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Inventor(s)	XIE; Zhao et al.

EARPHONES

Abstract

The present disclosure relates an earphone, comprising a shell assembly, a bone-conducting loudspeaker, and a fixing adhesive. The shell assembly is provided with an accommodation cavity. The bone-conducting loudspeaker is accommodated in the accommodation cavity. The bone-conducting loudspeaker is configured to vibrate along a central axis direction of the bone-conducting loudspeaker. The shell assembly and/or the bone-conducting loudspeaker is provided with a locating portion. The locating portion is configured to maintain a predetermined gap between an inner peripheral surface of the shell assembly and an outer peripheral surface of the bone-conducting loudspeaker along a radial direction of the bone-conducting loudspeaker. The fixing adhesive is filled in the predetermined gap and configured to connect the shell assembly to the bone-conducting loudspeaker. The present disclosure facilitates the adhesive fixation of the internal parts of the earphone and reduces the difficulty of assembling the earphone.

Inventors: **XIE; Zhao (Shenzhen, CN), XIE; Shuailin (Shenzhen, CN), ZHU; Guangyuan (Shenzhen, CN)**

Applicant: **SHENZHEN SHOKZ CO., LTD.** (Shenzhen, CN)

Family ID: **1000008616971**

Assignee: **SHENZHEN SHOKZ CO., LTD. (Shenzhen, CN)**

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The present application is a continuation of International Application No. PCT/CN2023/140254, filed on Dec. 20, 2023, which claims priority to Chinese Patent Application No. 202310541798.X, entitled Earphones, filed on May 12, 2023, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD
[0002] The present application relates to the technical field of electronic devices, and in particular, to earphones.
BACKGROUND
[0003] With the increasing prevalence of electronic devices, they have become indispensable social and entertainment tools in people's daily lives, leading to higher user expectations. Earphones, as a type of electronic device, are now widely used in daily life and can be paired with terminal devices such as mobile phones and computers to provide an immersive auditory experience. However, some shell assemblies of earphones are not easily secured with adhesive, making assembly more challenging.
SUMMARY
[0004] The present disclosure provides an earphone, comprising a shell assembly, a bone-conducting loudspeaker, and a fixing adhesive. The shell assembly is provided with an accommodation cavity. The bone-conducting loudspeaker is accommodated in the accommodation cavity, and the bone-conducting loudspeaker is provided to vibrate along a central axis direction of the bone-conducting loudspeaker. The shell assembly and/or the bone-conducting loudspeaker is provided with a locating portion, the locating portion is configured to maintain a predetermined gap between an inner peripheral surface of the shell assembly and an outer peripheral surface of the bone-conducting loudspeaker along a radial direction of the bone-conducting loudspeaker. The fixing adhesive is filled in the predetermined gap and configured to connect the shell assembly to the bone-conducting loudspeaker.
[0005] In some embodiments, there are a plurality of locating portions and the plurality of locating portions are spaced apart along a circumferential direction of the bone-conducting loudspeaker.
[0006] In some embodiments, the bone-conducting loudspeaker includes a vibration transmission sheet, the vibration transmission sheet includes a central fixing portion, an annular fixing portion around a periphery of the central fixing portion, and a linkage assembly connected between the central fixing portion and the annular fixing portion, and the locating portion is integrally molded to an outer ring edge of the annular fixing portion.
[0007] In some embodiments, the locating portion is integrally molded to the inner peripheral surface of the shell assembly.
[0008] In some embodiments, the bone-conducting loudspeaker includes a vibration transmission

sheet, the vibration transmission sheet includes a central fixing portion, an annular fixing portion around a periphery of the central fixing portion, and a linkage assembly connected between the central fixing portion and the annular fixing portion, the locating portion includes a first locating portion integrally molded to an outer ring edge of the annular fixing portion and a second locating portion integrally molded to the inner peripheral surface of the shell assembly.

[0009] In some embodiments, the first locating portion and the second locating portion are staggered from each other along a circumferential direction of the bone-conducting loudspeaker.

[0010] In some embodiments, the bone-conducting loudspeaker includes a voice coil assembly, a vibration transmission sheet, and a magnet assembly. The voice coil assembly is arranged around the magnet assembly, the vibration transmission sheet is elastically connected to the voice coil assembly and the magnet assembly to elastically constrain relative movement between the voice coil assembly and the magnet assembly along the central axis direction of the bone-conducting loudspeaker, and the fixing adhesive connects the shell assembly and the voice coil assembly.

[0011] In some embodiments, the voice coil assembly includes two sets of voice coils spaced apart along the central axis direction and a magnetic conduction shield arranged around an outer periphery of the two sets of voice coils. The magnet assembly includes a magnet and two magnetic conduction plates, the two magnetic conduction plates are arranged on opposite end surfaces of the magnet along the central axis direction, projections of the two magnetic conduction plates along the radial direction overlap with the two sets of voice coils, and current directions of the two sets of voice coils are opposite to each other.

[0012] In some embodiments, the earphone further comprises a wearing assembly. The shell assembly includes a shell and a shell, the shell and the shell fit with each other to form the accommodation cavity, the shell is connected to the wearing assembly, and the fixing adhesive connects the shell and the voice coil assembly.

[0013] In some embodiments, the shell and the shell fit with each other along the central axis direction, and the shell further presses and fixes the voice coil assembly to the shell.

[0014] In some embodiments, the bone-conducting loudspeaker includes a voice coil assembly, a magnet assembly, and a vibration transmission sheet. The vibration transmission sheet is elastically connected to the voice coil assembly and the magnet assembly to elastically constrain relative movement between the voice coil assembly and the magnet assembly along the central axis direction of the bone-conducting loudspeaker, one of the voice coil assembly and the magnet assembly is rigidly connected to the shell assembly. The shell assembly is provided with a stop member, and the stop member rigidly constrains a range of relative movement between the voice coil assembly and the magnet assembly along the central axis direction.

[0015] In some embodiments, the stop member is protrudingly arranged on a surface of the shell assembly directed toward another one of the voice coil assembly and the magnet assembly along the central axis direction and abuts against the vibration transmission sheet or the another one of the voice coil assembly and the magnet assembly after the another one of the voice coil assembly and the magnet assembly moves a predetermined distance relative to the one of the voice coil assembly and the magnet assembly.

[0016] In some implementations, the stop member is integrally molded to the shell assembly.

[0017] In some embodiments, the one of the voice coil assembly and the magnet assembly is arranged around the another one of the voice coil assembly and the magnet assembly. The vibration transmission sheet includes a central fixing portion, an annular fixing portion around a periphery of the central fixing portion, and a linkage assembly connected between the central fixing portion and the annular fixing portion. The annular fixing portion is connected to the one of the voice coil assembly and the magnet assembly, the central fixing portion is connected to the another one of the voice coil assembly and the magnet assembly, and the stop member includes a first stop member configured to abut against the central fixing portion.

[0018] In some embodiments, the stop member includes a second stop member configured to abut

against the linkage assembly.
[0019] In some embodiments, in a natural state, the linkage assembly has an extension component starting at the annular fixing portion and pointing toward an interior of the bone-conducting loudspeaker along the central axis direction. Along the central axis direction, a spacing from the first stop member to the central fixing portion is greater than a spacing from the second stop member to the linkage assembly.
[0020] In some embodiments, in the natural state, the second stop member abuts against the linkage assembly.
[0021] In some embodiments, the spacing from the first stop member to the central fixing portion is greater than or equal to 0.1 mm.
[0022] In some embodiments, along an extension direction of the linkage assembly, a position of the second stop member abutting against the linkage assembly is closer to the annular fixing portion compared to the central fixing portion.
[0023] In some embodiments, the shell assembly includes a first shell and a second shell fitting with each other along the central axis direction. The stop member is arranged on an inner surface of the first shell and/or an inner surface of the second shell, and an outer surface of the first shell and/or an outer surface of the second shell is in contact with a user's skin.
[0024] In some implementations, the voice coil assembly is arranged around the magnet assembly, and the voice coil assembly is rigidly connected to the first shell and/or second shell.
[0025] In some embodiments, the second shell further presses and fixes the voice coil assembly to the first shell.
[0026] The beneficial effect of the present disclosure is as follows: by maintaining the predetermined gap between the bone-conducting loudspeaker and the shell assembly along the circumferential direction of the bone-conducting loudspeaker can facilitate the addition of the fixing adhesive, thereby simplifying the process of producing the earphone. This allows the fixing adhesive to flow along the circumferential direction of the bone-conducting loudspeaker and fill the gap between the bone-conducting loudspeaker and the shell assembly more evenly, thereby enhancing the fixing effect of the fixing adhesive, stabilizing the position of the bone-conducting loudspeaker in the accommodation cavity, and rendering the structure of the earphone more compact and stable.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0027] To more clearly illustrate the technical solutions in the embodiments of the present disclosure, the accompanying drawings that need to be used in the description of the embodiments will be briefly introduced in the following, and it will be obvious that the accompanying drawings in the following description are only some of the embodiments of the present disclosure, and other attachments can be obtained according to them without creative labor to a person of ordinary skill in the art.
[0028] FIG. **1** is a schematic diagram illustrating a 3D structure of a general assembly of an earphone according to some embodiments of the present disclosure;
[0029] FIG. **2** is a schematic diagram illustrating a 3D structure of a portion between a core assembly and a wearing assembly shown in FIG. **1**;
[0030] FIG. **3** is an exploded structural diagram of the core assembly shown in FIG. **2**;
[0031] FIG. **4** is a schematic diagram illustrating a sectional structure of the core assembly shown in FIG. **2** along A-A;
[0032] FIG. **5** is a schematic diagram illustrating a sectional structure of the core assembly shown in FIG. **2** along B-B;

[0033] FIG. **6** is a schematic diagram illustrating a 3D structure of a bone-conducting loudspeaker shown in FIG. **3**;
[0034] FIG. **7** is an exploded schematic diagram of a bone-conducting loudspeaker shown in FIG. **3**;
[0035] FIG. **8** is a schematic diagram illustrating a sectional structure of the bone-conducting loudspeaker shown in FIG. **6** along C-C;
[0036] FIG. **9***a* is a schematic diagram illustrating sound signals in a first frequency band and a second frequency band in the earphone shown in FIG. **1**;
[0037] FIG. **9***b* is a schematic diagram illustrating frequencies of electrical signals input to a bone-conducting loudspeaker and an air-conducting loudspeaker of the earphone shown in FIG. **1** in a first operation mode;
[0038] FIG. **10***a* is a schematic diagram illustrating an exemplary structure of a detachable solution for a bone-conducting loudspeaker and an air-conducting loudspeaker of the earphone shown in FIG. **1**;
[0039] FIG. **10***b* is a schematic diagram illustrating an exemplary structure of the bone-conducting loudspeaker and the air-conducting loudspeaker shown in FIG. **10***a;*
[0040] FIG. **11** is a schematic diagram illustrating a 3D structure of an air-conducting loudspeaker shown in FIG. **3**;
[0041] FIG. **12** is an exploded schematic diagram of the air-conducting loudspeaker shown in FIG. **11**;
[0042] FIG. **13** is a schematic diagram illustrating a vibration transmission sheet shown in FIG. **7** from a front view;
[0043] FIG. **14** is a schematic diagram illustrating a portion of a sectional structure of the bone-conducting loudspeaker shown in FIG. **8**;
[0044] FIG. **15** is a schematic diagram illustrating an exemplary structure of an annular fixing portion of the vibration transmission sheet shown in FIG. **13**;
[0045] FIG. **16** is a schematic diagram illustrating an exemplary structure of a linkage assembly of the vibration transmission sheet shown in FIG. **13** connected to a central fixing portion;
[0046] FIG. **17** is another schematic diagram illustrating a disassembled structure of the core assembly shown in FIG. **2**;
[0047] FIG. **18** is a schematic diagram illustrating an exemplary structure of a bone-conducting loudspeaker shown in FIG. **17**;
[0048] FIG. **19** is a schematic diagram illustrating a portion of a disassembled structure of the core assembly shown in FIG. **17**;
[0049] FIG. **20** is a schematic diagram illustrating another sectional structure of the core assembly shown in FIG. **2** along B-B;
[0050] FIG. **21** is a schematic diagram illustrating an enlarged structure of an F-region shown in FIG. **20**;
[0051] FIG. **22** is another schematic diagram illustrating a portion of a disassembled structure of the core assembly shown in FIG. **18**;
[0052] FIG. **23** is a schematic diagram illustrating a sectional structure of the core assembly shown in FIG. **2**; and
[0053] FIG. **24** is a schematic diagram illustrating a portion of a sectional structure of the core assembly shown in FIG. **23**.

DETAILED DESCRIPTION

[0054] The present application is described in further detail below in conjunction with the accompanying drawings and embodiments. In particular, it is noted that the following embodiments are only used to illustrate the present disclosure, but do not limit the scope of the present disclosure. Similarly, the following embodiments are only part of the embodiments of the present disclosure rather than all of the embodiments, and all other embodiments obtained by a person of

ordinary skill in the art without creative labor fall within the scope of protection of the present disclosure.
[0055] References to “embodiments” in the present disclosure mean that particular features, structures, or characteristics described in conjunction with embodiments may be included in at least one embodiment of the present disclosure. It is understood by those of skill in the art, both explicitly and implicitly, that the embodiments described in the present disclosure may be combined with other embodiments.
[0056] The following embodiments of the present disclosure describe an exemplary structure of an earphone **100**.
[0057] As shown in FIG. **1**, the earphone **100** may include a core assembly **1**, an ear-hook assembly **2**, and a rear-hook assembly **3**. There may be two core assemblies **1**. The two core assemblies **1** are used to transmit vibration and/or sound to the user's left ear and right ear, respectively. The two core assemblies **1** may be the same or different. For example, one of the core assemblies **1** may be provided with a microphone, and another core assembly **1** may not be provided with a microphone. For example, one of the core assemblies **1** may be provided with a key and a corresponding circuit board, and another core assembly **1** may not be provided with a key and a corresponding circuit board. The two core assemblies **1** may be identical on a core module (e.g. a loudspeaker module). The core assembly **1** described in the following text can be considered as being detailed with one of the two core assemblies **1** as an example. There may be two ear-hook assemblies **2**, and the two ear-hook assemblies **2** may be located on the user's left and right ears, respectively, so that the core assemblies **1** can be fitted to the user's face. For example, one of the ear-hook assemblies **2** may be provided with a battery, and another ear-hook assembly **2** may be provided with a control circuit, or the like. One end of the ear-hook assembly **2** is connected to the core assembly **1**, and another end of the ear-hook assembly **2** is connected to the rear-hook assembly **3**. The rear-hook assembly **3** connects the two ear-hook assemblies **2**, and the rear-hook assembly **3** is used to wrap around the back of a user's neck or the back of a user's head and provide a clamping force that allows the two core assemblies **1** to be clamped to two sides of a user's face and the ear-hook assemblies **2** to be more securely attached to the user's ears. It should be understood that the earphone **100** may also not include the rear-hook assembly **3**, and the core assembly **1** may be worn on the user's ears through the ear-hook assembly **2**.
[0058] The following content primarily provides an exemplary description of the core assembly **1** and other structures of the earphone **100**.
[0059] As shown in FIG. **2**, FIG. **3**, FIG. **4**, and FIG. **5**, the core assembly **1** may include a shell assembly **10**, a bone-conducting loudspeaker **11**, and an air-conducting loudspeaker **12**.
[0060] Optionally, the shell assembly **10** may be provided with an accommodation cavity **1001** and an accommodation cavity **1002** that are isolated from each other. The shell assembly **10** may also be referred to as a core shell assembly **10**. The bone-conducting loudspeaker **11** is accommodated in the accommodation cavity **1001**, and the accommodation cavity **1001** may be referred to as a first accommodation cavity. The air-conducting loudspeaker **12** is accommodated in the accommodation cavity **1002**, and the accommodation cavity **1002** may be referred to as a second accommodation cavity.
[0061] The air-conducting loudspeaker **12** conducts the sound into the ear canal of the user through air vibration, and the bone-conducting loudspeaker **11** conducts the sound into the user through bone-conducting vibration. Optionally, the sealing performance of the accommodation cavity **1001** is greater than the sealing performance of the accommodation cavity **1002**. The sealing performance can be considered as airtightness. Optionally, the accommodation cavity **1001** may be provided as a completely airtight accommodation cavity, and the accommodation cavity **1002** is provided as an accommodation cavity with a relatively high degree of sealing performance while guaranteeing sound generation of the air-conducting loudspeaker **12**. In the above-described manner, as the accommodation cavity **1002** in which the air-conducting loudspeaker **12** is placed

needs to be connected to the outside world to facilitate the conduction of the sound waves through the air, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are separately and independently arranged. There is no need to set the bone-conducting loudspeaker **11** in the accommodation cavity **1002**. Instead, the bone-conducting loudspeaker **11** is separately arranged in the accommodation cavity **1001**, and since the accommodation cavity **1001** is independent, it is possible to set the sealing performance of the accommodation cavity **1001** at a higher level, which effectively enhances the sealing effect of the bone-conducting loudspeaker **11**, thereby preventing the bone-conducting loudspeaker **11** from being damaged by erosion of the external environmental factors, and at the same time guaranteeing the sound quality effect of the air-conducting loudspeaker **12**. Additionally, in the earphone **100**, when the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are operating at the same time, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are arranged in the accommodation cavity **1001** and the accommodation cavity **1002**, respectively, which can effectively reduce mutual interference between the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12**, thereby effectively enhancing the sound quality of the earphone **100**.

[0062] Optionally, referring to FIG. **2** and FIG. **3**, the shell assembly **10** may include a shell **101**, a shell **102**, and a shell **103**, and the shell **101** and the shell **102** fit with each other to form the accommodation cavity **1001**. The shell **101** and/or the shell **102** further form a portion of the accommodation cavity **1002**, and the shell **103** may form another portion of the accommodation cavity **1002**, and in turn, the shell **103** and the shell **101** and/or the shell **102** fit with each other to form the accommodation cavity **1002**.

[0063] The shell assembly **10** may be composed of the shell **101**, the shell **102**, and the shell **103**. The shell **101** and the shell **102** fit with each other to form the accommodation cavity **1001**, and the shell **103** and the shell **101** fit with each other to form the accommodation cavity **1002**. The shell assembly **10** is formed by the shell **101**, the shell **102** and the shell **103** fitting with each other in the structure described above, which can make the core assembly **1** compact and at the same time facilitate the assembly of the core assembly **1**, thereby enhancing the assembly efficiency of the core assembly **1**. In some embodiments, the shell **101** may be referred to as a first shell; the shell **102** may be referred to as a second shell; and the third shell **103** may be referred to as a third shell.

[0064] As another example, a portion of the accommodation cavity **1002** may also be provided in the shell **102**. The shell **103** and the shell **102** form the accommodation cavity **1002** by fitting with each other, or the shell **101** and the shell **102** fit with each other to form a portion of the accommodation cavity **1002**, and the shell **103**, the shell **101**, and the shell **102** fit with each other to form the accommodation cavity **1002**.

[0065] Through the above structure, it is possible to place the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** in the accommodation cavity **1001** and the accommodation cavity **1002** which are independent of each other, respectively, reducing the mutual influence between the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12**. This setup maximizes the acoustic output of both the air-conducting loudspeaker **12** and the bone-conducting loudspeaker **11**, while enabling a compact structure of the core assembly **1**, which in turn contributes to the miniaturization of the core assembly **1** and facilitates its assembly, thereby improving the assembly efficiency of the core assembly **1**.

[0066] Optionally, a vibration direction of the bone-conducting loudspeaker **11** is arranged to intersect with a vibration direction of the air-conducting loudspeaker **12**, and the shell **101** and the shell **102** fit along the vibration direction of the bone-conducting loudspeaker **11**. The shell **103** fits with the shell **101** and/or the shell **102** along the vibration direction of the air-conducting loudspeaker **12**.

[0067] Specifically, the vibration direction of the bone-conducting loudspeaker **11** is arranged to intersect with the vibration direction of the air-conducting loudspeaker **12**. The vibration direction of the bone-conducting loudspeaker **11** is referred to as a bone-conducting vibration direction X**1**, and the vibration direction of the air-conducting loudspeaker **12** is referred to herein as an air-conducting vibration direction X**2**, wherein the bone-conducting vibration direction X**1** and the air-conducting vibration direction X**2** are arranged to intersect rather than being parallel to each other. For example, the bone-conducting vibration direction X**1** and the air-conducting vibration direction X**2** are arranged perpendicularly or approximately perpendicular to each other (e.g., 90°±10°). When the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are operating at the same time, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are vibrating along the bone-conducting vibration direction X**1** and the air-conducting vibration direction X**2**, respectively. Since the two vibration directions are arranged to intersect with each other, this can effectively mitigate the impact of the bone-conducting loudspeaker **11**'s vibration on the sound quality of the air-conducting loudspeaker **12**. Further, the shell **101** and the shell **102** may be assembled in conjunction with each other along the bone-conducting vibration direction X**1**, and the shell **103** and the shell **101** may be assembled in conjunction with each other along the air-conducting vibration direction X**2**. For example, the accommodation cavity **1002** may be formed by only the shell **101** and the shell **103** fitting together, with the shell **103** having a fitting relationship only with the shell **101** along the air-conducting vibration direction X**2**. As another example, instead of fitting with the shell **101** to form the accommodation cavity **1002**, the shell **103** may fit with other shells along the air-conducting vibration direction X**2** to form the accommodation cavity **1002**, or the shell **103** may fit with the shell **101** and other shells to form the accommodation cavity **1002**. In this way, it is favorable for the assembly of the core assembly **1** to enhance the efficiency of the assembly of the core assembly **1**.

[0068] Referring to FIG. **6** and FIG. **7**, optionally, the bone-conducting loudspeaker **11** includes a voice coil assembly **111** and a magnet assembly **112**. The voice coil assembly **111** is provided around the magnet assembly **112** and is fixedly connected to the shell **101** and/or the shell **102**. The surface of the shell **101** and/or the shell **102** that is disposed opposite to the bone-conducting loudspeaker **11** along the vibration direction of the bone-conducting loudspeaker **11** is configured to contact the user's skin and transmit bone-conducting vibration.

[0069] Optionally, referring to FIG. **6**, FIG. **7**, and FIG. **8**, the voice coil assembly **111** includes two sets of voice coils **1110** spaced apart along a central axis direction Z of the bone-conducting loudspeaker **11** and a magnetic conduction shield **1111** surrounding an outer periphery of the two sets of voice coils **1110**. The magnet assembly **112** includes a magnet **1121** and two magnetic conduction plates **1122**, and the two magnetic conduction plates **1122** are respectively disposed on opposite end surfaces of the magnet **1121** along the central axis direction Z. Projections of the two magnetic conduction plates **1122** along a radial direction of the bone-conducting loudspeaker **11** overlap with the two sets of voice coils **1110**, respectively, and current directions of the two sets of voice coils **1110** are opposite to each other. The central axis direction Z of the bone-conducting loudspeaker **11** coincides with the vibration direction of the bone-conducting loudspeaker **11** (i.e., the bone-conducting vibration direction X**1**).

[0070] Optionally, referring to FIG. **5**, FIG. **7** and FIG. **8**, an outer peripheral surface of the magnetic conduction shield **1111** may be in contact with the shell assembly **10** and/or fixedly connected to the shell assembly **10** by an adhesive material, whereby the bone-conducting loudspeaker **11** and the shell assembly **10** can be rigidly connected/rigidly contacted, such that the bone-conducting loudspeaker **11** can be securely accommodated within the accommodation cavity **1001**. Further, the outer peripheral surface of the magnetic conduction shield **1111** may be completely in contact with the shell assembly **10** or a portion of the outer peripheral surface may be in contact with the shell assembly **10**. Further, a portion of the outer peripheral surface of the magnetic conduction shield **1111** may be partially connected to the shell assembly **10** and another portion may be fixedly connected to the shell assembly **10** by an adhesive material. For the portion in contact with the shell assembly **10**, the shell assembly **10** and/or the outer peripheral surface of the magnetic conduction shield **1111** may be provided with a structure such as a supporting rib,

supporting bump, or the like, to realize the partial contact between the two.
[0071] For example, the outer peripheral surface of the magnetic conduction shield **1111** is in contact with the shell assembly **10** and/or is fixedly connected to the shell assembly **10** by an adhesive material along at least two normal directions perpendicular to each other (a normal direction of the outer peripheral surface of the magnetic conduction shield **1111**). Optionally, the outer peripheral surface of the magnetic conduction shield **1111** is in contact with the shell assembly **10** along a first direction and/or is fixedly connected to the shell assembly **10** by an adhesive material. For example, the outer peripheral surface of the magnetic conduction shield **1111** is in contact with the shell assembly **10** along a second direction and/or is fixedly connected to the shell assembly **10** by an adhesive material. For example, the first direction includes a first positive direction and a first negative direction that are opposite to each other. For example, the outer peripheral surface of the magnetic conduction shield **1111** is in contact with the shell assembly **10** and/or is fixedly connected to the shell assembly **10** by an adhesive material along the first positive direction and/or along the first negative direction. The second direction includes a second positive direction and a second negative direction that are opposite to each other. For example, the outer peripheral surface of the magnetic conduction shield **1111** is in contact with the shell assembly **10** and/or is fixedly connected to the shell assembly **10** by an adhesive material along the second positive direction and/or the second negative direction. The first direction is perpendicular to the second direction. The perpendicular mentioned here may allow for some deviation, such as angles ranging from 80° to 100°, all of which can be considered perpendicular.
[0072] As shown in FIG. **7**, the outer peripheral surface of the magnetic conduction shield **1111** may include, for example, two opposite first outer side surfaces and two opposite second outer side surfaces. Each of the second outer side surfaces is located between the two first outer side surfaces, and the two second outer side surfaces and the two first outer side surfaces enclose an annular structure. For example, each of the first outer side surfaces is in contact with and/or fixedly connected to the shell assembly **10** by an adhesive material, and each of the second outer side surfaces is in contact with and/or fixedly connected to the shell assembly **10** by an adhesive material. For example, the two first outer side surfaces may be arranged opposite along the first direction, and the two second outer side surfaces may be arranged opposite along the second direction. For example, the first direction may be a direction X**2** illustrated in FIG. **5** and the second direction may be a direction LD illustrated in FIG. **5**.
[0073] Optionally, each of the second outer side surfaces and the two first outer side surfaces may be connected directly at an angle (corner) to each other, e.g. vertically. The transition between each second outer side surface and the two first outer side surfaces may also be curved, such as being connected by a curved connection surface. In this way, there is at least one curved connection surface between the two second outer side surfaces and the two first outer side surfaces. For example, there are four curved connection surfaces. Further, at least one curved connection surface is in contact with the shell assembly **10** or is fixedly connected to the shell assembly **10** by an adhesive material, or four curved connection surfaces are in contact with the shell assembly **10** or are fixedly connected to the shell assembly **10** by an adhesive material.
[0074] Set up in this way, a rigid contact/rigid connection can be realized between the bone-conducting loudspeaker **11** and the shell assembly **10**, effectively improving the overall strength of the shell assembly **10** and making the vibration transmission between the two more efficient, thereby reducing noises and sound leakage.
[0075] Referring to FIG. **9***a*, optionally, the earphone **100** includes a first operation mode and a second operation mode. In the first operation mode, the bone-conducting loudspeaker **11** plays sound signals in a first frequency band P**1**, and the air-conducting loudspeaker **12** plays sound signals in a second frequency band P**2**. In the second operation mode, the bone-conducting loudspeaker **11** plays sound signals in the first frequency band P**1** and sound signals in the second frequency band P**2**, and the first frequency band P**1** and the second frequency band P**2** are at least

partially offset in a frequency domain. For example, if the first frequency band P**1** and the second frequency band P**2** do not overlap in the frequency domain, a frequency range of the first frequency band P**1** is higher than a frequency range of the second frequency band P**2**. For example, if the first frequency band P**1** and the second frequency band P**2** partially overlap in the frequency domain, a frequency range of an offset portion of the first frequency band P**1** is higher than a frequency range of an offset portion of the second frequency band P**2**.

[0076] In some embodiments, the earphone **100** includes a frequency division point n (as shown in FIG. **9***a*), the first frequency band P**1** includes a frequency band that is greater than the frequency division point n, and the second frequency band P**2** includes a frequency band that is lower than the frequency division point n. The frequency division point n is located at an intersection point of the first frequency band P**1** and the second frequency band P**2**. When the earphone **100** is in the first operation mode, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are operating together, the bone-conducting loudspeaker **11** mainly outputs sound signals in the first frequency band P**1**, and the air-conducting loudspeaker **12** mainly outputs sound signals in the second frequency band P**2**. That is, an operation frequency band of the bone-conducting loudspeaker **11** includes a frequency band greater than the frequency division point n, and an operation frequency band of the air-conducting loudspeaker **12** includes a frequency band lower than the frequency division point n.

[0077] Referring to FIG. **9***b*, FIG. **9***b* illustrates an electrical signal band P**3** input into the bone-conducting loudspeaker **11** and an electrical signal band P**4** input into the air-conducting loudspeaker **12**, respectively, when the earphone **100** is in the first operation mode. In some embodiments, the electrical signal band P**3** of the bone-conducting loudspeaker **11** and the electrical signal band P**2** of the air-conducting loudspeaker **12** have an overlapping intersection point m. The frequency division point n is located within a frequency range of 0.5 to 3 times the frequency span of the overlapping intersection point m. For example, if the overlapping intersection point m is 300 Hz, the frequency division point n may be located in a range of 150 Hz to 900 Hz, such as 500 Hz.

[0078] In some embodiments, the first frequency band P**1** includes a mid-high frequency or a high frequency, and the second frequency band P**2** includes a mid-low frequency or a low frequency. For example, a low-frequency range of 30 Hz to 150 Hz is considered a low-frequency band, a mid-frequency range of 150 Hz to 500 Hz is a mid-low frequency band, and 500 Hz to 5 KHz is a mid-high frequency band, and a high-frequency range of 5 KHz to 16 KHz is a high-frequency band.

[0079] When the earphone **100** is in the first operation mode, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** are operating together, the bone-conducting loudspeaker **11** mainly outputs sound signals in the first frequency band P**1**, and the air-conducting loudspeaker **12** mainly outputs sound signals in the second frequency band P**2**. In the earphone **100**, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** operate together, wherein the bone-conducting loudspeaker **11** outputs the sound signals in the first frequency band P**1** and the air-conducting loudspeaker **12** outputs the sound signals in the second frequency band P**2**. These signals are combined to form a more complete sound signal that is transmitted to the user's ear, which enhances the sound quality of the mid-low frequency band of the sound signal emitted by the earphone **100**, thereby significantly improving the overall sound quality of the sound signal emitted by the earphone **100**. Furthermore, the bone-conducting loudspeaker **11** may also operate separately, i.e., in the second operation mode, the air-conducting loudspeaker **12** does not work, and the bone-conducting loudspeaker **11** may simultaneously output sound signals in the first frequency band P**1** and sound signals in the second frequency band P**2**. For example, when the earphone **100** is working in an environment where the user is sweating heavily during exercise or where the user is in a humid and rainy environment, the earphone **100** may actively cut off the operation of the air-conducting loudspeaker **12**, and only the bone-conducting loudspeaker **11** is used for sound generation, thereby ensuring the overall sound quality of the sound signal emitted by the earphone **100** while preventing the air-conducting loudspeaker **12** from being eroded by unfavorable factors such as sweat or rain, effectively enhancing the reliability and stability of the earphone **100**.

[0080] Optionally, the earphone **100** may further include a third operation mode. In the third operation mode, the air-conducting loudspeaker **12** plays sound signals in the first frequency band P**1** and the second frequency band P**2**. Specifically, the earphone **100** switches to the third operation mode in response to detecting that the bone-conducting loudspeaker **11** is damaged and unavailable or that the environment in which the earphone **100** is currently located is unfavorable for the bone-conducting loudspeaker **11** to operate. In the third operation mode, the air-conducting loudspeaker **12** operates alone and outputs sound signals in the first frequency band P**1** and the second frequency band P**2**, to ensure that the earphone **100** can output high-quality sound signals normally.

[0081] An alternative embodiment of the shell assembly **10** as illustrated in FIG. **10***a* and FIG. **10***b* is described below, and different from the shell assembly **10** described above, the shell assembly **10** hereinafter includes a first portion **1003** and a second portion **1004**, with the first portion **1003** being connected to a wearing assembly **27** (as illustrated in FIG. **1** and FIG. **2**). The second portion **1004** is detachably connected to the first portion **1003** or the wearing assembly **27**. The bone-conducting loudspeaker **11** is provided on the first portion **1003**, and the air-conducting loudspeaker **12** is provided on the second portion **1004** and can be removed from the wearing assembly **27** in a detachable manner. In other words, the shell assembly **10** includes the detachable first portion **1003** and the detachable second portion **1004**. The bone-conducting loudspeaker **11** is provided on the first portion **1003**, the air-conducting loudspeaker **12** is provided on the second portion **1004**, and the second portion **1004** is detachably connected to the first portion **1003** or the wearing assembly **27**. With this arrangement, the air-conducting loudspeaker **12** can be separately detachable from the rest of the components on the earphone **100**, and the bone-conducting loudspeaker **11** can continue to operate after the air-conducting loudspeaker **12** is separately detached. Separately detaching the air-conducting loudspeaker **12** from the other components of the earphone **100** can enhance the environmental adaptability of the earphone **100**, which allows the air-conducting loudspeaker **12** to be quickly detached from the earphone **100** in extreme environments, such as when the user is sweating heavily during exercise or in humid and rainy conditions, preventing damage to the air-conducting loudspeaker **12**. Meanwhile, the earphone **100** can continue to output high-quality sound signals through the bone-conducting loudspeaker **11**. When only the bone-conducting loudspeaker **11** in the earphone **100** is operating alone, the earphone **100** can control the bone-conducting loudspeaker **11** to operate through the second operation mode, to ensure the sound quality of the sound signals output by the earphone **100**. Furthermore, the second portion **1004** is detachably connected to the first portion **1003** or the wearing assembly **27**, which facilitates the replacement of the second portion **1004**. On one hand, this allows for the replacement with the air-conducting loudspeaker **12** of different performance characteristics, and on the other hand, it also makes maintenance easier.

[0082] Optionally, as shown in FIG. **10***b*, the earphone **100** has a wire group for supplying power and/or audio signals to, for example, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12**. The wire group may be connected within the first portion **1003**. The first portion **1003** may be provided with a first electrode portion **10031**, and the second portion **1004** may be provided with a second electrode portion **10041**. After the first portion **1003** and the second portion **1004** are detachably assembled, the first electrode portion **10031** and the second electrode portion **10041** are in contact and can be electrically connected. The first electrode portion **10031** and the second electrode portion **10041** may have various structures, for example, the first electrode portion **10031** includes at least two first electrode contacts. The second electrode portion **10041** includes at least two second electrode contacts, and the at least two first electrode contacts and the at least two second electrode contacts may be in one-to-one correspondence. For example, one of the first electrode portion **10031** and the second electrode portion **10041** includes a pogo pin, and another includes a leaf spring or contact. The electrical connection is established through the contact between the pogo pin and the leaf spring or contact. For example, the first electrode portion **10031** and the second electrode portion **10041** each includes a leaf spring, and the electrical connection is realized by the elastic contact between the leaf springs of the first electrode portion **10031** and the second electrode portion **10041**. As another example, the first electrode portion **10031** and the second electrode portion **10041** include other forms. For example, the first electrode portion **10031** includes a plurality of ring electrodes that are nested together, and the second electrode portion **10041** includes a plurality of ring electrodes that are nested together. The first electrode portion **10031** and the second electrode portion **10041** may establish an electrical connection through the corresponding contact between their ring electrodes. The first electrode portion **10031** and the second electrode portion **10041** are not limited to the examples listed above, and the first electrode portion **10031** and the second electrode portion **10041** are configured to ensure electrical connection when the first portion **1003** and the second portion **1004** are assembled and to allow for their separation after disassembly.

[0083] In some implementations, the wire group is coupled to the bone-conducting loudspeaker **11** and the first electrode portion **10031**, and the second electrode portion **10041** is coupled to the air-conducting loudspeaker **12**. After the second portion **1004** and the first portion **1003** are assembled, the first electrode portion **10031** and the second electrode portion **10041** are in contact with each other correspondingly and are conductive such that the wire group is also capable of powering and/or providing audio signals to the air-conducting loudspeaker **12**.

[0084] In other embodiments, the first electrode portion **10031** is coupled to the bone-conducting loudspeaker **11**, and the second electrode portion **10041** is coupled to the air-conducting loudspeaker **12**. The wire group is coupled to at least two first electrode portions **10031**, and the wire group may supply power and/or audio signals to the bone-conducting loudspeaker **11** through the first electrode portion **10031**, and may also supply power and/or audio signals to the air-conducting loudspeaker **12** through the contact between the first electrode portion **10031** and the second electrode portion **10041**.

[0085] As another example, the wire group may also be connected to the second portion **1004**, the first portion **1003** is detachably connected to the second portion **1004**, and a specific connection relationship can be referred to the above description.

[0086] The first portion **1003** is provided with a first connection portion **10032**, and the second portion **1004** is provided with a second connection portion **10042**. The first connection portion **10032** and the second connection portion **10042** are detachably connected by snap-fit, adhesion, magnetic suction, threaded connection, or the like. For example, the first connection portion **10032** may be provided as one of a slot or a snap, and the second connection portion **10042** may be provided as another of a slot or a snap. The first portion **1003** and the second portion **1004** are detachably connected by a snap-fit mechanism, allowing the first electrode portion **10031** and the second electrode portion **10041** to contact each other and establish an electrical connection.

[0087] Referring to FIG. **3** and FIG. **5**, optionally, the shell assembly **10** may also be provided with a pressure relief hole **1081** for connecting the accommodation cavity **1002** to the external environment. The pressure relief hole **1081** is provided to extend toward the side where the accommodation cavity **1001** is located. Specifically, the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** may be accommodated in the accommodation cavity **1001** and the accommodation cavity **1002**, respectively, and the shell assembly **10** is provided with the pressure relief hole **1081** for relieving pressure for the air-conducting loudspeaker **12**. The pressure relief hole **1081** enables the accommodation cavity **1002** to be in communication with the external environment, and the pressure relief hole **1081** extends from the connection position with the accommodation cavity **1002** toward the side where the accommodation cavity **1001** is located. For example, a portion of a hole wall of the pressure relief hole **1081** extends from the connection

position with the accommodation cavity **1002** toward the side where the accommodation cavity **1001** is located. With this setup, it is possible to effectively reduce the shell space occupied by the pressure relief hole **1081** on a periphery of the accommodation cavity **1002**, making efficient use of the space between the accommodation cavity **1001** and the accommodation cavity **1002**. This improves the spatial utilization of the shell assembly **10**, enabling a more compact and reasonable configuration while meeting the sound production requirements of the air-conducting loudspeaker **12**. Besides, such an inclined extension can increase the dimension of the pressure relief hole **1081**, which makes it possible to provide the air-conducting loudspeaker **12** with better sound quality.
[0088] Optionally, a projection of the pressure relief hole **1081** along a direction X**3** (shown in FIG. **5**) perpendicular to an arrangement direction of the accommodation cavity **1001** and the accommodation cavity **1002** at least partially overlaps with the accommodation cavity **1001**. The direction X**3** perpendicular to the arrangement direction of the accommodation cavity **1001** and the accommodation cavity **1002** may be understood as a direction perpendicular to the bone-conducting vibration direction X**1** and perpendicular to the air-conducting vibration direction X**2**. The projection of the pressure relief hole **1081** along the direction X**3** at least partially overlaps with the accommodation cavity **1001**, which ensures that the dimension of the pressure relief hole **1081** satisfies the pressure relief requirements of the air-conducting loudspeaker **12**. At the same time, this arrangement effectively reduces the space occupied by the pressure relief hole **1081** and the corresponding shell portion, thereby reducing the structural dimension of the shell assembly **10** in the region where the air-conducting loudspeaker **12** is located.
[0089] Further, the pressure relief hole **1081** is provided to extend inclined toward the side on which the accommodation cavity **1001** is located, and along the direction X**3** perpendicular to the arrangement direction of the accommodation cavity **1001** and the accommodation cavity **1002**, the dimension of the pressure relief hole **1081** gradually increases in the direction from the accommodation cavity **1002** to the external environment. In other words, while the pressure relief hole **1081** extends inclined toward the accommodation cavity **1001**, the dimension of the pressure relief hole **1081** gradually increases in the direction from the accommodation cavity **1002** to the external environment, which makes the air discharge smoother, and can reduce the velocity of the air, thereby enhancing the sound quality of the sound emitted by the earphone **100**.
[0090] Referring to FIG. **3**, FIG. **4**, and FIG. **5**, the shell assembly **10** includes a partition wall **1012** for isolating the accommodation cavity **1001** from the accommodation cavity **1002**. At least a portion of the partition wall **1012** extends toward the side on which the accommodation cavity **1001** is located, and forms a portion of the hole wall of the pressure relief hole **1081**.
[0091] Specifically, in a cross-section perpendicular to a vibration direction (i.e., the bone-conducting vibration direction X**1**) of the bone-conducting loudspeaker **11**, the bone-conducting loudspeaker **11** has a long-side edge **1101** and a short-side edge **1102**, with the long-side edge **1101** being longer than the short-side edge **1102**. The partition wall **1012** includes a wall segment **1013** and a wall segment **1014**. The wall segment **1013** is disposed side-by-side with the long-side edge **1101**, and the wall segment **1014** is connected to the wall segment **1013** and extends from a periphery of the connection between the long-side edge **1101** and the short-side edge **1102** toward the side on which the accommodation cavity **1001** is located. The wall segment **1014** is used to form a portion of the hole wall of the pressure relief hole **1081**. In some embodiments, the wall segment **1013** may be referred to as a first wall segment and the wall segment **1014** may also be referred to as a second wall segment.
[0092] The above spatial layout and structural arrangement of the pressure relief hole **1081** may be realized by the shell assembly **10**. It should be understood that the above spatial layout and structural arrangement of the pressure relief hole **1081** may also be realized by other solutions, which will not be discussed in detail herein. In addition to the earphone **100** provided with both the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12**, the above spatial layout and structural arrangement of the pressure relief hole **1081** may also be applied to the earphone **100**

provided with only the air-conducting loudspeaker **12**, which will not be described in detail herein.
[0093] Optionally, as shown in FIG. **3**, a central axis Z of the bone-conducting loudspeaker **11** (a central axis direction of the bone-conducting loudspeaker **11** may also be denoted by Z) may intersect with a central axis V of the air-conducting loudspeaker **12**, or may not intersect with the central axis V of the air-conducting loudspeaker **12**. For example, the central axis Z and the central axis V are skew lines, not lying in the same plane, and are arranged in a staggered manner. In a direction perpendicular to the central axis Z and the central axis V, the central axis Z is disposed farther away from the pressure relief hole **1081** compared to the central axis V. Generally speaking, along an LD direction shown in FIG. **5**, the bone-conducting loudspeaker **11** is located farther away from the pressure relief hole **1081** compared to the air-conducting loudspeaker **12**. By setting the central axis Z and the central axis V to be skew lines and by setting the central axis Z farther away from the pressure relief hole **1081** as compared to the central axis V, a larger space can be made available for the design of the pressure relief hole **1081**, which in turn allows the dimension of the pressure relief hole **1081** to be larger, thereby enhancing the pressure relief effect.
[0094] Optionally, the distance between the central axis Z and the central axis Vis in a range of 0.3 mm to 1 mm, in a range of 0.5 mm to 0.8 mm, such as 0.6 mm, 0.7 mm, or in a range of 0.2 mm to 1.2 mm. By setting the above dimensions, on the one hand, it is possible to ensure the sound quality effect of the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** while keeping the core assembly **1** small, and on the other hand, it is possible to provide a larger space for setting the pressure relief hole **1081**, which in turn allows for the setting of a larger pressure relief hole **1081**.
[0095] As mentioned above, the shell assembly **10** includes the shell **101**, the shell **102**, and the shell **103**. The partition wall **1012** may be disposed on the shell **101** and/or the shell **102**, and the shell **101** and the shell **102** fit with each other to form the accommodation cavity **1001** and the pressure relief hole **1081**. For example, the shell **101** and/or the shell **102** further form a portion of the accommodation cavity **1002**. For example, the shell **103** may form another portion of the accommodation cavity **1002**, with the shell **103** fitting with the shell **101** and/or the shell **102** to form the accommodation cavity **1002**. The partition wall **1012** disposed on the shell **101** and/or the shell **102** may be understood as the partition wall **1012** being a part of the shell **101** and/or the shell **102**. It should be understood that how the partition wall **1012** is disposed is not limited to be disposed on the shell **101** and/or the shell **102**. In other embodiments, the partition wall **1012** may be a component that is independent of the shell **101** and/or the shell **102**.
[0096] As shown in FIG. **3**, the partition wall **1012** is disposed on the shell **101**, and the shell **101** is provided with a sub-accommodation cavity **1010** and a sub-accommodation cavity **1011** located on opposite sides of the partition wall **1012**. An opening direction of the sub-accommodation cavity **1010** is oriented toward a wall surface of the partition wall **1012**. Specifically, the opening direction of the sub-accommodation cavity **1010** is parallel or substantially parallel to the wall surface of the partition wall **1012**. The opening direction of the sub-accommodation cavity **1011** intersects with the wall surface of the partition wall **1012**. The shell **102** is provided with a sub-accommodation cavity **1020**, the shell **102** is capped at an open end of the sub-accommodation cavity **1010**, and the sub-accommodation cavity **1020** fits with the sub-accommodation cavity **1010** to form the accommodation cavity **1001**. The shell **103** is provided with a sub-accommodation cavity **1030**, the shell **103** is capped at an open end of the sub-accommodation cavity **1011**, and the sub-accommodation cavity **1030** fits with the sub-accommodation cavity **1011** to form the accommodation cavity **1002**. In some embodiments, the sub-accommodation cavity **1010** may also be referred to as a first sub-accommodation cavity, the sub-accommodation cavity **1011** may also be referred to as a second sub-accommodation cavity, the sub-accommodation cavity **1020** may also be referred to as a third sub-accommodation cavity, and the sub-accommodation cavity **1030** may also be referred to as a fourth sub-accommodation cavity.
[0097] By providing the partition wall **1012** to divide the shell **101** into the sub-accommodation

cavity **1010** whose opening direction is oriented towards the wall surface of the partition wall **1012** and the sub-accommodation cavity **1012** that intersects with the wall surface of the partition wall **1012**, both the sub-accommodation cavity **1010** and the sub-accommodation cavity **1012** can have larger spaces. This improves the spatial utilization of the shell **101** and helps reduce mutual interference caused by vibrations between the bone-conducting loudspeaker **11** and the air-conducting loudspeaker **12** during operation, thereby enhancing sound quality.

[0098] As shown in FIG. **4**, the air-conducting loudspeaker **12** includes a vibration diaphragm **123**. The vibration diaphragm **123** divides the accommodation cavity **1002** into a cavity portion **1006** disposed on the side of the vibration diaphragm **123** away from the partition wall **1012** and a cavity portion **1007** disposed between the vibration diaphragm **123** and the partition wall **1012**. The pressure relief hole **1081** is in communication with the cavity portion **1007**. As shown in FIG. **3** and FIG. **5**, the shell assembly **10** is further provided with a sound outlet hole **1080** in communication with the cavity portion **1006**. The cavity portion **1007** is in communication with the external environment via the pressure relief hole **1081**. When the vibration diaphragm **123** vibrates along the air-conducting vibration direction X**2**, the cavity portion **1007** may be relieved of the pressure via the pressure relief hole **1081**, to ensure normal and stable operation of the air-conducting loudspeaker **12**. In some embodiments, the cavity portion **1006** may also be referred to as a first cavity portion, and the cavity portion **1007** may also be referred to as a second cavity portion.

[0099] Optionally, the distance between the vibration diaphragm **123** and a cavity wall of the accommodation cavity **1002** along a vibration direction of the vibration diaphragm **123** (the air-conducting vibration direction X**2**) is greater than 0.8 mm, or greater than 1 mm. Specifically, the distance (i.e., the distance along the air-conducting vibration direction X**2**) between the vibration diaphragm **123** and the partition wall **1012** (i.e., a portion of the cavity wall of the accommodation cavity **1002**) may be greater than 0.8 mm, or greater than 1 mm. This ensures that the vibration diaphragm **123** has a larger vibration space, and the distance enables the airflow in the cavity portion **1007** to be distributed more uniformly, which in turn enables the air pressure to be more uniform and improves the consistency of the vibration of the vibration diaphragm **123**. In some embodiments, the distance between the vibration diaphragm **123** and the partition wall **1012** refers to the minimum distance between the two. In other embodiments, the distance between the vibration diaphragm **123** and the partition wall **1012** refers to the distance between a vibration region of the vibration diaphragm **123** (e.g., a center region or a region of maximum amplitude) and the partition wall **1012**.

[0100] As shown in FIG. **3** to FIG. **5**, optionally, in a wearing state, the center of the pressure relief hole **1081** is not higher than the center of the sound outlet hole **1080**, and in the wearing state, a line connecting the center of the pressure relief hole **1081** and the center of the sound outlet hole **1080** is pointed toward the user's ear. Optionally, in the wearing state, the line connecting the center of the pressure relief hole **1081** to the center of the sound outlet hole **1080** is pointed toward the ear canal of the user's ear. Generally speaking, the line connecting the center of the pressure relief hole **1081** and the center of the sound outlet hole **1080** may be inclined upward toward the head top direction relative to the human body and point toward the user's ear. The center of the pressure relief hole **1081** may be the centroid of the pressure relief hole **1081**. The center of the sound outlet hole **1080** may be the centroid of the sound outlet hole **1080**. This setup helps to avoid the user's ear (especially the ear canal) being at the acoustic null point in the wearing state or in cases of improper wearing (such as slight tilting). As a result, it ensures that the user can hear the sound properly, reducing hearing loss and improving sound quality.

[0101] If there is a plurality of sound outlet holes **1080**, the line described above may be a line connecting the center of at least one of the sound outlet holes **1080** and the center of the pressure relief hole **1081**. As another example, if there is a plurality of sound outlet holes **1080**, a line connecting the centers of the plurality of sound outlet holes **1080** forms a shape, and the center of the shape serves as the center of the plurality of sound outlet holes **1080**, and the line described above may be a line connecting the center of the shape and the center of the pressure relief hole **1081** that is pointed toward the user's ear.

[0102] Optionally, in the wearing state, an angle between the line connecting the center of the pressure relief hole **1081** and the center of the sound outlet hole **1080** and the coronal axis of the user is ≥0° and <90°, and an angle between the line and the vertical axis of the user is >0° and ≤90°. This setup helps to avoid the user's ear being at the acoustic null point in the wearing state or in cases of improper wearing (such as slight tilting). As a result, it ensures the output of the earphone **100** and the acoustic effect.

[0103] As shown in FIG. **4**, the air-conducting loudspeaker **12** further includes a magnetic circuit assembly **120** and a voice coil **122**. The magnetic circuit assembly **120** includes a cover body **121** with an open end **1211**, and an annular flange **1212** that is disposed at the open end **1211** of the cover body **121** and protrudes from an outer peripheral surface of the cover body **121**. A rim of the vibration diaphragm **123** is fixed to a side of the annular flange **1212** facing the open end **1211** and covers the open end **1211** of the cover body **121**. The voice coil **122** is connected to the vibration diaphragm **123**. As shown in FIG. **3** and FIG. **5**, the vibration diaphragm **123** is arranged opposite to the cover body **121**, away from the sound outlet hole **1080**.

[0104] The air-conducting loudspeaker **12** requires a larger vibration diaphragm **123** to achieve good sound quality, and the larger vibration diaphragm **123** also requires a larger support structure such as the annular flange **1212**. In other words, the annular flange **1212** and the vibration diaphragm **123** are both structures in the air-conducting loudspeaker **12** that have large radial dimensions compared to the other structures, which greatly affects the overall structural dimension of the shell assembly **10**. By setting the annular flange **1212** and the vibration diaphragm **123** on the side away from the sound outlet hole **1080**, the vibration diaphragm **123** and the annular flange **1212** can be located closer to the interior of the shell assembly **10**. With such an arrangement, in the air-conducting loudspeaker **12**, structures with a larger radial dimension are arranged away from the sound outlet hole **1080**, and structures with a smaller dimension can be located closer to the sound outlet hole **1080**. Such an opposite configuration inside the air-conducting loudspeaker **12**, compared to the traditional loudspeaker design where the vibration diaphragm must be oriented toward the sound outlet hole **1080**, effectively reduces the dimension of the portion of the shell assembly **10** that is near the sound outlet hole **1080**, which allows the dimension of the shell assembly **10** to decrease from the central region to the region around the sound outlet hole **1080** (i.e., the radial dimension of the outer peripheral surface of the shell assembly **10** can gradually decrease). As a result, the structure becomes more compact, significantly improving the spatial utilization of the shell assembly **10** and reducing the overall volume of the shell assembly **10**. Such an opposite configuration can optimize the sound path and thus improve the sound quality. In short, by reversing the air-conducting loudspeaker **12** along the air-conducting vibration direction X**2**, the structural dimension of the shell assembly **10** can be effectively reduced.

[0105] Optionally, as shown in FIG. **3** and FIG. **4**, the cavity wall of the accommodation cavity **1002** is provided with an annular table surface **1005** (the annular table surface **1005** is also shown in FIG. **5**, but not labeled). As shown in FIG. **4** and FIG. **5**, the annular flange **1212** is pressed against the annular table surface **1005**. The vibration diaphragm **123** divides the accommodation cavity **1002** into the cavity portion **1006** and the cavity portion **1007**, with the cavity portion **1006** being disposed on the side of the vibration diaphragm **123** facing the sound outlet hole **1080** and the cavity portion **1007** being disposed on the side of the vibration diaphragm **123** away from the sound outlet hole **1080**. The magnetic circuit assembly **120** is located within the cavity portion **1006**. As shown in FIG. **5**, the shell assembly **10** is provided with the pressure relief hole **1081** to enable communication between the cavity portion **1007** and the external environment. Specifically, the annular table surface **1005** may be provided on shell **101**.

[0106] As shown in FIG. **4**, the vibration diaphragm **123** may be disposed on the side of the annular flange **1212** toward the annular table surface **1005**. The earphone **100** further includes a sealing adhesive **1041** that seals a gap between the side of the annular flange **1212** that is opposite the annular table surface **1005** and the shell assembly **10**. The annular flange **1212** fits with the shell assembly **10** to form an adhesive accommodation groove **1042** for accommodating the sealing adhesive **1041** on the side of the annular flange **1212** that is opposite the annular table surface **1005**. Based on reversing the air-conducting loudspeaker **12**, since the vibration diaphragm **123** is closer to an inner side of the shell assembly **10** compared to the adhesive accommodation groove **1042**, while the adhesive accommodation groove is closer to an outer side of the shell assembly **10**, on the one hand, it is easy to dispense the adhesive, and on the other hand, when dispensing the adhesive on the adhesive accommodation groove **1042**, it can prevent the adhesive from overflowing onto the vibration diaphragm **123**, reducing the effect of the adhesive on the vibration diaphragm **123**, thereby ensuring the sound quality effect.

[0107] Further as shown in FIG. **11**, a sound-conducting hole **1213** is disposed on the annular flange **1212**. The sound-conducting hole **1213** is provided to connect a space surrounded by the vibration diaphragm **123** and the magnetic circuit assembly **120** to the cavity portion **1006** around the periphery of the magnetic circuit assembly **120**. A portion of sound waves generated by the vibration of the vibration diaphragm **123** along the air-conducting vibration direction X**2** is conducted via the sound-conducting hole **1213** to the cavity portion **1006** around the periphery of the magnetic circuit assembly **120**.

[0108] Optionally, as shown in FIG. **4**, the shell **103** is used to accommodate one end of the cover body **121** away from the vibration diaphragm **123**, and the sound outlet hole **1080** is provided on the shell **103**. The cover body **121** includes a circumferential side surface **121***a* and an end surface **121***b*, and the end surface **121***b* is connected to the circumferential side surface **121***a*. The end surface **121***b* is oriented toward the sound outlet hole **1080**. A first gap **1031** (a position of the dashed line pointed to by the label **1031** in FIG. **4**) exists between a connection region between the end surface **121***b* and the circumferential side surface **121***a* located on a first side of the cover body **121** and the shell **103**. A second gap **1032** (a position of the dashed line pointed to by the label **1032** in FIG. **4**) exists between a connection region between the circumferential side surface **121***a* located on a second side of the cover body **121** and the end surface **121***b* and the shell **103**. The first gap **1031** is smaller than the second gap **1032**. The size of the first gap **1031** and the size of the second gap **1032** may be distances between the corresponding connection regions to the shell **103**, respectively. For example, the distance is the length of the dashed line illustrated in FIG. **4** (the dashed line may be perpendicular to an inner surface of the shell **103** at a corresponding location). The first side and the second side refer to a first side and a second side of the circumferential side surface **121***a* that are opposite to each other.

[0109] Referring to FIG. **4**, FIG. **5**, FIG. **11**, and FIG. **12**, in a cross-section perpendicular to the vibration direction of the vibration diaphragm **123**, the cover body **121** has a length direction LD and a width direction HD. The dimension of the cover body **121** along the length direction LD is larger than the dimension of the cover body **121** along the width direction HD, and the first side and the second side are opposite along the width direction HD. The first side may be located on the side of the magnetic circuit assembly **120** close to the user's face, as shown in FIG. **4**. The first gap **1031** is smaller than the second gap **1032**, and the first gap **1031** is located on the first side, which in turn makes the smaller first gap **1031** closer to the user's face, and can ensure that the air-conducting loudspeaker **12** outputs sound signals normally, while also effectively reducing the dimension of the shell **103**.

[0110] Further, the first side is located on the side of the magnetic circuit assembly **120** close to the user's face, and at least a portion of an outer surface of the shell **103** is provided inclined toward the shell **101** and the shell **102** along a direction from the second side to the first side. For example, the portion of the outer surface of the shell provided with the sound outlet hole **1080** is provided inclined toward the shell **101** and the shell **102** along a direction from the second side to the first side, i.e., the sound outlet hole **1080** is disposed on the at least a portion of the shell **103**. With this

setting manner, it is possible to make the sound outlet hole **1080** toward the user's ear, so that the sound signal output from the air-conducting loudspeaker **12** can be better transmitted into the user's ear. A portion of the shell **103** that is opposite the circumferential side surface **121***a* is connected to a portion of the shell provided with the sound outlet hole. Optionally, after reversing the air-conducting loudspeaker **12**, an outer surface of the portion of the shell **103** that is opposite the circumferential side surface **121***a* may be provided in an inclined manner, and specifically, the outer surface may gradually converge and tilt along the air-conducting vibration direction X**2**, from the first shell **101** to the direction away from the first shell **101** and into the accommodation cavity **1002**, to make the shell assembly **10** compact and miniaturized, thereby reducing the volume of the shell assembly **10**. Moreover, the shell assembly **10** may have a fitting surface **10***a* in contact with the user's face and an inclined surface **10***b* (the inclined surface may be a curved inclined surface that gradually tilts away from the face) connected to the fitting surface **10***a* and tilted away from the fitting surface **10***a*. The inclined surface **10***b* is used to avoid the user's tragus, thereby reducing the compression on the tragus, facilitating wearing, improving the wearing comfort, and having better sound quality effect. The fitting surface **10***a* is mainly composed of the shell **102**, and the inclined surface **10***b* may be composed of the shell **102** and the shell **103** together.
[0111] Further, a portion of the end surface **121***b* adjacent to the circumferential side surface **121***a* disposed on the first side may be connected to the shell **103**, or a connection region between the end surface **121***b* and the circumferential side surface **121***a* disposed on the first side may be in contact with the shell **103**, further reducing the dimension of the shell assembly **10**. The contact here can be direct contact, where further adhesive bonding can be applied for fixation, or it can be indirect contact through adhesive fixation. A portion of the cavity portion **1006** that is on the periphery of the cover body **121** may be further divided into a first space portion and a second space portion by the above contact position. Specifically, the first space portion may be enclosed between the circumferential side surface **121***a* disposed on the first side and the shell **103**, or the first space portion may be enclosed by a combination of the end surface **121***b*, the circumferential side surface **121***a* disposed on the first side, and the shell **103**, while the second space portion may be enclosed between at least a portion of the end surface **121***b*, a portion of the circumferential side surface **121***a* disposed on the second side, and the shell **103**. The first gap **1031** is located in the first space portion, the second gap is located in the second space portion, and the second space portion is in communication with the sound outlet hole **1080**. If the end surface **121***b* encloses both the first space portion and the second space portion, the area of the portion of the end surface **121***b* enclosing the first space portion is smaller than the area of the portion of the end surface **121***b* enclosing the second space portion, i.e., the contact position is closer to the first side and to the portion of the shell assembly **10** opposite the first side. Corresponding positions of the cover body **121** and the shell **103** may be contacted to form the contact position. In other embodiments, the corresponding positions of the cover body **121** and the shell **103** may be set to have a gap whose distance is greater than 0.1 mm, and the gap is so set that the cover body **121** does not collide with the shell **103** when vibrates due to the vibration of the vibration diaphragm **123**, thereby reducing the possibility of generating noise. In conclusion, corresponding to the contact position, a position corresponding to the gap is referred to as a minimum gap position.
[0112] In the state in which the contact position is set, at least a portion of sound waves can enter the second space portion from the first space portion along the circumferential side surface **121***a*, and then pass out from the second space portion via the sound outlet hole **1080**.
[0113] Optionally, referring to FIG. **4**, on the first side, the average distance between the annular flange **1212** and the shell **103** along the vibration direction X**2** of the vibration diaphragm **123** is greater than or equal to 0.5 mm. Optionally, on the second side, the second gap **1032** is greater than or equal to 0.5 mm. On the first side, the average distance between the annular flange **1212** and the shell **103** along the vibration direction X**2** of the vibration diaphragm **123** is the average value of the sum of the maximum distance L**5** and the minimum distance L**4** between the annular flange

1212 and the shell **103** along the vibration direction of the vibration diaphragm **123** (i.e., the air-conducting vibration direction X**2**).

[0114] By setting the above dimensions, on the one hand, it is ensured that there is a sufficient size of a sound cavity to achieve a better sound quality before leading the sound waves out of the sound outlet hole **1080**, and on the other hand, it is possible to make the shell assembly **10** smaller and more compact. In addition, by reversing the accommodation cavity **1002** and the air-conducting loudspeaker **12** as shown in FIG. **4**, the sound waves enter the second space portion from the first space portion along the circumferential side surface **121***a* (i.e., the sound waves can enter the second gap **1032** from the first gap **1031**), and along the air-conducting vibration direction X**2**, the second space portion is gradually inclined to the first space portion to better point to the sound outlet hole **1080**, so that the transmission direction of the sound waves is more directed to the user's ear, further enhancing the transmission efficiency of the sound waves, and enhancing the sound quality.

[0115] Optionally, as shown in FIG. **4**, the cover body **121** includes a magnetic conduction shield **121***c*. The magnetic circuit assembly **120** further includes the magnet **124** disposed within the magnetic conduction shield **121***c*, and the voice coil **122** extends into a magnetic gap formed by the magnetic conduction shield **121***c* and the magnet **124**.

[0116] Referring to FIG. **6**, FIG. **7**, and FIG. **8**, the bone-conducting loudspeaker **11** includes the voice coil assembly **111**, the magnet assembly **112**, and a vibration transmission sheet **113**. The first one of the voice coil assembly **111** and the magnet assembly **112** surrounds the second one of the voice coil assembly **111** and the magnet assembly **112**. For example, the voice coil assembly **111** surrounds the magnet assembly **112**. As shown in FIG. **8** and FIG. **13**, the vibration transmission sheet **113** includes a central fixing portion **1131**, an annular fixing portion **1132** around the periphery of the central fixing portion **1131**, and a linkage assembly **1133** connected between the central fixing portion **1131** and the annular fixing portion **1132**. The annular fixing portion **1132** is connected to the first one of the voice coil assembly **111** and the magnet assembly **112**, and the central fixing portion **1132** is connected to the second one of the voice coil assembly **111** and the magnet assembly **112**. For example, the annular fixing portion **1132** is connected to the voice coil assembly **111** and the central fixing portion **1131** is connected to the magnet assembly **112**. The linkage assembly **1133** is used to elastically constrain relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z of the bone-conducting loudspeaker **11**. It should be understood that the linkage assembly **1133** can maintain the stable position of the voice coil assembly **111** and the magnet assembly **112** along a radial direction perpendicular to the central axis direction Z, i.e., the linkage assembly **1133** can constrain the voice coil assembly **111** and the magnet assembly **112** along a radial direction. The relatively stable position of the voice coil assembly **111** and the magnet assembly **112** along the radial direction can render the relative movement between the two along the central axis direction Z more stable, which in turn makes the sound quality better. For example, the annular fixing portion **1132** serves as a stop member and rigidly constrains a range of relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z (illustrated in FIG. **6**). For example, the annular fixing portion **1132** is fixedly connected to the voice coil assembly **111**. When used as a stop member, the magnet assembly **112** may be rigidly stopped when the vibration magnitude of the magnet assembly **112** relative to the voice coil assembly **111** is excessive, thereby limiting the movement stroke of the magnet assembly **112** and imposing a rigid constraint on the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**. It should be understood that the stop member may be realized in other structural forms or ways.

[0117] The central axis direction Z of the bone-conducting loudspeaker **11** may coincide with the vibration direction of the bone-conducting loudspeaker **11** (i.e., the bone-conducting vibration direction X**1**). The linkage assembly **1133** is an elastic member or can generate an elastic deformation that elastically constrains the voice coil assembly **111** and the magnet assembly **112**.

The elastic constraint may be understood as the voice coil assembly **111** and the magnet assembly **112** moving relative to each other within the range of relative movement permitted by the elastic deformation of the linkage assembly **1133**. On the one hand, the linkage assembly **1133** can limit the range of relative movement between the voice coil assembly **111** and the magnet assembly **112** along the bone-conducting vibration direction X**1**, and on the other hand, the linkage assembly **1133** can reset the voice coil assembly **111** and the magnet assembly **112** through elastic recovery after the voice coil assembly **111** and the magnet assembly **112** have achieved relative movement. Rigidly constraining the range of relative movement between the voice coil assembly **111** and the magnet assembly **112** by the stop member along the central axis direction Z may be understood as the stop member constraining the maximum range of relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z, preventing the relative movement between the voice coil assembly **111** and the magnet assembly **112** from exceeding the maximum range of relative movement and causing the vibration transmission sheet **113** to transition from elastic deformation to plastic deformation, resulting in a decrease in the elasticity of the vibration transmission sheet **113** and causing damage to the voice coil assembly **111** and the magnet assembly **112**. Rigidity and elasticity herein are relative, i.e., the constraining strength of the stop member is greater than the constraining strength of the linkage assembly **1133**.
[0118] As shown in FIG. **8**, the annular fixing portion **1132** serves as a stop member, and a projection of the annular fixing portion **1132** along the central axis direction Z partially overlaps with an outer end surface **1103** of the second one of the voice coil assembly **111** and the magnet assembly **112**. Specifically, the annular fixing portion **1132** is connected to the voice coil assembly **111**, and the projection of the annular fixing portion **1132** along the central axis direction Z partially overlaps an outer end surface **1103** of the magnet assembly **112**. By setting the projection of the annular fixing portion **1132** to partially overlap the outer end surface **1103** of the second one of the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z, when the relative movement amplitude of the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z is too large, the outer end surface **1103** of the voice coil assembly **111** and the magnet assembly **112** may abut against with the annular fixing portion **1132**. Since the annular fixing portion **1132** is fixed relative to the first one of the voice coil assembly **111** and the magnet assembly **112**, the annular fixing portion **1132** rigidly abuts against the second one of the voice coil assembly **111** and the magnet assembly **112**, thus rigidly constraining the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**. For example, if the earphone **100** is subjected to the drop or collision, the relative movement amplitude of the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z may be too excessive, resulting in the vibration transmission sheet **113** transition from elastic deformation to plastic deformation, which reduces its elasticity. By applying a rigid constraint through the annular fixing portion **1132**, the vibration transmission sheet **113** can be prevented from being overstretched, thereby mitigating performance degradation and reducing the impact on sound quality. In addition, providing the annular fixing portion **1132** as the stop member can eliminate the need to add an additional stopper structure, leading to a simple and stable structure with reduced costs.
[0119] Optionally, as shown in FIG. **6**, FIG. **7**, and FIG. **8**, the outer end surface **1103** includes a center region **1104** and a peripheral region **1106** surrounding the center region **1104**. The center region **1104** is provided with a protrusion portion **1105**, and the protrusion portion **1105** protrudes with respect to the peripheral region **1106**. The central fixing portion **1131** is fixedly connected to the protrusion portion **1105**, and the projection of the annular fixing portion **1132** along the central axis direction Z partially overlaps with the peripheral region **1106**.
[0120] Optionally, referring to FIG. **14**, along the radial direction of the bone-conducting loudspeaker **11**, a width L**6** of an overlapping region between the annular fixing portion **1132** and the outer end surface **1103** is greater than or equal to 0.03 mm, thereby ensuring the constraining

strength of the stop member.

[0121] Optionally, in a natural state, a spacing distance L**7** between an upper surface of the protrusion portion **1105** and a lower surface of the annular fixing portion **1132** of the vibration transmission sheet **113** along the central axis direction Z is less than or equal to 1 mm. Setting the spacing distance L**7** within the above range enables the linkage assembly **1133** to be reasonably pre-deformed when the central fixing portion **1131** and the protrusion portion **1105** are fixedly connected, which in turn improves the vibration efficiency of the vibration transmission sheet **113**. If the spacing distance L**7** is set too large, the pre-deformation amount of the linkage assembly **1133** will be excessive, making it prone to exceeding the yield limit and undergoing plastic deformation, which reduces its elastic deformation performance. Conversely, with the vibration transmission sheet **113** elastically suspended, the absence of pre-deformation would cause the relative position of the magnet assembly **112** and the voice coil assembly **111** along the central axis direction Z to deviate from the central position under the influence of gravity. This deviation would affect the relative movement between the magnet assembly **112** and the voice coil assembly **111**, thereby affecting sound quality performance. In some embodiments, since the lower surface of the central fixing portion **1131** and the upper surface of the protrusion portion **1105** need to be welded in affinity, the spacing distance L**7** between the upper surface of the protrusion portion **1105** and the lower surface of the annular fixing portion **1132** along the central axis direction Z may also be considered as the spacing distance between the lower surface of the central fixing portion **1131** and the lower surface of the annular fixing portion **1132**.

[0122] It should be understood that whether the protrusion portion **1105** is fixed to the central fixing portion **1131** by some other structures or means, the spacing distance between the lower surface of the central fixing portion **1131** and the lower surface of the annular fixing portion **1132** along the central axis direction Z indicates the pre-deformation amount of the vibration transmission sheet **113** along the central axis direction Z.

[0123] Optionally, in a natural state, a ratio of the spacing distance between the lower surface of the central fixing portion **1131** and the lower surface of the annular fixing portion **1132** along the central axis direction Z to an extension component of the length of at least one linkage **1134** along a first direction W**1** is in a range of 0 to 0.1, and the range of values includes endpoint values. Optionally, a ratio of the spacing distance between the lower surface of the central fixing portion **1131** and the lower surface of the annular fixing portion **1132** along the central axis direction Z to the extension component of the length of the at least one linkage **1134** along a second direction W**2** is in a range of 0 to 0.18, and the range of values includes endpoint values. With such an arrangement, it is possible to make the vibration transmission sheet **113** be capable of pre-deformation reasonably. On the one hand, suspended components (the voice coil assembly **111** or the magnet assembly **112**) can be ensured sufficiently supported without sagging to ensure the vibration performance, and on the other hand, an excellent space for elastic deformation can be guaranteed. If the ratio is too large, it is likely to result in an excessive pre-deformation amount of the vibration transmission sheet **113** that exceeds the yield limit, resulting in a decrease in elastic performance. If the ratio is too small, it is likely to lead to insufficient support of the vibration transmission sheet **113** to the suspended components, which leads to degradation of vibration performance and loss of sound quality.

[0124] Optionally, the upper surface of the protrusion portion **1105** occupies less than or equal to 30% of the area of the outer end surface **1103**, and the protrusion portion **1105** occupying a smaller area can realize a more stable fixed connection with the linkage assembly **1133**. In this way, it does not occupy the linkage assembly **133** excessively, but makes the linkage assembly **1133** have a sufficiently large area to generate elastic deformation, thereby providing sufficient deformation space to make the vibration transmission sheet **113** more elastic.

[0125] Optionally, as shown in FIG. **7** and FIG. **8**, the magnet assembly **112** includes the magnet **1121** and two magnetic conduction plates **1122**. The two magnetic conduction plates **1122** are

disposed on two opposite end surfaces of the magnet **1121** along the central axis direction Z. The protrusion portion **1105** is disposed on the magnetic conduction plates **1122** such that the center region **1104** and the peripheral region **1106** are formed on an outer surface of each of the magnetic conduction plates **1122**. Two projections of the two magnetic conduction plates **1122** along a radial projection of the bone-conducting loudspeaker **11** overlap with the voice coil assembly **111**, respectively. The peripheral region **1106** is provided affixed to the magnet **1121**, the protrusion portion **1105** is disposed spaced apart from the magnet **1121**, and the peripheral region **1106** occupies more than or equal to 60% of the area on the outer end surface **1103**. In this way, setting the protrusion portion **1105** can make the pre-deformation amount of the vibration transmission sheet **113** more reasonable, and can reduce the pre-deformation amount, ensuring the elastic deformation performance of the vibration transmission sheet **113**. In addition, there is also no need to set up additional connection members to connect the vibration transmission sheet **113** and the magnetic conduction plate **1122**, which can reduce the overall mass of the entire bone-conducting loudspeaker **11**, and thus can improve the vibration effect of the bone-conducting loudspeaker **11**. Optionally, when the bone-conducting loudspeaker **11** is in a normal operation state, the stop member is provided so as not to constrain the relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z. However, when the bone-conducting loudspeaker **11** is subjected to dropping, collision, or the like, the relative movement between the voice coil assembly **111** and the magnet assembly **112** may exceed the elastic constraint range permitted by the elastic deformation of the vibration transmission sheet **113**, then at this time, the stop member may rigidly constrain the relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z, reducing the probability that the relative movement between the voice coil assembly **111** and the magnet assembly **112** exceeds the permitted elastic constraint range, thereby reducing the probability of loss of elasticity of the vibration transmission sheet **113** due to overstretching.
[0126] Optionally, as shown in FIG. **7** and FIG. **8**, there are two vibration transmission sheets **113**, and the two vibration transmission sheets **113** are provided on two opposite sides of the bone-conducting loudspeaker **11** along the central axis direction Z. The linkage assembly **1133** of each vibration transmission sheet **113** includes two linkages **1134**. In other embodiments, the linkage assembly **1133** also includes at least two linkages **1134**.
[0127] Optionally, as shown in FIG. **7** and FIG. **8**, the voice coil assembly **111** surrounds the magnet assembly **112**. The voice coil assembly **111** includes two sets of voice coils **1110** spaced apart along the central axis direction Z and the magnetic conduction shield **1111** around the periphery of the two sets of voice coils **1110**. The magnet assembly **112** includes the magnet **1121** and two magnetic conduction plates **1122**. The two magnetic conduction plates **1122** are provided on two opposite end surfaces of the magnet **1121** along the central axis direction Z. Projections of the two magnetic conduction plates **1122** along the radial direction of the bone-conducting loudspeaker **11** overlap with the two sets of voice coils **1110**, respectively, and current directions of the two sets of voice coils **1110** are opposite to each other.
[0128] Optionally, the voice coil assembly **111** surrounds the magnet assembly **112**, and the voice coil assembly **111** is fixed to the shell assembly **10**.
[0129] Optionally, the annular fixing portion **1132** is fixedly connected to the magnetic conduction shield **1111**. Optionally, the annular fixing portion **1132** and the magnetic conduction shield **1111** are welded and fixed through offset welding. Specifically, an outer edge of the annular fixing portion **1132** is offset from an outer edge of a corresponding end portion of the magnetic conduction shield **1111**. For example, the outer edge of the annular fixing portion **1132** overlaps the end portion of the magnetic conduction shield **1111** and is located between the outer peripheral surface and the inner peripheral surface of the magnetic conduction shield **1111**, thereby forming an offset. Based on this offset, the outer edge of the annular fixing portion **1132** and the end portion of the magnetic conduction shield **1111** are welded and fixed. By welding and fixing the annular

fixing portion **1132** and the magnetic conduction shield **1111** through offset welding, the welding position is more obviously presented, which facilitates the welding process and observation of the weld seam, effectively improving welding efficiency and yield rate, thereby ensuring welding strength. For the form of welding the weld seam, it may be spot welding or continuous welding. Optionally, the weld bearing force between the annular fixing portion **1132** and the magnetic conduction shield **1111** is in a range of 400 N to 1200 N.

[0130] It may be appreciated that in some other embodiments of the present disclosure, the welding method may also be other methods such as lap welding (butt welding). The lap welding specifically involves stacking the annular fixing portion **1132** with the corresponding end portion of the magnetic conduction shield **1111**, and welding the stacked position together using methods such as laser welding.

[0131] Optionally, the vibration transmission sheet **113** is provided with an observation hole **1130** penetrating through two sides of the vibration transmission sheet **113**, as shown in FIG. **13** and FIG. **15**. The observation hole **1130** penetrating through two sides of the vibration transmission sheet **113** refers to that the observation hole **1130** penetrate through two sides of the vibration transmission sheet **113** along a thickness direction of the vibration transmission sheet **113**, and the thickness direction of the vibration transmission sheet **113** may be the central axis direction Z. Specifically, the observation hole **1130** may be formed in the annular fixing portion **1132**. Optionally, there are a plurality of observation holes **1130** arranged at intervals along the circumferential direction of the vibration transmission sheet **113**. By providing the observation hole **1130** on the vibration transmission sheet **113**, a structure of a magnetic circuit, such as a structure of the magnet assembly **112**, inside the bone-conducting loudspeaker **11** can be observed through the observation hole **1130**. Besides, the observation hole **1130** can be used to understand whether the position of the magnet assembly **112** is deviated, and even the working condition of the magnet assembly **112** can be observed, which is convenient for fault troubleshooting or structural optimization, or the like.

[0132] Optionally, the vibration transmission sheet **113** includes the central fixing portion **1131** formed by sheet processing, the annular fixing portion **1132** around the periphery of the central fixing portion **1131**, and the linkage assembly **1133** connected between the central fixing portion **1131** and the annular fixing portion **1132**. An inner ring edge **1132***a* of the annular fixing portion **1132** has the first direction W**1** and the second direction W**2** that are perpendicular to each other. That is, the annular fixing portion **1132** has the first direction W**1** and the second direction W**2**. The linkage assembly **1133** is composed of two linkages **1134**, each of the linkages **1134** has an outer edge **1135** toward the inner ring edge **1132***a*, and an inner edge **1136** away from the inner ring edge **1132***a*. An extension component of the outer edge **1135** along the first direction W**1** is greater than or equal to one-half of a dimension of the inner ring edge **1132***a* along the first direction W**1**, and the width of the linkage **1134** is greater than or equal to one-tenth of a dimension of the inner ring edge **1132***a* along the second direction W**2**.

[0133] Specifically, the above description is illustrated in a case where the central fixing portion **1131**, the annular fixing portion **1132**, and the linkage assembly **1133** are set up coplanar. In the case where there are distortion points such as protrusions or grooves at the inner ring edge **1132***a*, these distortion points should be eliminated, and a smooth linear transition should be formed on the outside of the distortion points to create the inner ring edge **1132***a*. For example, the second direction W**2** refers to a direction in which the shortest line segment intersecting the inner ring edge **1132***a* over the geometric center of the inner ring edge **1132***a* is located. The first direction W**1** refers to a direction that is perpendicular to the second direction W**2** in the plane in which the central fixing portion **1131**, the annular fixing portion **1132**, and the linkage assembly **1133** are located. The vibration transmission sheet **113** is provided as a two-linkage structure, and an extension component of the outer edge **1135** along the first direction W**1** is greater than or equal to one-half of the dimension of the inner ring edge **1132***a* along the first direction W**1**. In this way, the

extension length of the linkage **1134** can be increased, which makes the linkage **1134** has a larger deformation space. At the same time, since the width of the linkage **1134** is greater than or equal to one-tenth of the dimension of the inner ring edge **1132***a* along the second direction W**2**, it can improve the resistance as well as the service life of the linkage **1134**.
[0134] Optionally, the extension component of the outer edge **1135** along the first direction W**1** is further greater than or equal to two-thirds of the dimension of the inner ring edge **1132***a* along the first direction W**1**. Therefore, the extension component of the outer edge **1135** along the first direction W**1** is further greater than or equal to two-thirds of the dimension of the inner ring edge **1132***a* along the first direction W**1**, which may further increase the extension length of the linkage **1134** and allows the linkage **1134** to have a greater deformation space.
[0135] Optionally, the extension component of the outer edge **1135** along the second direction W**2** is greater than or equal to one-half of the dimension of the inner ring edge **1132***a* along the second direction W**2**. Therefore, the extension component of the outer edge **1135** along the second direction W**2** is greater than or equal to one-half of the dimension of the inner ring edge **1132***a* along the second direction W**2**, which may further increase the extension length of the linkage **1134** and allows the linkage **1134** to have a larger deformation space.
[0136] Optionally, the extension component of the outer edge **1135** along the second direction W**2** is greater than or equal to two-thirds of the dimension of the inner ring edge **1132***a* along the second direction W**2**. Therefore, the extension component of the outer edge **1135** along the second direction W**2** is greater than or equal to two-thirds of the dimension of the inner ring edge **1132***a* along the second direction W**2**, which can further increase the extension length of the linkage **1134** and allows the linkage **1134** to have a larger deformation space.
[0137] Optionally, the width of the linkage **1134** is greater than or equal to one-eighth of the dimension of the inner ring edge **1132***a* along the second direction W**2**. Therefore, the width of the linkage **1134** is greater than or equal to one-eighth of the dimension of the inner ring edge **1132***a* along the second direction W**2**, which can further improve the resistance as well as the service life of the linkage **1134**.
[0138] Optionally, the two linkages **1134** are rotationally symmetrical at 180 degrees centered on the central fixing portion **1131**. With this setup, the vibration transmission stability and balance of the vibration transmission sheet **113** can be effectively improved.
[0139] Optionally, the dimension of the inner ring edge **1132***a* along the first direction W**1** is larger than the dimension of the inner ring edge **1132***a* along the second direction W**2**. In other words, the annular fixing portion **1132** may be provided in a general runway shape. A ratio of the dimension of the inner ring edge **1132***a* along the first direction W**1** to the dimension of the inner ring edge **1132***a* along the second direction W**2** is greater than or equal to 1.5.
[0140] Optionally, along the first direction W**1**, two linkages **1134** are connected to two opposite sides of the central fixing portion **1131**. With this setup, it is possible to increase the length of the linkages **1134** effectively. Specifically, as shown in FIG. **15**, the inner ring edge **1132***a* includes two edge segments **11321** spaced apart along the second direction W**2**. Each of the linkages **1134** is provided to start at the central fixing portion **1131**, to extend through a gap between the central fixing portion **1131** and one of the two inner ring edges **1132***a*, and to be connected to the other of the two edge segments **11321**.
[0141] Optionally, one end of the linkage **1134** is smoothly connected to the central fixing portion **1131**. Another end of the linkage **1134** is smoothly connected to the annular fixing portion **1132**. Further, as shown in FIG. **16**, the linkage **1134** includes a first sub-linkage portion **1137** connected to the central fixing portion **1131**, a second sub-linkage portion **1138** connected to the annular fixing portion **1132** and a third sub-linkage portion **1139** connected between the first sub-linkage portion **1137** and the second sub-linkage portion **1138**. At least a portion of the first sub-linkage portion **1137** is progressively wider in a direction toward the central fixing portion **1131** and smoothly connected to the central fixing portion **1131**, at least a portion of the second sub-linkage

portion **1138** is progressively wider in a direction toward the annular fixing portion **1132** and smoothly connected to the annular fixing portion **1132**, and the third sub-linkage portion **1139** remains uniform in width.

[0142] Optionally, the inner edge **1136** of the first sub-linkage portion **1137** and the inner edge **1136** of the second sub-linkage portion **1138** are provided in an arcuate shape. The inner edge **1136** of the third sub-linkage portion **1139** is provided in a straight line and is in smooth transition with the inner edge **1136** of the first sub-linkage portion **1137** and the inner edge **1136** of the second sub-linkage portion **1138**, and/or the outer edge **1135** of the first sub-linkage portion **1137** and the outer edge **1135** of the second sub-linkage portion **1138** are provided in an arcuate shape, and the outer edge **1135** of the third sub-linkage portion **1139** is provided in a straight line and is in a smooth transition with the outer edge **1135** of the first sub-linkage portion **1137** and the outer edge **1135** of the second sub-linkage portion **1138**. Such a setting can effectively reduce the internal stress at the connection point between the linkage **1134** and the central fixing portion **1131** and the connection point between the linkage **1134** and the annular fixing portion **1132**.

[0143] Optionally, a portion of the second sub-linkage portion **1138** that is connected to the third sub-linkage portion **1139** is aligned with the width of the third sub-linkage portion **1139** and/or a portion of the first sub-linkage portion **1137** that is connected to the third sub-linkage portion **1139** is aligned with the width of the third sub-linkage portion **1139**.

[0144] Optionally, an extension component of the outer edge **1135** of the third sub-linkage portion **1139** along the first direction W**1** is greater than or equal to one-half of the dimension of the inner ring edge **1132***a* along the first direction W**1**, and the width of the third sub-linkage portion **1139** is greater than 0.5 mm.

[0145] Optionally, the inner edge **1136** of the first sub-linkage portion **1137** is provided as a concave arc, and an edge of the central fixing portion **1131** that is connected to the inner edge **1136** of the first sub-linkage portion **1137** is provided as a convex arc, forming a smooth transition with the inner edge **1136** of the first sub-linkage portion **1137**. Set up in this way, on the one hand, it is possible to make a reasonable transition between the central fixing portion **1131** and the first sub-linkage portion **1137**, and on the other hand, the convex arc setting can ensure the dimension of the central fixing portion **1131**, and thus ensure the fixing effect of the central fixing portion **1131** and the magnet assembly **112**.

[0146] Optionally, the bone-conducting loudspeaker **11** includes two vibration transmission sheets **113**. The two vibration transmission sheets **113** are provided on two opposite sides of the bone-conducting loudspeaker **11** along the central axis direction Z, respectively. The extension direction of the linkage assembly **1133** of the first one of the two vibration transmission sheets **113**, starting from the connected central fixing portion **1131**, is opposite to the extension direction of the linkage assembly **1133** of the second one of the two vibration transmission sheets **113**, which also starts from the connected central fixing portion **1131**. With this setup, the moment of inertia around the bone-conducting vibration direction X**1** can be offset when the bone-conducting loudspeaker **11** vibrates along the bone-conducting vibration direction X**1**.

[0147] Optionally, the magnet assembly **112** is less than or equal to 80% of the mass of the bone-conducting loudspeaker **11**, and the mass of the load pushed by the bone-conducting loudspeaker **11** is less than or equal to 9 times the mass of the bone-conducting loudspeaker **11**. The load pushed by the bone-conducting loudspeaker **11** includes the sum of the masses of the shell assembly **10** and the parts within the shell assembly **10** other than the magnet assembly **112**.

[0148] Optionally, the mass of the bone-conducting loudspeaker **11** is less than or equal to 8 grams.

[0149] Optionally, the vibration transmission sheet **113** is set such that the earphone **100** has a resonance peak, with the peak of the resonance peak being less than or equal to 500 Hz. Referring to FIG. **3** and FIG. **17**, the core assembly **1** includes the shell assembly **10**, the bone-conducting loudspeaker **11**, and a fixing adhesive **1062**. The shell assembly **10** is used to accommodate the bone-conducting loudspeaker **11**. The fixing adhesive **1062** is used to fix the bone-conducting loudspeaker **11** to the shell assembly **10**. Specifically, the shell assembly **10** is provided with the accommodation cavity **1001**. The bone-conducting loudspeaker **11** may be accommodated within the accommodation cavity **1001**, and the bone-conducting loudspeaker **11** is provided to vibrate along the central axis direction Z of the bone-conducting loudspeaker **11**. The portion of the shell assembly **10** corresponding to the bone-conducting loudspeaker **11** is fitted to the user's face, and the bone-conducting loudspeaker **11** can drive the shell assembly **10** to vibrate when vibrating, converting an electrical signal into a vibration signal and transmitting the vibration signal to the auditory nerve through the human tissues. The central axis direction Z of the bone-conducting loudspeaker **11** is shown in direction Z in FIG. **17**.

[0150] As shown in FIG. **3** and FIG. **17**, the earphone **100** further includes the wearing assembly **27**. The shell **101** and the shell **102** fit with each other to form the accommodation cavity **1001**, the shell **101** is connected to the wearing assembly **27**, and the fixing adhesive **1062** connects the shell **101** to the bone-conducting loudspeaker **11**. Fitting the shell **101** and the shell **102** to form the accommodation cavity **1001** can facilitate the earphone **100** to be installed with the wearing assembly **27** and the bone-conducting loudspeaker **11** during production, reduce the difficulty of the production of the earphone **100**, and also facilitate the subsequent disassembly and maintenance of the earphone **100**. The core assembly **1** includes the shell assembly **10** and a microphone assembly **13**. The microphone assembly **13** is accommodated within the accommodation cavity **1001**. As shown in FIG. **17**, the shell assembly **10** is provided with a sound inlet hole **1082**, and the microphone assembly **13** is configured to capture an external sound input via the sound inlet hole **1082**.

[0151] For example, the wearing assembly **27** includes elements such as an ear-hook, a headband, a clip, or the like, to facilitate wearing and fixing the earphone **100** in a position via the wearing assembly **27**. Optionally, the wearing assembly **27** is disposed on the shell **101** along a radial direction of the bone-conducting loudspeaker **11** such that the wearing assembly **27** does not interfere with the vibration effect brought about by the bone-conducting loudspeaker **11** along the central axis direction Z.

[0152] As shown in FIG. **7**, the voice coil assembly **111** surrounds the magnet assembly **112**, and the vibration transmission sheet **113** is elastically connected to the voice coil assembly **111** and the magnet assembly **112** to elastically constrain the relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z. The fixing adhesive **1062** connects the shell assembly **10** and the voice coil assembly **111**.

[0153] Specifically, the voice coil assembly **111** may interact with the magnet assembly **112** while current is passing through the voice coil assembly **111**, thereby generating vibration. Therefore, by controlling the current passing through the voice coil assembly **111**, the voice coil assembly **111** may interact with the magnet assembly **112** to generate corresponding vibration signals, and the vibration signals may be further transmitted to the shell assembly **10** and then to human tissues.

[0154] The vibration transmission sheet **113** is elastically connected to the voice coil assembly **111** and the magnet assembly **112** and can elastically constrain the voice coil assembly **111** and the magnet assembly **112**, so that when the voice coil assembly **111** generates vibration, the voice coil assembly **111** and the magnet assembly **112** are less likely to move relative to each other along the central axis direction Z, thereby ensuring the stability of the earphone **100**.

[0155] Optionally, the fixing adhesive **1062** connects the shell **101** and the voice coil assembly **111**. Specifically, the inner peripheral surface of the shell **101** and an outer peripheral surface of the voice coil assembly **111** may be opposite to each other, and the fixing adhesive **1062** may be filled in a gap between the inner peripheral surface of the shell **101** and the outer peripheral surface of the voice coil assembly **111** to connect and fix the shell **101** and the voice coil assembly **111**.

[0156] Optionally, the shell **101** and the shell **102** may fit along the central axis direction Z, and the shell **102** further presses and fixes the voice coil assembly **111** to the shell **101**. In this way, by using the shell **102** to further press and fix the voice coil assembly **111** to the shell **101**, it is possible to further stabilize the position of the voice coil assembly **111** along the central axis direction Z. The shell **101** and shell **102** fitting to further press and fix the voice coil assembly **111** reduces the need for additional fixing means, and also makes it easier for the voice coil assembly **111** to drive the shell assembly **10** to vibrate when it vibrates along the central axis direction Z, thereby improving the structural tightness of the earphone **100**.

[0157] As previously described, there may be two sets of voice coils **1110**, with the magnetic conduction shield **1111** around the periphery of the two sets of voice coils **1110**. The two sets of voice coils **1110** are available for the passage of current for vibration by interacting with the magnet assembly **112** as the current passes. Besides, providing the two sets of voice coils **1110** spaced apart along the central axis direction Z enables a stronger vibration of the voice coil assembly **111**.

[0158] The magnetic conduction shield **1111** is used to constrain the magnetic field direction of the magnet assembly **112**, and is also used to contact the shell assembly **10**. When the two sets of voice coils **1110** vibrate, the magnetic conduction shield **1111** can be driven to vibrate to transmit the vibration signals to the shell assembly **10** through the magnetic conduction shield **1111**.

[0159] As previously described, there may be two magnetic conduction plates **1122**, and the two magnetic conduction plates **1122** may be disposed on two opposite end surfaces of the magnet **1121** along the central axis direction Z, respectively. The two magnetic conduction plates **1122** are used to constrain the magnetic field direction of the magnet **1121** on two opposite end surfaces of the magnet **1121** along the central axis direction Z, thereby enhancing the effect of the interaction between the magnet **1121** and the voice coils **1110**. Optionally, projections of the two magnetic conduction plates **1122** along a radial direction E overlap with the two voice coils **1110**, ensuring that the magnetic conduction plates **1122** can act on the two voice coils **1110**. The current directions of the two sets of voice coils **1110** are opposite to ensure that the two voice coils **1110** are subjected to the same direction of force under the interaction of the same magnet **1121**.

[0160] A locating portion **1061** may be provided on the shell assembly **10** and/or the bone-conducting loudspeaker **11** as illustrated in FIG. **17** to FIG. **19**. The locating portion **1061** is configured to maintain a predetermined gap between an inner peripheral surface of the shell assembly **10** and an outer peripheral surface of the bone-conducting loudspeaker **11** along a radial direction of the bone-conducting loudspeaker **11**. The radial direction of the bone-conducting loudspeaker **11** is shown in the direction E in FIG. **17** to FIG. **19**. Directions perpendicular to the central axis direction Z are all referred to as the radial direction E of the bone-conducting loudspeaker **11**.

[0161] The position of the locating portion **1061** may be disposed on the shell assembly **10**, on the bone-conducting loudspeaker **11**, or on both the shell assembly **10** and the bone-conducting loudspeaker **11**, which is not limited by the present disclosure herein. For example, the locating portion **1061** may be disposed on one of the shell assembly **10** or the bone-conducting loudspeaker **11**, and is positioned against another one of the shell assembly **10** or the bone-conducting loudspeaker **11** along a radial direction of the bone-conducting loudspeaker **11**, thus forming a gap between the inner peripheral surface of the shell assembly **10** and the outer peripheral surface of the bone-conducting loudspeaker **11**.

[0162] The fixing adhesive **1062** may fill in the gap and connect the shell assembly **10** and the bone-conducting loudspeaker **11**. This allows the fixing adhesive **1062** to fix the shell assembly **10** and the bone-conducting loudspeaker **11** along a circumferential direction of the bone-conducting loudspeaker **11**, so that the bone-conducting loudspeaker **11** is less prone to deflection when vibrating along the central axis direction Z.

[0163] Maintaining the predetermined gap between the bone-conducting loudspeaker **11** and the shell assembly **10** along the circumferential direction of the bone-conducting loudspeaker **11** facilitates the addition of the fixing adhesive **1062**, simplifies the production process of the earphone **100**, and facilitates the flow of the fixing adhesive **1062** along the circumferential direction of the bone-conducting loudspeaker **11**, which enables it to be uniformly filled in the gap between the bone-conducting loudspeaker **11** and the shell assembly **10**. In this way, the fixing effect of the fixing adhesive **1062** can be improved, thus stabilizing the position of the bone-conducting loudspeaker **11** in the accommodation cavity **1001**, thereby making the structure of the earphone **100** more compact and stable.

[0164] Optionally, there may be a plurality of locating portions **1061**, and the plurality of locating portions **1061** are spaced apart along the circumferential direction of the bone-conducting loudspeaker **11**. The plurality of locating portions **1061** are spaced apart along the circumferential direction of the bone-conducting loudspeaker **11**, and the plurality of locating portions **1061** locate predetermined gaps along the circumferential direction of the bone-conducting loudspeaker **11** to facilitate application of the fixing adhesive **1062** along the circumferential direction of the bone-conducting loudspeaker **11**, thereby enhancing the fixation effect of the fixing adhesive **1062**. Optionally, the plurality of locating portions **1061** may be symmetrically arranged on two opposite sides of the bone-conducting loudspeaker **11** along the circumferential direction.

[0165] As shown in FIG. **18**, the vibration transmission sheet **113** may elastically constrain the relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z. Optionally, the central fixing portion **1131** is fixedly connected to the magnetic conduction plate **1122**, the annular fixing portion **1132** is fixedly connected to the magnetic conduction shield **1111**, and the linkage assembly **1133** connects the annular fixing portion **1132** and the central fixing portion **1131**.

[0166] Specifically, the locating portion **1061** is disposed at an outer ring edge of the annular fixing portion **1132** of the vibration transmission sheet **113** and extends along the radial direction of the bone-conducting loudspeaker **11** toward the inner peripheral surface of the shell assembly **10** for abutting against the inner peripheral surface of the shell assembly **10**, such that a predetermined gap can be maintained between the inner peripheral surface of the shell assembly **10** and the outer peripheral surface of the bone-conducting loudspeaker **11** along the radial direction of the bone-conducting loudspeaker **11**, enabling the fixing adhesive **1062** to be filled within the gap. By disposing the locating portion **1061** on the vibration transmission sheet **113** can facilitate the machining out of the locating portion **1061** through a simple machining process. Besides, the vibration of the vibration transmission sheet **113** is mainly along the central axis direction Z and relies on elastic deformation generated by the linkage assembly **1133**, on the one hand, disposing the locating portion **1061** at the outer ring edge of the annular fixing portion **1132** may not affect the elastic deformation of the linkage assembly **1133**, ensuring the vibration and sound quality effect of the bone-conducting loudspeaker **11**, and on the other hand, it can also enhance the strength of the annular fixing portion **1132**, and the smaller displacement and the relatively fixed position of the annular fixing portion **1132** can better support the inner peripheral surface of the shell assembly **10** and can more stably maintain the predetermined gap.

[0167] As previously described, there may be two vibration transmission sheets **113**, and the two vibration transmission sheets **113** are provided on two opposite sides of the bone-conducting loudspeaker **11** along the central axis direction Z. The locating portions **1061** may be disposed at the outer ring edge of the annular fixing portion **1132** of the two vibration transmission sheets **113**, respectively, which can make the force of the bone-conducting loudspeaker **11** more uniform. Along the central axis direction Z of the bone-conducting loudspeaker **11**, the gap between the inner peripheral surface of the shell assembly **10** and the outer peripheral surface of the bone-conducting loudspeaker **11** may be of a consistent width, which can enable the bone-conducting loudspeaker **11** to be set in a more accurate position and also enhance the filling effect of the fixing adhesive **1062**.

[0168] In some embodiments, the locating portion **1061** is disposed at the outer ring edge of the annular fixing portion **1132** of the vibration transmission sheet **113**, which also improves the assembly and positioning of the vibration transmission sheet **113** when it is fixed to the magnet assembly **112** and the magnetic conduction shield **1111** with a better locating accuracy, which in turn ensures that a magnetic gap between the magnetic conduction shield **1111** fixed with the voice coil **1110** and the magnet assembly **112** more uniform and balanced, thereby improving the sound quality. For example, the bone-conducting loudspeaker **11** can be assembled using an upper jig and a lower jig as follows: the magnet assembly **112** and the magnetic conduction shield **1111** fixed with the voice coil **1110** are located using the lower jig, while the vibration transmission sheet **113** is located using the upper jig. In this way, the vibration transmission sheet **113** can be located using the locating portion **1061**, and the upper jig can be designed with holes to facilitate the welding of the vibration transmission sheet **113** to the magnet assembly **112** and the magnetic conduction shield **1111**, which also ensures the alignment of corresponding positions on the vibration transmission sheet **113** (e.g., the central fixing portion **1131**) with the corresponding holes on the upper jig. Then, the upper jig and the lower jig are aligned to ensure that the corresponding positions on the vibration transmission sheet **113** (e.g., the central fixing portion **1131**) align with the corresponding positions on the magnet assembly **112** (e.g., the protrusion portion **1105**). Similarly, the corresponding positions on the vibration transmission sheet **113** (e.g., the annular fixing portion **1132**) align with the corresponding positions on the magnetic conduction shield **1111**. This alignment allows for subsequent operations through the holes in the upper jig, such as pre-deforming the vibration transmission sheet **113** and fixing the vibration transmission sheet **113**, the magnetic conduction shield **1111**, and the magnet assembly **112** together.

[0169] As shown in FIG. **19** to FIG. **21**, the locating portion **1061** may also be integrally molded to the inner peripheral surface of the shell assembly **10**.

[0170] In some embodiments, a plurality of locating portions **1061** may be spaced apart on an inner peripheral surface of the shell assembly **10**. The plurality of locating portions **1061** may be spaced apart on the shell assembly **10**, extend towards the bone-conducting loudspeaker **11**, and abut against the outer peripheral surface of the bone-conducting loudspeaker **11** to support a gap between the inner peripheral surface of the shell assembly **10** and the outer peripheral surface of the bone-conducting loudspeaker **11**. Optionally, the plurality of locating portions **1061** may be integrally molded to the inner peripheral surface of the shell **101**. By providing the locating portions **1061** on the inner peripheral surface of the shell assembly **10**, on the one hand, it can locate the bone-conducting loudspeaker **11** when assembling the bone-conducting loudspeaker **11**, which facilitates its assembly, on the other hand, since the locating portion **1061** is disposed on the inner peripheral surface of the shell assembly **10**, its position is stable and is not affected by the vibration of the bone-conducting loudspeaker **11**, and thus the predetermined gap can be stably maintained. Moreover, by disposing the locating portion **1061** on the shell assembly **10**, the bone-conducting loudspeaker **11** can be minimized and facilitate the vibration of the bone-conducting loudspeaker **11**, and by setting the locating portion **1061** on the shell assembly **10** abutting against the bone-conducting loudspeaker **11**, the vibration transmission of the bone-conducting loudspeaker **11** to the shell assembly **10** can be further ensured, thereby ensuring the sound quality effect of the bone-conducting loudspeaker **11**. Moreover, locating on the shell assembly **10** is relatively simple to process, which can streamline the manufacturing process of the locating portion **1061** and, in turn, reduce the overall manufacturing complexity of the earphone **100**.

[0171] In other embodiments, as illustrated in FIG. **22**, the locating portion **1061** includes a first locating portion **1063** integrally molded to the outer ring edge of the annular fixing portion **1132** and a second locating portion **1064** integrally molded to the inner peripheral surface of the annular fixing portion **1132**. The first locating portion **1063** is disposed on the annular fixing portion **1132** and extends along the radial direction E of the bone-conducting loudspeaker **11** to abut against the inner peripheral surface of the shell assembly **10**. The second locating portion **1064** is disposed on the inner peripheral surface of the shell assembly **10** and extends along the radial direction E of the bone-conducting loudspeaker **11** to abut against the outer peripheral surface of the bone-conducting loudspeaker **11**. It should be understood that the first locating portion **1063** may not be limited to being disposed on the annular fixing portion **1132**, but may also be disposed on the outer peripheral surface of the bone-conducting loudspeaker **11** such as the outer peripheral surface of the voice coil assembly **111**.

[0172] Both the bone-conducting loudspeaker **11** and the shell assembly **10** are provided with the locating portions **1061** to realize a bidirectional abut along the radial direction E, so that even if the locating portion **1061** on one of the sides is not effective in supporting the bone-conducting loudspeaker **11**, the locating portion **1061** on another side can ensure the support effect, which in turn enhances the redundancy and further stabilizes the position of the bone-conducting loudspeaker **11**. In this way, the locating portion **1061** can more securely support the gap between the inner peripheral surface of the shell assembly **10** and the outer peripheral surface of the bone-conducting loudspeaker **11**, to facilitate the addition of the fixing adhesive **1062** and to make the force of the bone-conducting loudspeaker **11** more even, thus making the structure of the earphone **100** more stable.

[0173] Optionally, the first locating portion **1063** and the second locating portion **1064** are staggered from each other along the circumferential direction of the bone-conducting loudspeaker **11**. Such an arrangement facilitates the assembly of the bone-conducting loudspeaker **11** into the shell assembly **10**, reduces friction and damage caused by the first locating portion **1063** and the second locating portion **1064** due to coming into contact with each other, and further stabilizes the position of the bone-conducting loudspeaker **11** and enhance the structural tightness of the earphone **100**.

[0174] Referring to FIG. **23**, the shell assembly **10** includes the accommodation cavity **1001**. The bone-conducting loudspeaker **11** is accommodated within the accommodation cavity **1001**. The vibration transmission sheet **113** may connect the voice coil assembly **111** and the magnet assembly **112** and elastically constrain the relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z of the bone-conducting loudspeaker **11**. First one of the voice coil assembly **111** and the magnet assembly **112** is rigidly connected to the shell assembly **10**, which in turn can transmit vibrations generated by the relative movement between the voice coil assembly **111** and the magnet assembly **112** to the shell assembly **10** for realizing bone conduction.

[0175] Specifically, the first one of the voice coil assembly **111** and the magnet assembly **112** refers to the voice coil assembly **111** and the second one of the voice coil assembly **111** and the magnet assembly **112** refers to the magnet assembly **112**. In this case, the voice coil assembly **111** may be rigidly connected to the shell assembly **10**. In other embodiments, the first one of the voice coil assembly **111** and the magnet assembly **112** also refers to the magnet assembly **112**, and the second one of the voice coil assembly **111** and the magnet assembly **112** refers to the magnet assembly **112**.

[0176] As previously described, the central fixing portion **1131** may be connected to the magnet assembly **112** and the annular fixing portion **1132** may be connected to the voice coil assembly **111**. The vibration transmission sheet **113** may be inherently elastic or may be subject to elastic deformation. The vibration transmission sheet **113** may adaptively deform elastically when the voice coil assembly **111** and the magnet assembly **112** move relative to each other. While the vibration transmission sheet **113** adaptively deforms elastically, the central fixing portion **1131** connecting the magnet assembly **112** and the annular fixing portion **1132** connecting the voice coil assembly **111** may move relative to each other along the central axis direction Z.

[0177] Usually, when the earphone **100** outputs sound normally, the range of relative movement between the magnet assembly **112** and the voice coil assembly **111** is within a permitted range, i.e., the relative movement between the two is realized through the elastic deformation generated by the vibration transmission sheet **113**. However, in some special scenarios, the range of relative movement between the magnet assembly **112** and the voice coil assembly **111** may exceed the permitted range. For example, when the earphone **100** falls to the ground or collide, the magnet assembly **112** continues to move due to inertia, resulting in an excessive displacement of the magnet assembly **112** relative to the voice coil assembly **111**, thereby exerting excessive force on the vibration transmission sheet **113**. Consequently, the vibration transmission sheet **113** may be overstretched, potentially exceed its range of elastic deformation, and undergo plastic deformation, which would reduce its elasticity, weaken the elastic constraint effect, and ultimately affect the performance of the earphone **100**.

[0178] To ameliorate the above-mentioned problems, the shell assembly **10** may be provided with the stop member **107**. The stop member **107** may rigidly constrain the range of relative movement between the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z. That is to say, the stop member **107** may apply a rigid constraint to the magnet assembly **112** when the magnet assembly **112** moves excessively compared to the voice coil assembly **111**, to limit the movement amplitude of the magnet assembly **112**, which in turn can reduce the elasticity degradation of the vibration transmission sheet **113** caused by the excessive movement amplitude.

[0179] Setting the stop member **107** to limit the range of relative movement between the voice coil assembly **111** and the magnet assembly **112** can avoid an excessively large range of relative movement between the voice coil assembly **111** and the magnet assembly **112** or reduce the possibility of an excessively large range of relative movement between the voice coil assembly **111** and the magnet assembly **112**, thereby minimizing the possibility of overstretching the vibration transmission sheet **113**.

[0180] The rigid constraint imposed by the stop member **107** and the elastic constraint imposed by the vibration transmission sheet **113** are relative to each other, i.e., the constraining strength exerted by the stop member **107** on the magnet assembly **112** when stopping the magnet assembly **112** is greater than the constraining strength exerted by the vibration transmission sheet **113** on the magnet assembly **112** and the voice coil assembly **111**.

[0181] Optionally, the stop member **107** protrudes from the shell assembly **10**. The first one of the voice coil assembly **111** and the magnet assembly **112** may be fixedly connected to the shell assembly **10**, and the stop member **107** is disposed on a surface of the shell assembly **10** towards the second one of the voice coil assembly **111** and the magnet assembly **112** along the central axis direction Z. The stop member **107** may be fixedly connected to the second one of the voice coil assembly **111** and the magnet assembly **112** or abut against the vibration transmission sheet **113** after the second one of the voice coil assembly **111** and the magnet assembly **112** moves a predetermined distance relative to the first one of the voice coil assembly **111** and the magnet assembly **112**, which in turn can effectively limit the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**.

[0182] For example, the voice coil assembly **111** is fixedly connected to the shell assembly **10**, and the stop member **107** may abut against the magnet assembly **112** or the vibration transmission sheet **113** after the magnet assembly **112** moves to a predetermined distance relative to the voice coil assembly **111**, thereby imposing a rigid constraint on the magnet assembly **112** or the vibration transmission sheet **113**. This makes it possible to limit the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**.

[0183] In other embodiments, the stop member **107** may also be in the form of a plate or other arbitrary shape.

[0184] Optionally, the stop member **107** is integrally molded to the shell assembly **10**, which can improve productivity and assembly efficiency.

[0185] The stop member **107** may apply a rigid constraint to the magnet assembly **112** directly or indirectly after the magnet assembly **112** moves a predetermined distance relative to the voice coil assembly **111**. Optionally, the stop member **107** applies the rigid constraint to the magnet assembly **112** indirectly by applying the rigid constraint directly on the vibration transmission sheet **113**.

[0186] Referring to FIG. **24**, the stop member **107** may abut against the central fixing portion **1131** of the vibration transmission sheet **113** and/or the linkage assembly **1133** to apply a rigid constraint on the vibration transmission sheet **113**.

[0187] Optionally, the stop member **107** includes a first stop member **1071** for abutting against the central fixing portion **1131**. The first stop member **1071** may effectively limit the vibration range of the vibration transmission sheet **113** and thus limit the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**.
[0188] Optionally, the stop member **107** includes a second stop member **1072** for abutting against the linkage assembly **1133**. The second stop member **1072** may fit with the first stop member **1071** to allow the stop member **107** and the vibration transmission sheet **113** to be abutted against each other to a greater extent, so as to more contact the vibration transmission sheet **113** and further protect the vibration transmission sheet **113**.
[0189] Optionally, there may be at least one first stop member **1071**. Optionally, there may be at least two second stop members **1072**.
[0190] During vibration of the vibration transmission sheet **113**, the moveable distance of a region near the center of the vibration transmission sheet **113** (e.g., the central fixing portion **1131**) is greater than the moveable distance of a region away from the center of the vibration transmission sheet **113**. If the first stop member **1071** and the second stop member **1072** are at the same distance from the bone-conducting loudspeaker **11** while the movement degrees in different regions of the vibration transmission sheet **113** are different, the first stop member **1071** and the second stop member **1072** may not simultaneously abut against the vibration transmission sheet **113**, which makes the rigid constraint less effective.
[0191] Optionally, the vibration transmission sheet **113** may be configured with a pre-deformation design, i.e., in a natural state, the linkage assembly **1133** has an extension component starting at the annular fixing portion **1132** and pointing toward the interior of the bone-conducting loudspeaker **11** along the central axis direction Z. The vibration transmission sheet **113** may be pre-deformed toward the interior of the bone-conducting loudspeaker **11** or may be pre-deformed toward the exterior of the bone-conducting loudspeaker **11**. The natural state refers to a state when the bone-conducting loudspeaker **11** is assembled or a state in which the voice coil assembly **111** and the magnet assembly **112** are relatively stationary when the bone-conducting loudspeaker **11** is not operating.
[0192] Along the central axis direction Z, a spacing d**2** from the first stop member **1071** to the central fixing portion **1131** is greater than a spacing d**1** from the second stop member **1072** to the linkage assembly **1133**. In this way, the possibility of the first stop member **1071** and the second stop member **1072** simultaneously abutting against the vibration transmission sheet **113** can be increased, which facilitates the first stop member **1071** and the second stop member **1072** to jointly exert a rigid constraint on the vibration transmission sheet **113**. Alternatively, as compared to the spacing d**2** from the first stop member **1071** to the central fixing portion **1131** being equal to the spacing d**1** from the second stop member **1072** to the linkage assembly **1133**, the spacing d**2** from the first stop member **1071** to the central fixing portion **1131** being greater than the spacing d**1** from the second stop member **1072** to the linkage assembly **1133** can provide sufficient vibration space for the vibration transmission sheet **113** to vibrate during normal operation, thereby enhancing the sound quality of the earphone **100**.
[0193] It should be understood that in a natural state, the second stop member **1072** and the linkage assembly **1133** may be spaced apart from each other or may abut against each other. Since the linkage assembly **1133** is relatively weak in rigidity and is susceptible to stretching, the second stop member **1072** and the linkage assembly **1133** abutting against each other in the natural state can further limit the vibration degree of the vibration transmission sheet **113** and better protect the linkage assembly **1133**.
[0194] Optionally, the spacing d**2** from the first stop member **1071** to the central fixing portion **1131** is greater than or equal to 0.1 mm, which can make the first stop member **1071** more sensitive against the vibration transmission sheet **113** and provide timely protection. In other words, the bone-conducting loudspeaker **11** can achieve bone conduction relatively well while being less

prone to damage during drops or collisions.

[0195] Considering that the spacing d**1** from the second stop member **1072** to the linkage assembly **1133** is smaller than the spacing d**2** from the first stop member **1071** to the central fixing portion **1131**, if the second stop member **1072** is too close to the first stop member **1071** (the central fixing portion **1131**), this may limit the movable distance of the magnet assembly **112** (i.e., the range of relative movement between the voice coil assembly **111** and the magnet assembly **112**). Optionally, along an extension direction of the linkage assembly **1133**, the position of the second stop member **1072** abutting against the linkage assembly **1133** is closer to the annular fixing portion **1132** as compared to the central fixing portion **1131**. In this way, the vibration degree of the central fixing portion **1131** can be retained to a certain extent, which allows the voice coil assembly **111** and the magnet assembly **112** of the bone-conducting loudspeaker **11** to have a larger range of relative movement within a reasonable limit.

[0196] As described previously, the outer end surface **1103** of the second one of the voice coil assembly **111** and the magnet assembly **112** includes the center region **1104** and the peripheral region **1106** surrounding the center region **1104** (refer to FIG. **7** and FIG. **8** for illustrations). The center region **1104** is provided with the protrusion portion **1105**. The protrusion portion **1105** protrudes with respect to the peripheral region **1106**. The central fixing portion **1131** is connected to the protrusion portion **1105**. In this case, it is advantageous for the second one of the voice coil assembly **111** and the magnet assembly **112** and the central fixing portion **1131** to be assembled together.

[0197] Taking the outer end surface **1103** disposed on the magnet assembly **112** as an example, the outer end surface **1103** includes the center region **1104** and the peripheral region **1106**. By disposing the protrusion portion **1105** on the outer end surface **1103** of the magnet assembly **112**, and fixedly connecting the central fixing portion **1131** of the vibration transmission sheet **113** to the protrusion portion **1105**, on the one hand, this configuration minimizes the fixed connection region between the vibration transmission sheet **113** and the magnet assembly **112**, reducing the limitations on the elastic deformation of the vibration transmission sheet **113** and improving the vibration effect while ensuring the elastic constraint, on the other hand, by not disposing the protrusion portion **1105** on the vibration transmission sheet **113**, the weight of the vibration transmission sheet **113** can be kept at a certain level to reduce its impact on the vibration. At the same time, this design allows for a more reliable and stable connection between the magnet assembly **112** and the vibration transmission sheet **113**.

[0198] Specifically, when the central fixing portion **1131** of the vibration transmission sheet **113** is rounded, the protrusion portion **1105** may also be cylindrical. The shape of the center region **1104** can be designed to match the shape of the central fixing portion **1131**, ensuring that a stable connection is formed between the center region **1104** and the central fixing portion **1131** of the vibration transmission sheet **113**.

[0199] Optionally, as shown in FIG. **17**, the shell assembly **10** includes the shell **101** and the shell **102** that fit with each other along the central axis direction Z. The stop member **107** is provided on an inner surface of the shell **101** and/or an inner surface of the shell **102**. The outer surface of the shell **101** and/or the outer surface of the shell **102** is in contact with the user's skin. The assembly of the bone-conducting loudspeaker **11** is facilitated by the above structure.

[0200] Optionally, the first one of the voice coil assembly **111** and the magnet assembly **112** surrounds the second one of the voice coil assembly **111** and the magnet assembly **112**. For example, the voice coil assembly **111** surrounds the magnet assembly **112**. The voice coil assembly **111** is rigidly connected to the shell **101** and/or the shell **102**. By setting the voice coil assembly **111** surrounding the magnet assembly **112**, it can minimize the magnet assembly **112**, which can reduce the volume of the bone-conducting loudspeaker **11**, and thus reduce the volume of the earphone **100**. In other embodiments, the magnet assembly **112** may also be provided outside the voice coil assembly **111**.

[0201] Optionally, the shell **102** further presses and fixes the voice coil assembly **111** to the shell **101**, so that the voice coil assembly **111** can be stably sandwiched between the shell **101** and the shell **102** with a better fixing effect, and thus enhancing the effect of vibration conduction to the shell assembly **10** and easily assembling the bone-conducting loudspeaker **11** in the shell assembly **10**.
[0202] The foregoing is only a part of the embodiments of the present disclosure, and is not intended to limit the scope of protection of the present disclosure, and any equivalent device or equivalent process transformations utilizing the contents of the present disclosure and the accompanying drawings, or applying them directly or indirectly in other related technical fields, are similarly included in the scope of patent protection of the present disclosure.

Claims

1. An earphone, comprising: a shell assembly, wherein the shell assembly is provided with an accommodation cavity; a bone-conducting loudspeaker accommodated in the accommodation cavity, wherein the bone-conducting loudspeaker is configured to vibrate along a central axis direction of the bone-conducting loudspeaker, the bone-conducting loudspeaker includes a voice coil assembly, a magnet assembly, and a vibration transmission sheet, the vibration transmission sheet is elastically connected to the voice coil assembly and the magnet assembly to elastically constrain relative movement between the voice coil assembly and the magnet assembly along the central axis direction of the bone-conducting loudspeaker, one of the voice coil assembly and the magnet assembly is rigidly connected to the shell assembly, the shell assembly is provided with a stop member, and the stop member rigidly constrains a range of relative movement between the voice coil assembly and the magnet assembly along the central axis direction.
2. The earphone of claim 1, wherein the stop member is protrudingly arranged on a surface of the shell assembly directed toward another one of the voice coil assembly and the magnet assembly along the central axis direction and abuts against the vibration transmission sheet or the another one of the voice coil assembly and the magnet assembly after the another one of the voice coil assembly and the magnet assembly moves a predetermined distance relative to the one of the voice coil assembly and the magnet assembly.
3. The earphone of claim 2, wherein the stop member is integrally molded to the shell assembly.
4. The earphone of claim 2, wherein the one of the voice coil assembly and the magnet assembly is arranged around the another one of the voice coil assembly and the magnet assembly, the vibration transmission sheet includes a central fixing portion, an annular fixing portion around a periphery of the central fixing portion, and a linkage assembly connected between the central fixing portion and the annular fixing portion, the annular fixing portion is connected to the one of the voice coil assembly and the magnet assembly, and the central fixing portion is connected to the another one of the voice coil assembly and the magnet assembly.
5. The earphone of claim 4, wherein the annular fixing portion serves as the stop member, and a projection of the annular fixing portion along the central axis direction partially overlaps with an outer end surface of the another one of the voice coil assembly and the magnet assembly.
6. The earphone of claim 4, wherein the stop member includes a first stop member configured to abut against the central fixing portion.
7. The earphone of claim 6, wherein a count of the first stop member is at least one.
8. The earphone of claim 6, wherein the stop member includes a second stop member configured to abut against the linkage assembly.
9. The earphone of claim 8, wherein a count of the second stop member is at least two.
10. The earphone of claim 8, wherein in a natural state, the linkage assembly has an extension component starting at the annular fixing portion and pointing toward an interior of the bone-conducting loudspeaker along the central axis direction, and along the central axis direction, a

spacing from the first stop member to the central fixing portion is greater than a spacing from the second stop member to the linkage assembly.
11. The earphone of claim 10, wherein in the natural state, the second stop member abuts against the linkage assembly.
12. The earphone of claim 11, wherein the spacing from the first stop member to the central fixing portion is greater than or equal to 0.1 mm.
13. The earphone of claim 11, wherein along an extension direction of the linkage assembly, a position of the second stop member abutting against the linkage assembly is closer to the annular fixing portion compared to the central fixing portion.
14. The earphone of claim 1, wherein the shell assembly includes a first shell and a second shell fitting with each other along the central axis direction, the first shell and the second shell fit with each other to form the accommodation cavity.
15. The earphone of claim 14, wherein the stop member is arranged on an inner surface of the first shell and/or an inner surface of the second shell, and an outer surface of the first shell and/or an outer surface of the second shell is in contact with a user's skin.
16. The earphone of claim 15, wherein the voice coil assembly is arranged around the magnet assembly, and the voice coil assembly is rigidly connected to the first shell and/or second shell.
17. The earphone of claim 15, wherein the second shell further presses and fixes the voice coil assembly to the first shell.
18. The earphone of claim 4, wherein the outer end surface of the another one of the voice coil assembly and the magnet assembly includes a center region and a peripheral region surrounding the center region, the center region is provided with a protrusion portion, and the protrusion portion protrudes with respect to the peripheral region, the central fixing portion is fixedly connected to the protrusion portion, and a projection of the annular fixing portion along the central axis direction partially overlaps with the peripheral region.
19. The earphone of claim 1, further comprising: an air-conducting loudspeaker, wherein the accommodation cavity includes a first accommodation cavity and a second accommodation cavity that are isolated from each other, the bone-conducting loudspeaker is accommodated in the first accommodation cavity, and the air-conducting loudspeaker is accommodated in the second accommodation cavity.
20. The earphone of claim 19, wherein a sealing performance of the first accommodation cavity is greater than a sealing performance of the second accommodation cavity.
