlet 114 and the antiragus 115 by flexing the projecting part 163 of the auricle insert part 16 to correspond to the shape of the auricle 110, even if the shapes of the auricle 110 of users are different each other. Thus, it is possible to provide a good tight fit of the earphone 11.

[0055] As described above, with the present embodiment, the auricle insert part 16 is formed by insert molding with an elastic member such that the elastic member is filled in the opening part 33c formed inside the protrusion part 33 and covers the outer periphery side face of the protrusion part 33.

Therefore, in this case, the shape of a protrusion part 166 formed in the opening 165 of the auricle insert part 16 corresponds the shape of the opening 33c in the protrusion part 33. Then, when the protrusion part 33 formed with the cover part 14 is embedded in the auricle insert part 16, the protrusion 166 is fitted into the opening part 33c in the protrusion part 33, so that it is possible to more firmly connect the protrusion part 33 with the auricle insert part 16.

[0056] Here, another embodiment of the earphone according to the present invention is possible where the opening part 33c inside the protrusion part 33 and the protrusion 166 of the auricle insert part 16 are omitted, and in this case, it is possible to firmly connect the auricle insert part 16 with the protrusion part 166 by insert molding.

[0057] Here, with the present embodiment, an elastic material, thermoplastic elastomer (TPE) which can be easily processed as well as plastic, is employed as the material for the auricle insert part 16. However, the present invention is not limited to this. For example, well-known resin materials such as plastic, rubber and thermosetting resin can be used as a material for the auricle insert part 16.

In addition, by using TPE, it is possible to freely design the form to improve a tight fit and also improve the degree of freedom to design. Meanwhile, well-known resin materials such as ABS resin available for injection molding, can be used as the material for the speaker housing part 14.

[0058] With the present embodiment as described above, the earphone is formed by, after the speaker

housing part 14 is formed, forming the auricle insert part 16 so as to cover the protrusion part 33 of the speaker housing part 14 by insert molding with a member different from the member constituting the speaker housing part 14.

In this way, the elastic auricle insert part 16 is mounted to the outer face of the housing (speaker housing), so that it is possible to reduce the outer diameter of the speaker housing part 14. Moreover, it is possible to increase the outer diameter of a speaker unit while preventing the outer diameter of the speaker housing part 14 from increasing.

[0059] In this way, the earphone according to the present embodiment is configured to integrally form the elastic auricle insert part 16 with the protrusion part 33 of the speaker housing part 14 by insert molding. Therefore, the outer diameter of the speaker housing 16 mainly depends on the speaker unit 31, and consequently it is possible to prevent the outer diameter of the speaker housing part 14 from increasing unnecessarily.

In addition, the earphone can be securely mounted in an ear by accommodating the earplug 13 and the auricle insert part 16 of the earphone in the auricle, and therefore it is possible to prevent the earphone from easily falling off the auricle.

[0060] Moreover, it is possible to design the earphone to increase the outer diameter of the speaker housing part 14 to the extent that the earphone can be securely mounted in the ear. In this case, it is possible to increase the outer diameter of the speaker unit 31, that is, it is possible to increase the speaker unit 31 itself incorporated in the speaker housing part 14, and improve the output sound pressure level of the earphone.

[0061] As described above, the earphone according to one embodiment of the present invention is configured such that one end part of the auricle insert part 16, which is the protrusion part 33 covered with an elastic member and serves as an auricle contact portion, extends in the vicinity of the cord pulling part 15 provided in the outer periphery side face of the speaker housing part 14.

In addition, the earphone is configured to have a face of the auricle insert part 16 facing the side faces of the anthelix 112 and the antiragus 115 in the auricle 110 when the auricle insert part 16 is arranged between the earlet 114 and the antiragus 115 in the auricle 110.

FIG. 11 is an image drawing showing a state when the earphone according to an embodiment of the present invention shown in FIG. 2 is inserted in the auricle 110 of the user. The auricle insert part 16 has the face facing the side faces of the anthelix 112 and the antiragus 115 in the auricle 110. Therefore, it is possible to increase the contact area between the auricle insert part 16 and, earlet 114 or the antiragus 115, and mount the earphone securely in the auricle 110 while the user feels a good tight fit.

[0062] Moreover, the projecting part 163 in the auricle insert part 16 is arranged between the earlet 114 and the antiragus 115, and a part of the projecting part 163 ex-

tends to the antiragus 115 in the earlobe 117 side. Therefore, it is possible to increase the contact area between a part of the projecting part 163 and the antiragus 115, and increase the contact area between the auricle 110 and the auricle insert part 16. Thus the earphone is securely mounted in the auricle 110.

Also, by extending the projecting part 163 to the antiragus 115 in the vicinity of the earlobe 117 in according to need, the projecting part 163 may be accommodated in a space formed between the earlet 114 and the antiragus 115. In this case, it is possible to increase the contact area between the projecting part 163 and the earlet 114 or the antiragus 115, and therefore securely mount the earphone in the auricle 110.

[0063] Moreover, the earphone according to one embodiment of the present invention is configured to substantially approximately equalize the outer diameter of the earplug 13 with the outer diameter of the speaker housing part 14 as shown in FIG. 1. By this means, the outer diameter of the speaker housing part 14 is smaller than in conventional earphones as described in Patent Literatures 1 to 3.

In this way, the earplug 13 and the auricle insert part 16 are accommodated in the auricle 110 while preventing the outer diameter of the speaker housing part 14 from increasing. By this means, it is possible to mount securely the earphone in the auricle 110 to prevent the earphone from easily falling off the auricle 110.

[0064] In addition, the above-described earphone may be used in an electronic device such as a portable audio player and a portable video player. FIG. 12 is an external view showing a portable audio player 100 with an earphone 150 according to one embodiment of the present invention. The portable audio player 100 has a portable case 101 made of resin or metal material, and various operation switches 103 and a display 104 which are provided on a front face 102 of the portable case 101.

In addition, the portable audio player 100 has a connector on the bottom face 107 to be able to electrically connect a signal generating device in the portable audio player 100 and a signal processing device in another electrical device one another.

[0065] The earphone 150 is attached to the portable audio player 100 as an outside component. The earphone 150 has a remote control part 151, earphone parts 152, a plug part 153 and a cord part 154. The remote control part 151 is configured to be able to remotely control the portable audio player 100 through the cord part 154, using its small switch, small monitor and so forth.

The remote control part 151 is configured to be able to control the volume and the balance between the left and right earphone parts 152, select and change the displayed contents on a screen or the contents of programs or games, by the external operation. This control may be performed using the operation switch 103 provided on the front face 102. Moreover, the earphone parts 152 are configured to convert an audio signal received through the cord part 154 into an acoustic wave and output the

result as sound.

[0066] Although some embodiments of the present invention have been described in detail with reference to the drawings, the specific configurations are not limited to these embodiments. Any design change may be encompassed in the present invention without departing from the gist of the present invention. Moreover, among the above-described embodiments, the technologies may be commonly used as long as the objectives and the configurations are consistent or not conflicted with each other.

List of Reference Signs

[0067]

11, 12	earphone
13	earplug
14	speaker housing part
15	cord pulling part
15a	main body
15b	connecting end portion
15c	cord slot
16	auricle insert part
16a	width of the auricle insert part
31	speaker unit
31a	diaphragm
32	sound conduit
32a	lip
33	protrusion part
33a	plane portion
33b	width of the protrusion part 33
33c	opening
34	acoustic filter
100	portable audio player
110	auricle
111	earring
112	anthelix
113	cavum conchae
114	earlet
115	antiragus
116	incisura intertragica
117	earlobe
118	crus helix
119	external acoustic meatus
141	cover part
141a	sound guide
141b	first acoustic hole
141c	second acoustic hole part
141d	positioning portion
141e	step portions
141f	inner side face
141g	inner side face
142	tubular part
142a	counter-positioning portion
142b	coupling portion
142c	reinforcement portion
142d	support portion

142e	cutout portion
142f	opening
142g	protrusions
143	bottom face part
5 143a	cutout portion
143b	recessed portion
150	earphone
151	remote control part
152	earphone part
10 153	plug part
154	cord part
161	inner side face
162	outer side face
163	projecting part
15 164	inner side face
165	opening
166	protrusion

20 Claims

1. An earphone comprising:

- a speaker housing (14) that accommodates a speaker body and has an opening that allows an acoustic wave emitted from the speaker body to pass through;
- a sound conduit (32) that guides the acoustic wave passing through the opening to a prescribed direction; and
- an earplug (13) that includes a tubular portion mounted to the sound conduit (32) to communicate with the sound conduit (32) and has an outer periphery formed to be elastically transformable,
- wherein the speaker housing (14) has an outer periphery side face, and an auricle insert part (16) is arranged in the outer periphery side face;
- wherein the auricle insert part (16) includes a protrusion part (33) as part of the auricle insert part (16), the protrusion part (33) is continuously formed with the speaker housing (14) and protrudes from the outer periphery side face of the speaker housing (14) to an outside; and
- wherein the auricle insert part (16) includes a side face which faces one of an earlet (114) and an antiragus (115) in an auricle (110) when the speaker housing (14) is arranged between the earlet (114) and the antiragus (115).

2. The earphone according to claim 1, wherein the protrusion part (33) has an substantially trapezoidal planar shape, and that the width of the protrusion part (33) increases in the direction from the speaker housing (14) toward the outside.

3. The earphone according to claim 2, wherein a part of the auricle insert part (16) is formed

with an elastic member; and
wherein an opening (33c) in the protrusion part (33) is filled with the elastic member, and the elastic member covers the protrusion part (33).

4. The earphone according to claim 3,
wherein the auricle insert part (16) is provided along the outer periphery side face of the speaker housing (14) and includes an auricle contact portion that contacts the side face of one of the earlet (114) and the antiragus (115) in the auricle (110); and
wherein the auricle contact portion is formed with the elastic member.
5. The earphone according to claim 4,
wherein a cord pulling part (15) is provided at the outer periphery side face of the speaker housing (14) next to the protrusion part (33); and wherein the auricle contact portion extends in a vicinity of the cord pulling part (15).
6. The earphone according to claim 5,
wherein the auricle contact portion includes an projecting part (163) extending in the vicinity of the cord pulling part (15); and wherein the projecting part (163) is partly arranged in a space surrounded by the earlet (114) and the antiragus (115).
7. The earphone according to claim 6,
wherein a width (16a) of the auricle insert part (16) is greater than a width (33b) of the protrusion part (33) in a direction from the speaker housing (14) to the cord pulling part (15); and
wherein the projecting part (163) has elasticity compared to a part containing the protrusion part (33) in the auricle insert part (16).
8. The earphone according to claim 7,
wherein the projecting part (163) is arranged near the speaker housing (14).
9. The earphone according to claim 8,
wherein the speaker housing (14) includes:

- a cover part (141) arranged in an acoustic emission side of the speaker body;
- a tubular part (142) that covers an outer periphery of the speaker body; and
- a bottom face part (143) arranged to face the cover part (141),

wherein the cover part (141), the tubular part (142) and the bottom face part (143) are formed with different members, respectively.

10. The earphone according to claim 9,
wherein the protrusion part (33) is formed in an outer periphery side face of the cover part (141); and

wherein a positioning portion (141d) that positions the tubular part (142) is formed in an inner side face of the cover part (141) near the protrusion part (141d).

11. The earphone according to claim 10,
wherein a counter-positioning portion (142a) corresponding to the positioning portion (141d) in the cover part (141), is formed in an outer periphery side face of the tubular part (142).
12. The earphone according to claim 11,
wherein one of the positioning portion (141d) and the counter-positioning portion (142a) has a projecting cross sectional shape or a recessed cross sectional shape toward the speaker body in cross section.
13. The earphone according to claim 12,
wherein the cover part (141) has a first acoustic hole part (141b) formed in the outer periphery side face of the cover part (141), on the side that the acoustic wave emitting from the speaker body; and
wherein a second acoustic hole part (141c) is formed in the outer periphery side face of the cover part (141) near the protrusion part (33).
14. The earphone according to claim 13,
wherein the sound conduit (32) extends in the direction intersecting with a central axis of the speaker housing (14).
15. The earphone according to claim 14,
wherein the thickness of the tubular part (142) is substantially uniform in a circumferential direction of the tubular part (142).
16. The earphone according to claim 15,
wherein the tubular part (142) includes an opening (142f) communicating with the cord pulling part (15), and a cord electrically connected with the speaker body passes through the opening (142f) and the cord pulling part (15).
17. The earphone according to claim 16,
wherein a reinforcement portion (142c) is formed near the opening (142f) in the tubular part 142, along the outer periphery side face of the tubular part 142; wherein the bottom face part (143) includes a recessed portion (143b), the recessed portion (143c) being formed in an inner face of the bottom face part (143) and contacting the reinforcement portion (142c); and wherein the bottom face part (143) and the tubular part (142) are connected with one another.
18. The earphone according to claim 17,
wherein the speaker body is arranged at an edge of

the speaker housing (14) in the opening (142t) side.

- 19.** An electronic device including an earphone according to any of claims 1 to 18.

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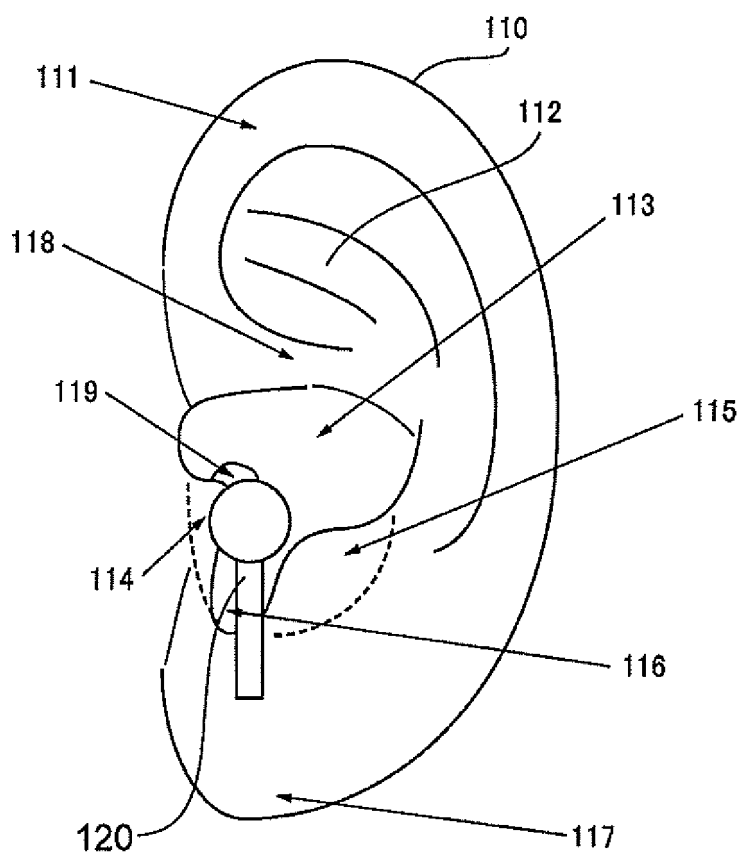
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PRIOR ART

FIG.1

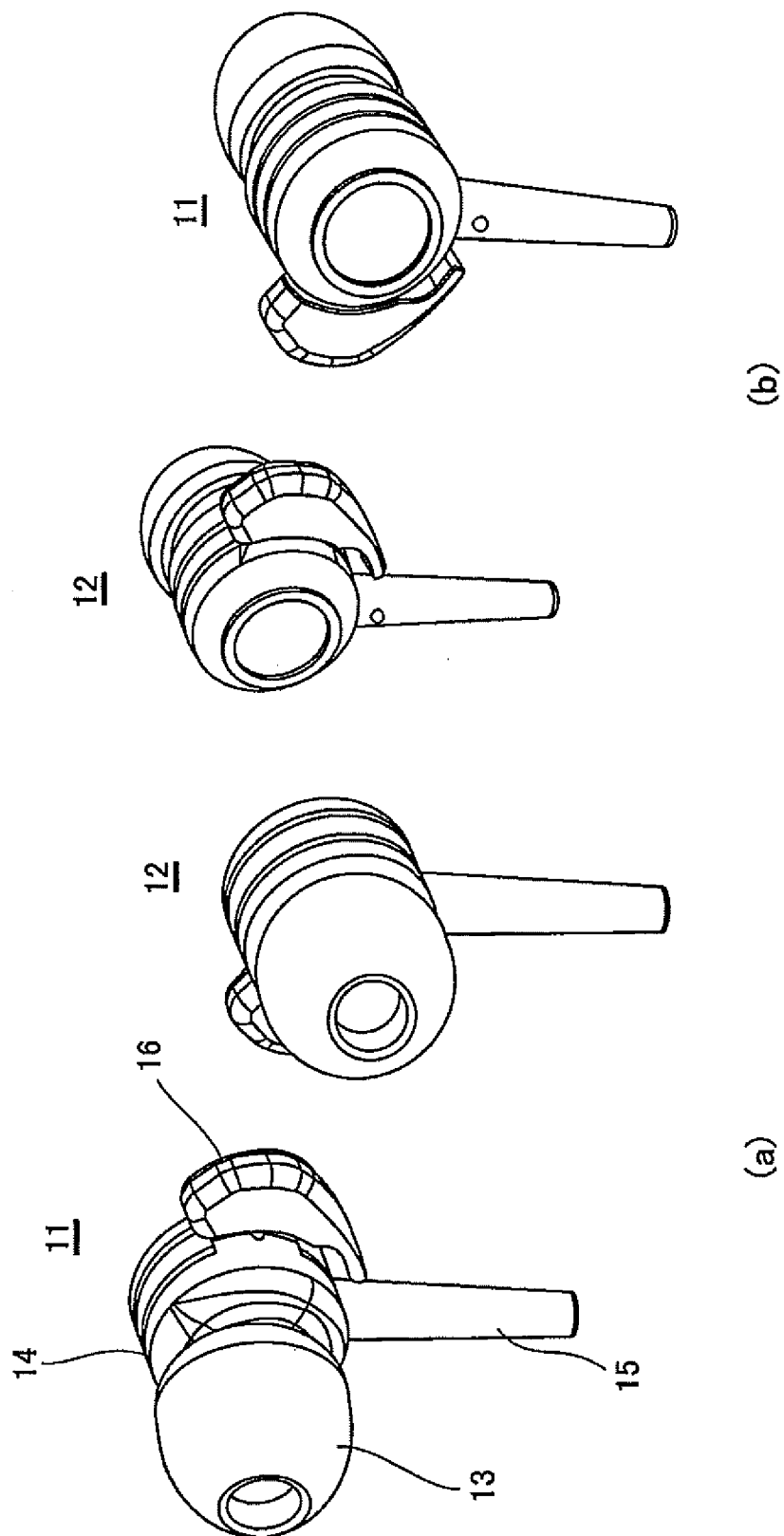


FIG. 2

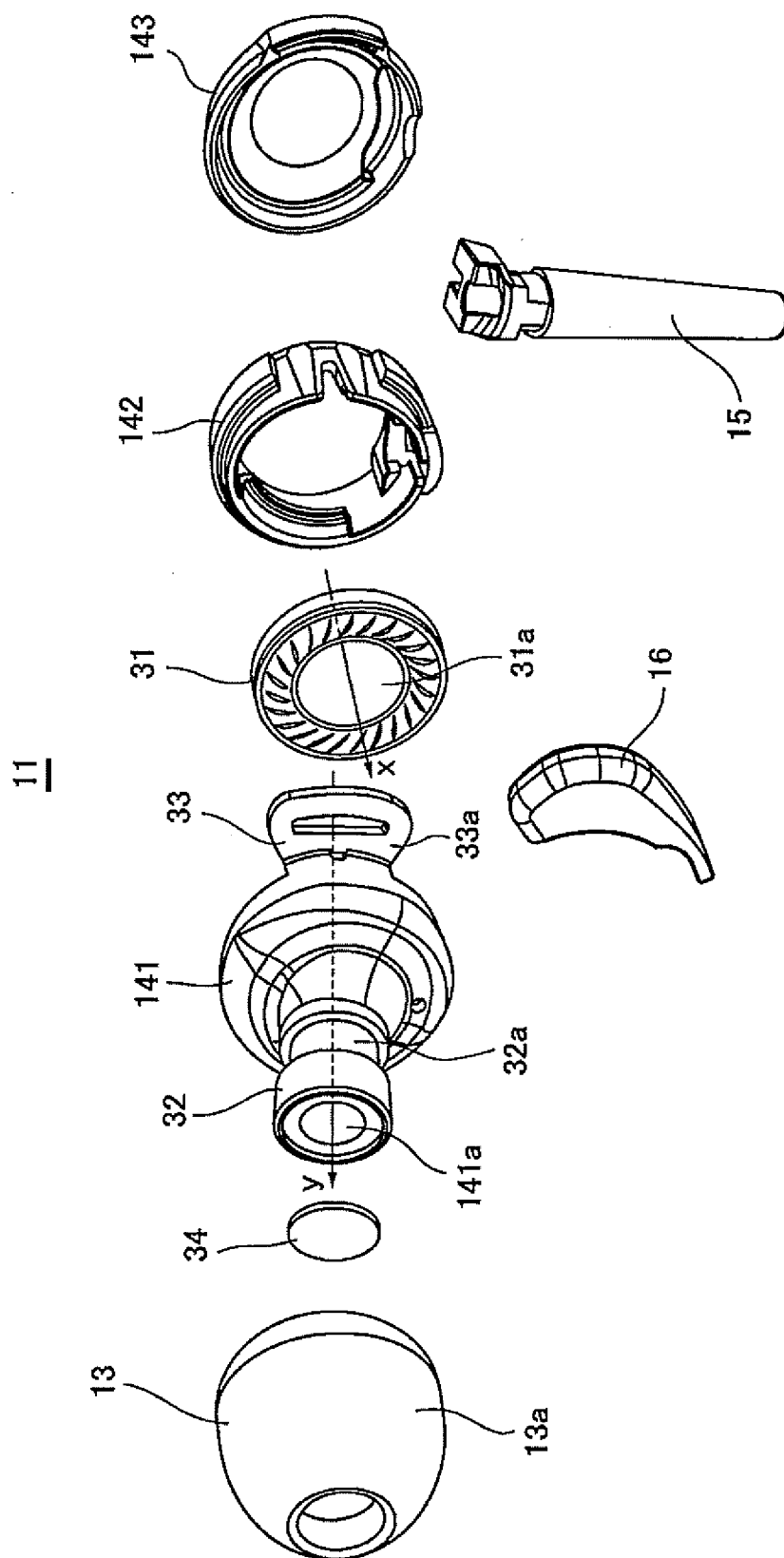
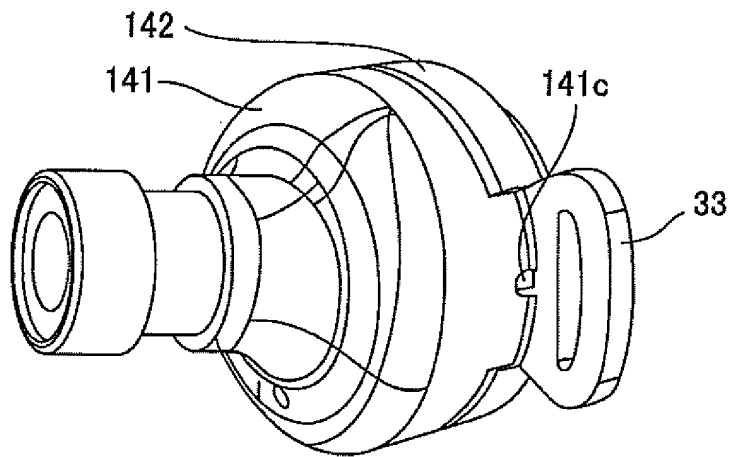
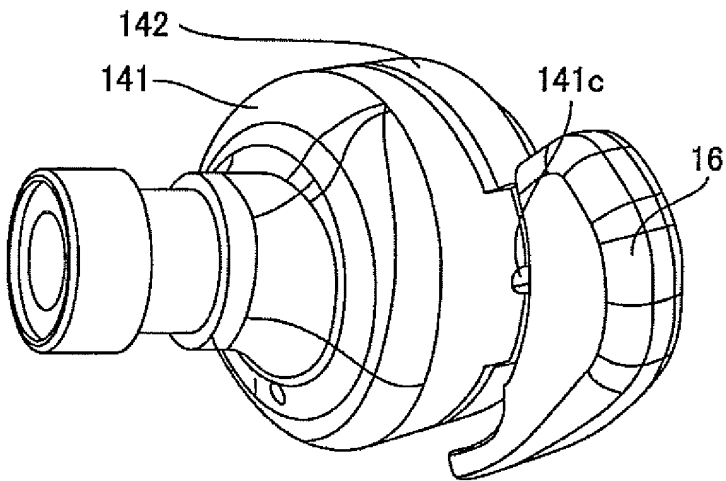


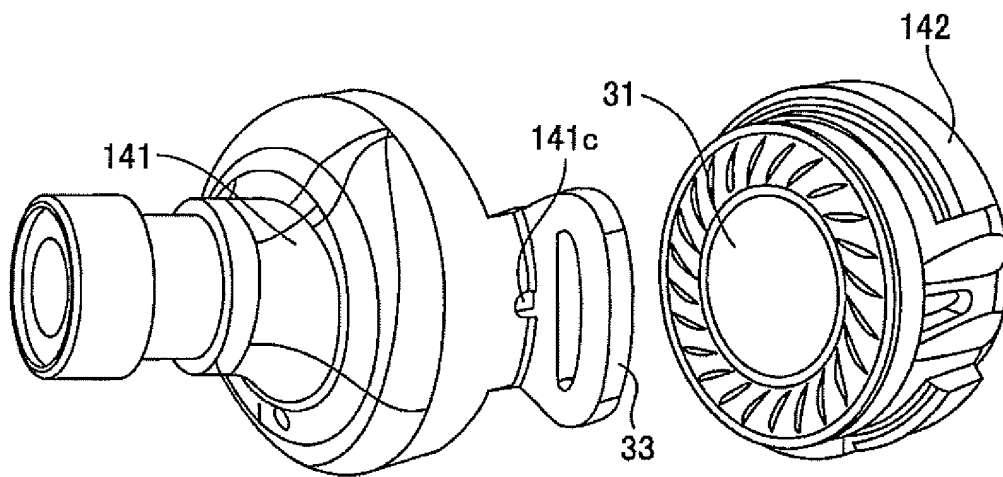
FIG.3



(a)



(b)



(c)

FIG.4

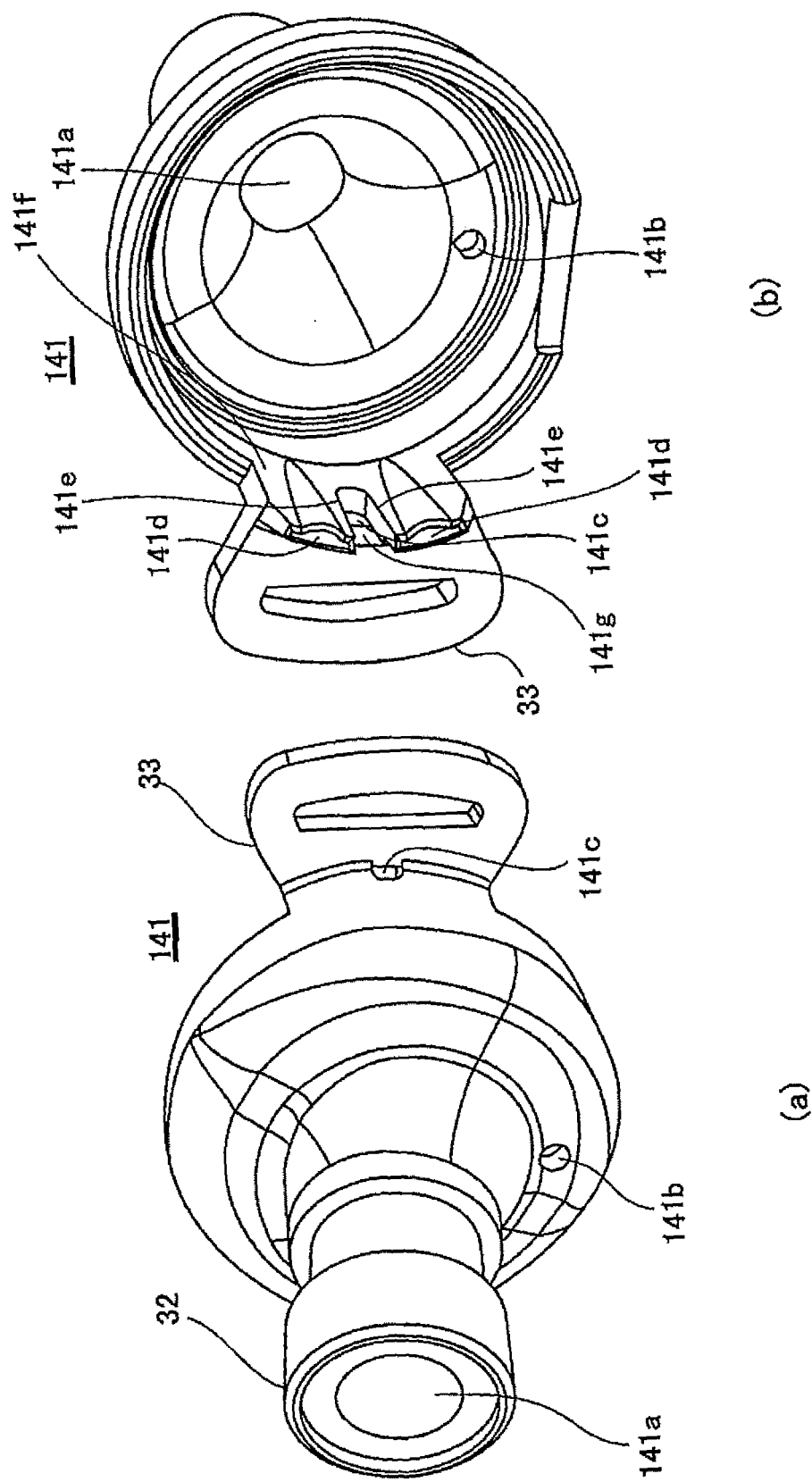


FIG. 5

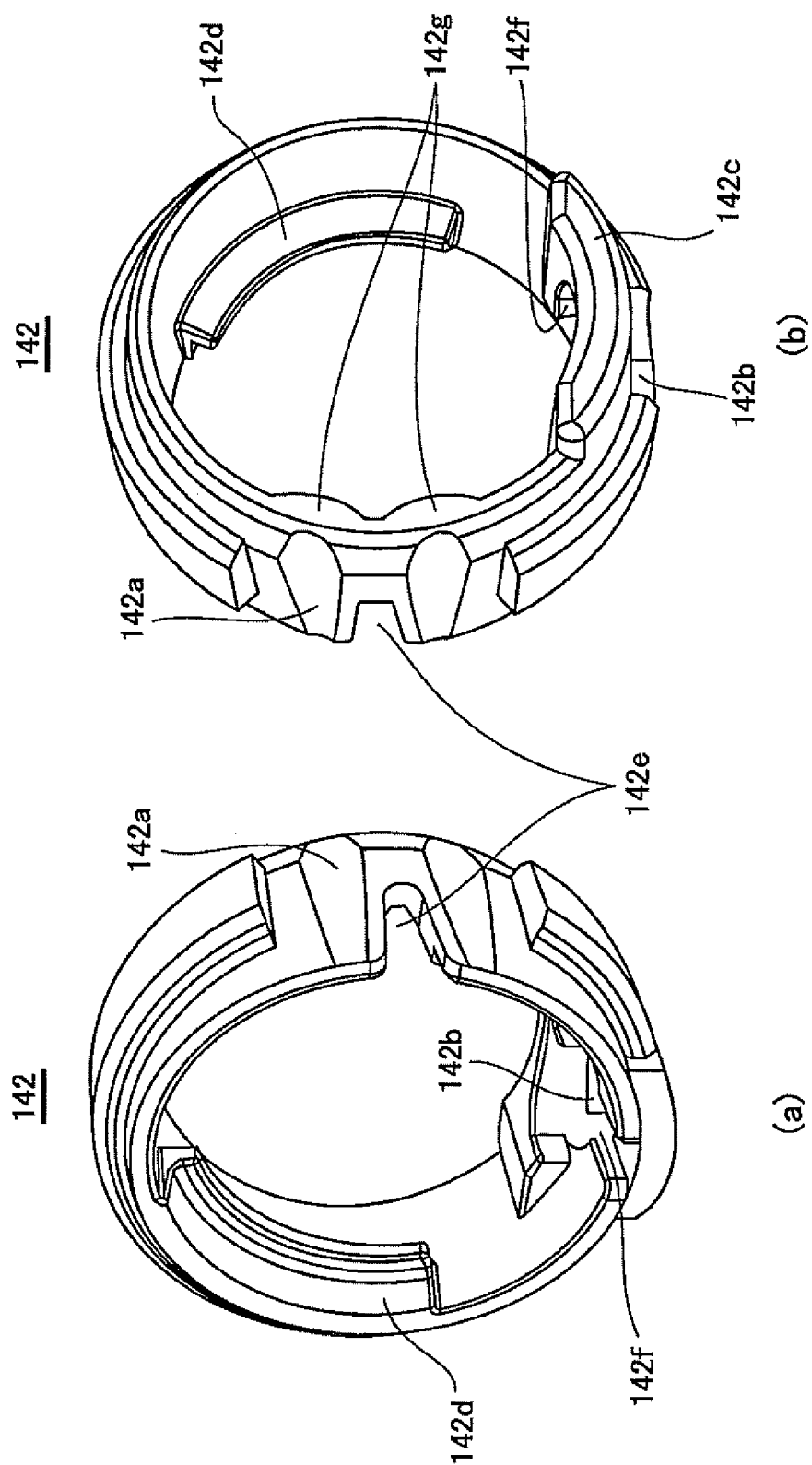


FIG. 6

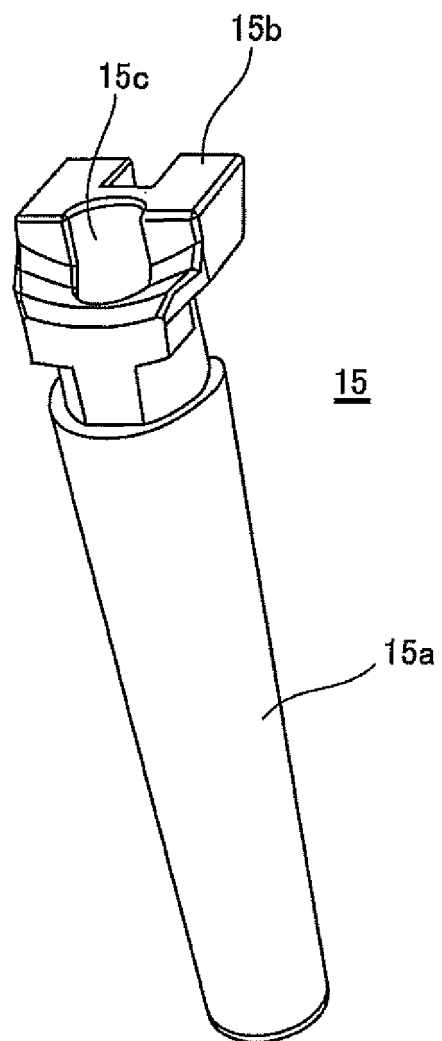


FIG. 7

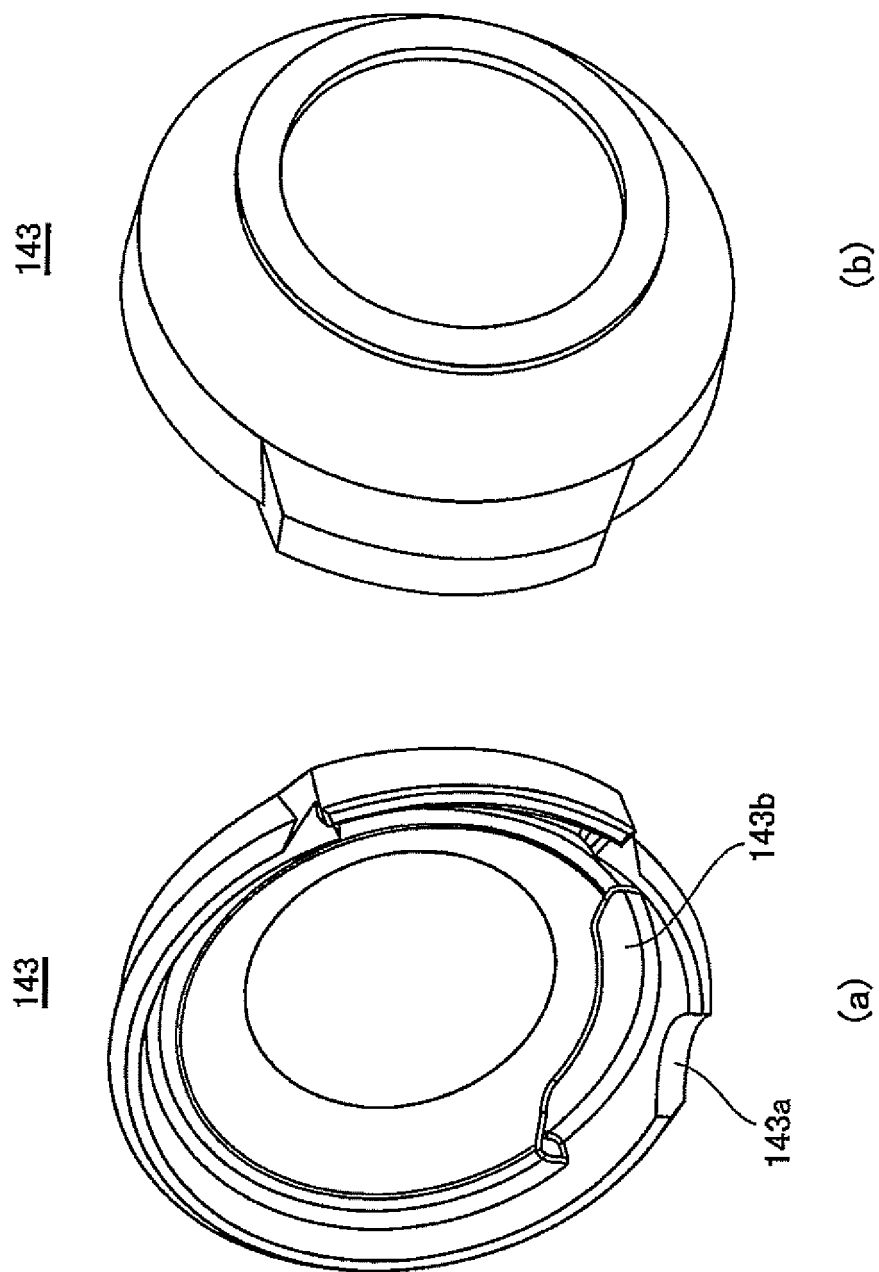


FIG. 8

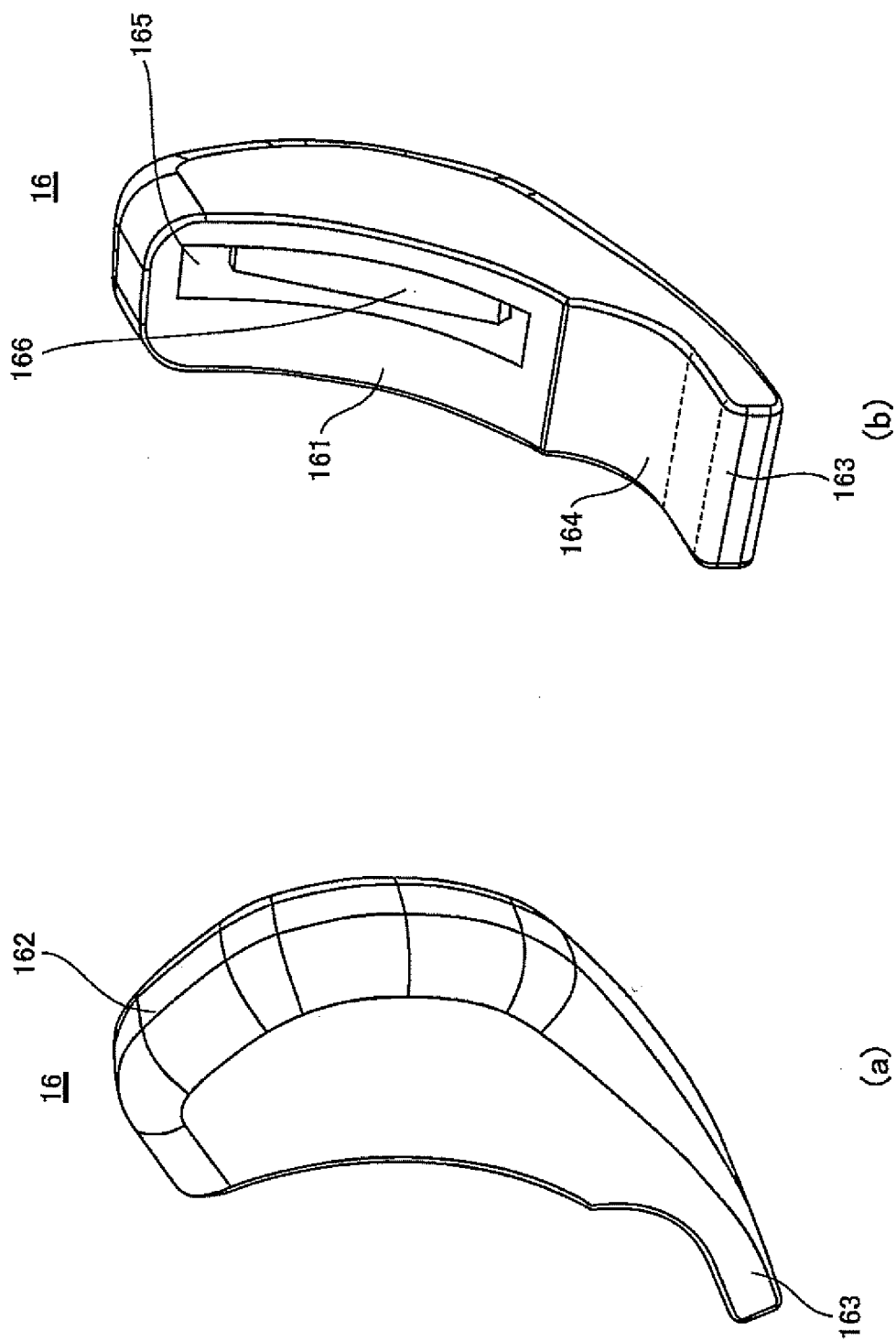


FIG. 9

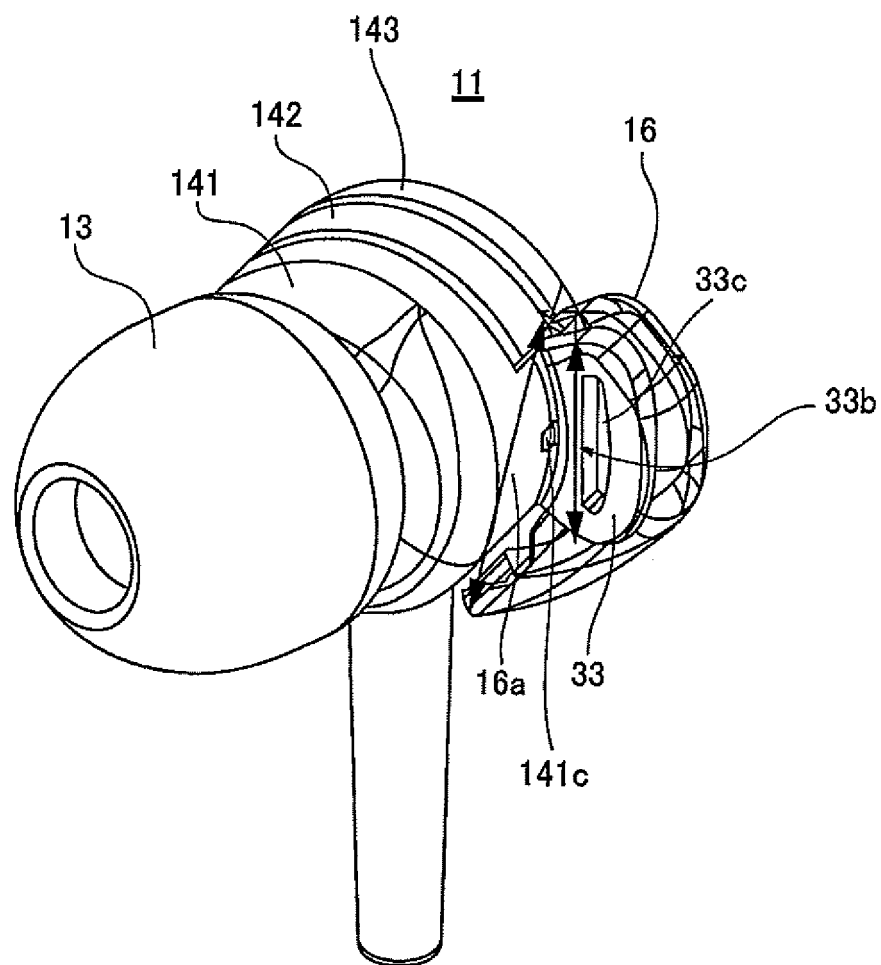


FIG.10

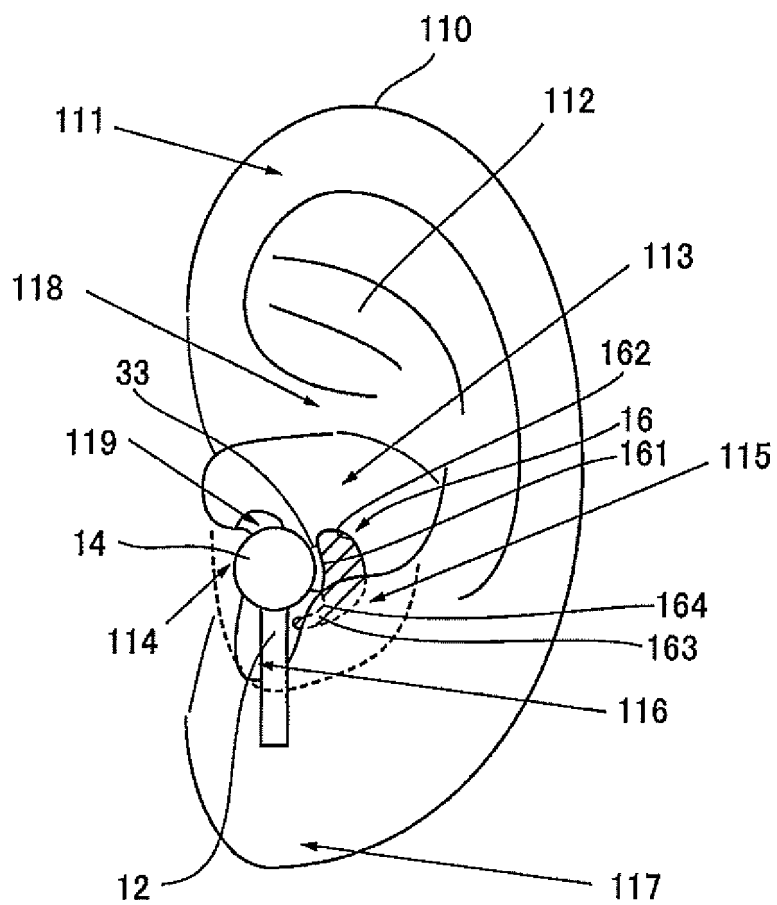


FIG.11

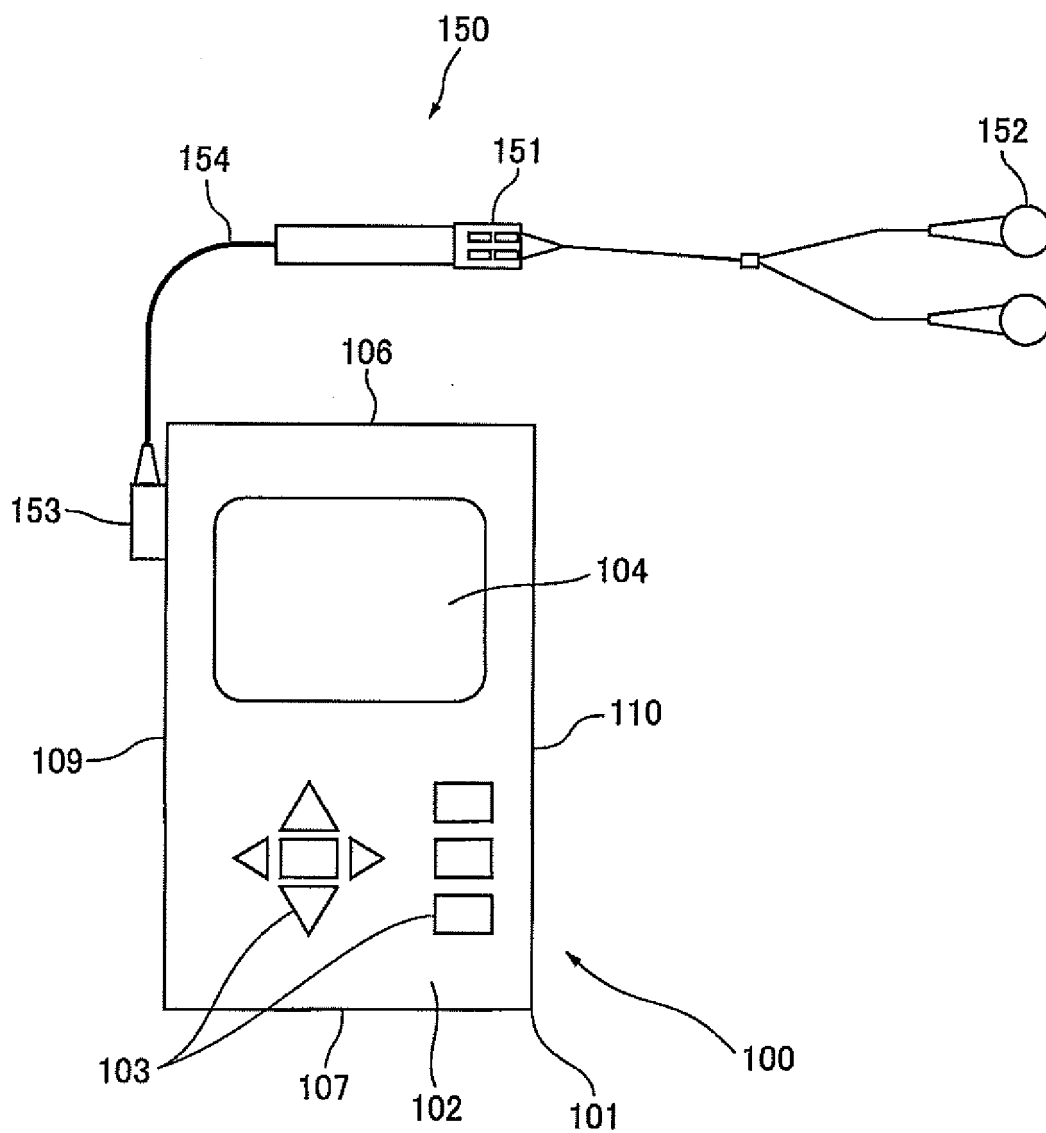


FIG.12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/062980

A. CLASSIFICATION OF SUBJECT MATTER

H04R1/10 (2006.01) i

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)

H04R1/10

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009

Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-044429 A (Victor Company Of Japan, Ltd.), 26 February, 2009 (26.02.09), Par. Nos. [0010] to [0019], [0025] to [0033], [0052]; Figs. 1 to 7 & US 2009/0041284 A	1-19
A	JP 2001-333484 A (Yoshitaka WATANABE), 30 November, 2001 (30.11.01), Par. Nos. [0014], [0022] to [0026]; Figs. 2 to 4 (Family: none)	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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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“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

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“&” document member of the same patent family

Date of the actual completion of the international search
19 August, 2009 (19.08.09)Date of mailing of the international search report
01 September, 2009 (01.09.09)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/062980

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-078984 A (Pioneer Corp., Tohoku Pioneer Corp.), 14 March, 2003 (14.03.03), Par. No. [0020]; Fig. 1 & US 2003/0044038 A1 & CN 1407786 A	1-19

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/062980

<Object of Examination>

The descriptions of claims 1-19 are indefinite in the positional relation between a protrusion formed to protrude from the outer circumference of a speaker casing to the outside and a concha insert, and do not comply with the requirement of clarity in PCT Article 6.

Hence, the investigation is made on the constitution, which is equipped with the concha insert as a separate member to cover said protrusion, as described in Figs. 2-4 and 10.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 2007189468 A [0006]