

# **SUPPORTING MEMBER FOR FITTING IN EXTERNAL EAR AND EARPHONE PROVIDED WITH SUCH SUPPORTING MEMBER**

## **TECHNICAL FIELD**

The present invention relates to a supporting member for fitting in an external ear, which is used to support an inner earphone in an external ear, and an inner earphone provided with such a supporting member.

## **BACKGROUND ART**

First, a closed type inner earphone of the related art, which has been disclosed in Patent Document 1 (Japanese Patent Application Publication No. 2000-341784), is explained. FIG. 11 is an appearance perspective view of the conventional inner earphone of this type.

Referring to FIG. 11, a conventional inner earphone 1 includes a housing 2 serving as an earphone body in which a speaker unit, not shown, is incorporated, a cylindrical ear plug 3 which is provided so as to project from the front surface side of the housing 2 and is inserted in an external ear canal, a plug cover 5 which is formed of a rubber material attached to the ear plug 3 so as to be folded from an opening portion 4 on the distal end side of the ear plug 3, and a connection cord 7 which is pulled out from the housing 2 to the outside via a cord holding portion 6.

Usually, the plug cover 5 is formed so as to have a cylindrical attachment portion 5a fitted on the ear plug 3 and a sleeve 5b which is folded from the distal end side of the attachment portion 5a toward the proximal end side so as to swell out.

Therefore, according to this inner earphone 1, when the inner earphone 1 is mounted in an external ear, the sleeve 5b of the plug cover 5 deforms elastically so as to follow the inner surface of the external ear canal to tightly close the contact portion. Therefore, a sound from the outside is cut off and an internal sound does not leak to the outside, and also high reproducibility of the

low range can be obtained.

However, the shape and size of external ear canal of the user who wears the housing 2 of the inner earphone 1 have a difference between individuals. Therefore, in some cases, the inner earphone 1 easily comes off the external ear side merely by a touch on the connection cord 7.

In order to overcome this problem, the sleeve 5b of the plug cover 5 has only to be formed so as to be somewhat larger than the average size of external ear canals of the users to produce a sufficient adhesion strength between the sleeve 5b and the external ear canal. However, this solution to the above problem is unfavorable because the user feels a sense of oppression, and long-term wearing of the inner earphone 1 sometimes causes pain to the user.

## SUMMARY OF THE INVENTION

Accordingly, a problem with the present invention is to support an inner earphone on an external ear in such a manner that the user feels a desirable sense of wearing and moreover the inner earphone does not come off inadvertently.

To solve the above problem, the present invention provides a supporting member for fitting in external ear, which is used to support an inner earphone in an external ear, wherein the supporting member includes an attaching base portion attached to a housing in which a speaker unit of the inner earphone is incorporated; and an external ear locking portion formed into a loop shape which is provided so as to project from a part of the attaching base portion and is arranged in the vicinity of an antitragus so as to come elastically into contact with a groove portion between a concha and an antihelix when the housing is mounted in an external ear canal of the external ear.

According to this configuration, the supporting member includes the attaching base portion attached to the housing in which the speaker unit of the inner earphone is incorporated; and the external ear locking portion which is provided so as to project from a part of the attaching base portion and is arranged in the vicinity of the antitragus so as to come elastically into contact with the

groove portion between the concha and the antihelix when the housing is mounted in the external ear canal of the external ear. Thereby, the inner earphone can surely be supported in the external ear via the external ear locking portion.

Preferably, in the attaching base portion, a microphone arranged near the mouth of a wearer of the inner earphone is supported via an arm member.

According to this configuration, in the attaching base portion, the microphone arranged near the mouth of the wearer of the inner earphone is supported via the arm member. Thereby, the inner earphone can be formed into a headset type having a microphone.

Also, the present invention embraces an inner earphone provided with the above-described supporting member for fitting in external ear. According to this configuration, there can be provided an inner earphone that does not come off the external ear inadvertently even if a tensile force is applied to a connection cord etc.

Preferably, the housing has an ear plug inserted in an external ear canal, and the ear plug is provided with a plug cover formed of an elastic material that comes into contact with the external ear canal while being accompanied by elastic deformation.

According to this configuration, the housing has the ear plug inserted in the external ear canal, and the ear plug is provided with the plug cover formed of an elastic material that comes into contact with the external ear canal while being accompanied by elastic deformation. Thereby, a sound from the outside is cut off and an internal sound does not leak to the outside, and also high reproducibility of the low range can be obtained. Moreover, such an effect that is brought about by the plug cover can make the holding force of the supporting member for fitting in external ear with respect to the external ear surer.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is an exploded perspective view illustrating a basic construction of an inner earphone in accordance with the present invention;

FIG. 2 is a side view of the inner earphone shown in FIG. 1, viewed from the decorative member side;

FIG. 3 is an appearance perspective view of the inner earphone shown in FIG. 1;

FIG. 4(a) is a schematic view showing the relationship between the inner earphone and an external ear, and FIG. 4(b) is a schematic view showing a state in which the inner earphone is worn in an external ear;

FIGS. 5(a) to 5(c) are explanatory views showing examples in which the loop size of an external ear locking portion of an external ear supporting member is different;

FIG. 6 is an explanatory view showing a state in which the external ear supporting members shown in FIGS. 5(a) to 5(c) are replaced with respect to a housing;

FIG. 7 is an explanatory view showing a detailed configuration example of a supporting member for fitting in external ear;

FIG. 8 is an appearance perspective view of an inner earphone provided with the supporting member for fitting in external ear shown in FIG. 7;

FIG. 9(a) is a side view of an inner earphone of a headset type having a microphone, and FIG. 9(b) is a front view thereof;

FIG. 10 is an explanatory view showing a state in which the headset type inner earphone shown in FIG. 9 is being used; and

FIG. 11 is an appearance perspective view of a conventional closed type inner earphone.

## **DETAILED DESCRIPTION**

An embodiment of the present invention will now be described with reference to FIGS. 1 to 10. The present invention is not limited to this embodiment.

As shown in an exploded perspective view of FIG. 1, an inner earphone 11 in accordance with the present invention includes, as a basic configuration, a

housing 22 in which a speaker unit 12 is incorporated and a supporting member 32 for fitting in external ear, which is attached to the housing 22.

In this inner earphone 11, as the speaker unit 12, an electroacoustic transducer including a diaphragm, not shown, and a backplate for driving the diaphragm is used.

The housing 22 has a cylindrical first cover 23 covering the sound-producing surface side of the speaker unit 12 and a cylindrical second cover 27 covering the back surface side of the speaker unit 12, and the speaker unit 12 is incorporated in these covers 23 and 27.

For the use as the inner earphone, the housing 22 is, as shown in FIG. 4, formed so as to have a size such as to be inserted on the external ear canal side of an external ear 61 and to be held between a tragus 62 and an antitragus 63.

In the inner earphone 11, the first cover 23 has a cylindrical ear plug 24 that is inserted in the external ear canal. Also, the second cover 27 has an internal space 28 that is open to the front end surface side (the lower surface side in FIG. 1) thereof and houses the speaker unit 12, and is provided with a locking hole 29 for fixing a decorative member 42 on the rear end surface side (the upper surface side in FIG. 1).

In this example, the speaker unit 12 has a packing 15 formed of an elastic material attached to the outer peripheral surface of the speaker unit 12, and is housed in the internal space 28 of the second cover 27 via this packing 15. The decorative member 42 has a lid plate 43 formed into a disc shape. On the back surface side of the lid plate 43, there is provided a fastener 44 that is forcedly fitted in the locking hole 29 of the second cover 27.

The supporting member 32 for fitting in external ear is formed of an elastic material, such as elastomer or silicone rubber, which is elastically deformable, and integrally includes an attaching base portion 33 detachably attached to the second cover 27 and an external ear locking portion 38 provided so as to project from a part of the attaching base portion 33 to the side.

The attaching base portion 33 is of a cylindrical shape, and has a housing

space 34 that is open to the front end surface side of the attaching base portion 33, so that the second cover 27 is housed in this housing space 34. Also, in a rear end surface 35 of the attaching base portion 33, a through hole 36 is formed to guide the fastener 44 of the lid plate 43 into the locking hole 29 in the second cover 27.

The attaching base portion 33 is installed to the housing 22 by fitting the second cover 27 in the housing space 34 of the attaching base portion 33. As a method for fixing the attaching base portion 33, the inside diameter of the housing space 34 is made slightly smaller than the outside diameter of the second cover 27, and thereby the second cover 27 may be forcedly fitted in the housing space 34. Alternatively, after the second cover 27 has been fitted in the housing space 34, the attaching base portion 33 may be fixed to the housing 22 by utilizing the fastener 44 of the lid plate 43.

The external ear locking portion 38 is preferably formed into a loop shape such that the end portions of arms, which are pulled out along the substantially tangent line from opposed two places on a cylindrical outer peripheral surface 37 of the attaching base portion 33, are connected to each other by a top end portion 38a curved with a predetermined curvature.

This inner earphone 11 is assembled as described below. The speaker unit 12 is housed in the housing 22 consisting of the first cover 23 and the second cover 27, and the supporting member 32 for fitting in external ear is installed on the second cover side of the housing 22. Subsequently, the fastener 44 of the lid plate 43, which is the decorative member 42, is forcedly fitted in the locking hole 29 in the second cover 27.

FIG. 2 is a side view of the assembled inner earphone 11, viewed from the decorative member 42 side, and FIG. 3 is an appearance perspective view of the assembled inner earphone. As shown in FIG. 2, the attaching base portion 33 of the supporting member 32 for fitting in external ear is provided with a cord holding portion 17, and a connection cord 18 is pulled out of this cord holding portion 17.

Also, as shown in FIG. 3, a plug cover 52 having a sleeve 53 formed by a soft rubber elastic body is attached to the ear plug 24 provided on the first cover 23 as in the conventional example described before with reference to FIG. 11.

FIGS. 4(a) and 4(b) show states before and after the inner earphone 11 is mounted in the external ear 61, respectively. In FIG. 4(a) showing the whole of the external ear 61, reference character 61a denotes a helix, 62 denotes a tragus, 63 denotes an antitragus, 64 denotes an intertragic notch, 65 denotes a concha, 66 denotes an antihelix located on the inside of the helix 61a, and 67 denotes a groove portion located between the concha 65 and the antihelix 66.

Here, the positional relationship between the cord holding portion 17 and the external ear locking portion 38 is explained. When the cord holding portion 17 is arranged along the intertragic notch 64 of the external ear 61, the positional relationship between the cord holding portion 17 and the external ear locking portion 38 is determined so that the external ear locking portion 38 is arranged in the vicinity of the antitragus 63, and the top end portion 38a thereof intrudes into the groove portion 67 located between the concha 65 and the antihelix 66 and comes elastically into contact with the inner surface of the antihelix 66.

Since the supporting member 32 for fitting in external ear is attachable to and detachable from the housing 22 of the inner earphone 11, as shown in FIGS. 5(a) to 5(c), supporting members 32a to 32c for fitting in external ear in which the loop size of the external ear locking portion 38 is, for example, large, medium, and small are prepared so that the supporting member 32 for fitting in external ear can be replaced with respect to the housing 22 according to the size on request as shown in FIG. 6.

In the case where the supporting members 32a to 32c are replaceable with respect to the housing 22, as shown in FIG. 7, a slit 17a is provided in the cord holding portion 17 along the lengthwise direction thereof, by which the connection cord 18 pulled out of the speaker unit 12 can be laid in the cord holding portion 17 as shown in FIG. 8 when the supporting member 32 for fitting in external ear is replaced.

FIG. 9 is an explanatory view showing a modification of the supporting member 32 for fitting in external ear. FIG. 9(a) is a side view, and FIG. 9(b) is a front view. In this modification, the inner earphone is of a headset type having a microphone. The supporting member 32 for fitting in external ear is provided with an arm 39 extending from the attaching base portion 33 thereof, and a microphone 40 is supported at the tip end of the arm 39.

Therefore, according to this modification, as shown in FIG. 10, in a state in which the external ear locking portion 38 of the supporting member 32 for fitting in external ear is brought elastically into contact with the groove portion 67 located between the concha 65 and the antihelix 66, the inner earphone 11 can be used as a microphone-equipped earphone (headset) in which the microphone 40 is positioned near a mouth 60 of a user 59.

The inner earphone 11 in accordance with the present invention is used by inserting the ear plug 24 of the housing 22 in which the speaker unit 12 is incorporated into the external ear canal of the external ear 61. At this time, as shown in FIG. 4, the cord holding portion 17 of the connection cord 18 is preferably positioned along the intertragic notch 64 of the external ear 61 so that the housing 22 is held between the tragus 62 and the antitragus 63.

Thereby, the external ear locking portion 38 of the supporting member 32 for fitting in external ear is arranged in the vicinity of the antitragus 63, and the top end portion 38a of the external ear locking portion 38 is brought elastically into contact with the groove portion 67 located between the concha 65 and the antihelix 66, so that the housing 22 can be fixed surely to the external ear 61. Therefore, depending on the amount of force, the inner earphone 11 can be prevented from coming off even if an accidental tensile force is applied to the connection cord 18.

Also, since the external ear locking portion 38 is elastically deformable, even if the shape of the external ear 61 has a difference between individuals, the external ear locking portion 38 absorbs this difference so that the top end portion 38a can always be brought into contact with the groove portion 67. Moreover,

since the supporting member 32 for fitting in external ear is detachable from the housing 22, as shown in FIG. 5, for example, three supporting members 32a to 32c for fitting in external ear having different loop sizes of the external ear locking portions 38 are prepared, by which a supporting member 32 for fitting in  
5 external ear having the optimum size matching the shape of external ear of the user can be selected appropriately.

Furthermore, as shown in FIG. 3, the plug cover 52 consisting of a rubber elastic body is attached to the ear plug 24, and the sleeve 53 thereof is brought into close contact with the inner peripheral surface of the external ear canal, by  
10 which a sound from the outside is cut off and an internal sound does not leak to the outside, and also high reproducibility of the low range can be obtained. Also, the plug cover 52, together with the supporting member 32 for fitting in external ear, contributes to the holding of the inner earphone 11 in the external ear 61.

The above is an explanation of the present invention given based on an  
15 example shown in the figures, and the specific configuration of the present invention is not limited to this example. For example, the housing 22 may be formed so as not to have the ear plug 24.

## CLAIMS:

1. A supporting member for fitting in external ear, which is used to support an inner earphone in an external ear, wherein the supporting member comprises an attaching base portion attached to a housing in which a speaker unit of the inner earphone is incorporated; and an external ear locking portion formed into a loop shape which is provided so as to project from a part of the attaching base portion and is arranged in the vicinity of an antitragus so as to come elastically into contact with a groove portion between a concha and an antihelix when the housing is mounted in an external ear canal of the external ear.

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2. The supporting member for fitting in external ear according to claim 1, wherein in the attaching base portion, a microphone arranged near the mouth of a wearer of the inner earphone is supported via an arm member.

15 3. An inner earphone provided with the supporting member for fitting in external ear described in claim 1 or 2.

4. The inner earphone according to claim 3, wherein the housing has an ear plug inserted in an external ear canal, and the ear plug is provided with a plug  
20 cover formed of an elastic material that comes into contact with the external ear canal while being accompanied by elastic deformation.