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(54) **LOUDSPEAKER DRIVER, LOUDSPEAKER MODULE, AND ELECTRONIC DEVICE**

(57) This application provides a speaker core, a speaker module, and an electronic device, to improve a driving force of the speaker core thereby improving sound production performance of the speaker core. The speaker core includes a basket, a sound diaphragm, a first voice coil and a second voice coil. The sound diaphragm is mounted on the basket, both the first voice coil and the second voice coil are located on an inner side of

the basket and are mounted on the sound diaphragm, and the second voice coil is located on an inner side of the first voice coil and is spaced from the first voice coil. The first voice coil has a first end face facing the sound diaphragm, the second voice coil has a second end face facing the sound diaphragm, and the second end face is located on a side of the first end face facing the sound diaphragm.

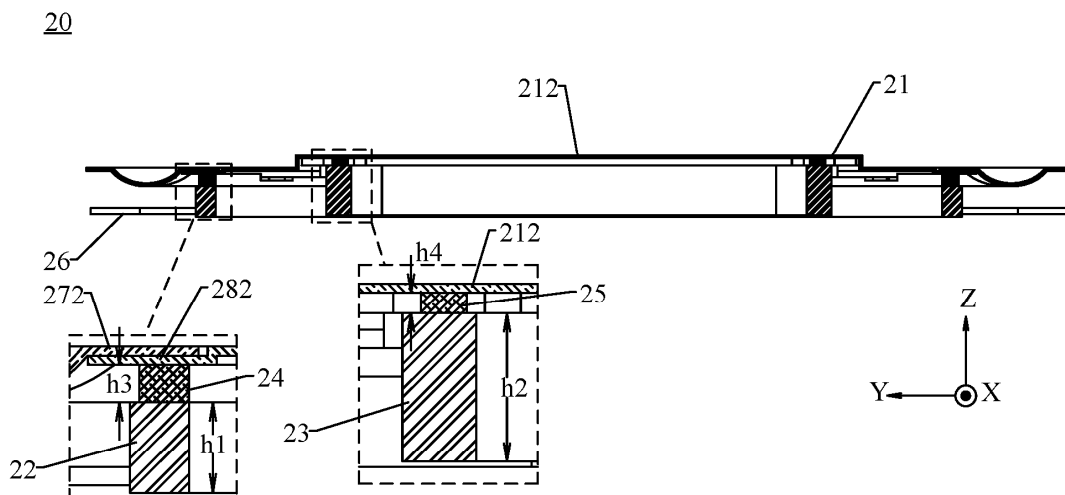


FIG. 7

Description

[0001] This application claims priority to Chinese Patent Application No. 202410050495.2, filed with the China National Intellectual Property Administration on January 12, 2024 and entitled "SPEAKER CORE, SPEAKER MODULE, AND ELECTRONIC DEVICE", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] This application relates to the field of speaker technologies, and in particular, to a speaker core, a speaker module, and an electronic device.

BACKGROUND

[0003] With continuous development of science and technology, electronic devices such as mobile phones are widely used in people's daily life and work, and have become indispensable daily necessities. In an existing electronic device, a moving-coil speaker core is usually used to implement sound production of the electronic device. However, the existing moving-coil speaker core usually uses a single voice coil to drive a diaphragm to vibrate and produce a sound. As a result, a driving force of the speaker core is small, leading to poor sound production performance of the speaker core.

SUMMARY

[0004] This application provides a speaker core, a speaker module, and an electronic device, to improve a driving force of the speaker core thereby improving sound production performance of the speaker core.

[0005] According to a first aspect, this application provides a speaker core, including a basket, a sound diaphragm, a first voice coil, and a second voice coil. The sound diaphragm is mounted on the basket, both the first voice coil and the second voice coil are located on an inner side of the basket and are mounted on the sound diaphragm, and the second voice coil is located on an inner side of the first voice coil and is spaced from the first voice coil.

[0006] The first voice coil has a first end face facing the sound diaphragm, the second voice coil has a second end face facing the sound diaphragm, and the second end face is located on a side of the first end face facing the sound diaphragm.

[0007] In this application, the speaker core drives, by using both the first voice coil and the second voice coil, the sound diaphragm to vibrate, so as to implement sound production through vibration. The first voice coil and the second voice coil may cooperate with the magnetic circuit assembly to shorten a magnetic conduction path. A driving magnetic field provided by the magnetic circuit assembly may be fully used to improve magnetic field utilization of the magnetic circuit assembly. This is

equivalent to implementing a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core. In addition, the first voice coil and the second voice coil are arranged at different height planes, so that the driving magnetic field provided by the magnetic circuit assembly can be further fully used, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core.

[0008] In an implementation, the sound diaphragm includes a body and a convex, the body is mounted on the basket, the convex is connected to the body, and protrudes from the body toward a direction away from the basket.

[0009] The first voice coil is mounted on the body, and the second voice coil is mounted on the convex, so that the first voice coil and the second voice coil are designed at different height planes, and the driving magnetic field provided by the magnetic circuit assembly can be fully used, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core.

[0010] In an implementation, a ratio of an area of the convex to an area of the sound diaphragm ranges from 1/4 to 1/3.

[0011] The ratio of the area of the convex portion to the area of the sound diaphragm is small, that is, an area occupied by the convex portion on the sound diaphragm is small. An area, other than the convex portion, on the sound diaphragm may be used for airflow. In this way, a height of the speaker core near the sound output hole may be reduced, and a cross-sectional area of the sound output hole may be increased, to reduce an airflow rate, thereby helping improve sound quality of a speaker module during external sound output and improve sound production performance of the speaker module.

[0012] In an implementation, a height of the second voice coil is greater than a height of the first voice coil. Compared with the first voice coil, the second voice coil is higher, which is equivalent to using a long voice coil structure to drive the sound diaphragm, thereby implementing low distortion of the speaker core, and effectively improving sound quality of the speaker module during external sound output.

[0013] In an implementation, the speaker core further includes a first magnetic conductive plate, a first magnet, a second magnet, and a third magnet. The first magnetic conductive plate is located on a side of the basket that faces away from the sound diaphragm, and is spaced from the basket. The first magnet, the second magnet, the third magnet are all located on a surface of the first magnetic conductive plate facing the basket. The second magnet is located on an inner side of the first magnet, and a first gap is formed between the second magnet and the first magnet. The third magnet is located on an inner side

of the second magnet, and a second gap is formed between the third magnet and the second magnet.

[0014] An end portion of the first voice coil that faces away from the sound diaphragm is located in the first gap, and an end portion of the second voice coil that faces away from the sound diaphragm is located in the second gap. That is, the end portion of the first voice coil that faces away from the sound diaphragm and the end portion of the second voice coil that faces away from the sound diaphragm are both located in the magnetic field provided by the magnetic circuit assembly. When the first voice coil and the second voice coil receive an audio signal transmitted by the flexible printed circuit, the first voice coil and the second voice coil move up and down in a Z-axis direction to cut a magnetic force line of the magnetic field, and drive the sound diaphragm to vibrate.

[0015] In an implementation, the second magnet includes a magnet body and a magnet protrusion, the magnet body is located on the surface of the first magnetic conductive plate facing the basket, and a first sub-gap is formed between the magnet body and the third magnet. The magnet protrusion is connected to a surface of the magnet body that faces away from the first magnetic conductive plate, and a second sub-gap is formed between the magnet protrusion and the third magnet. The second sub-gap communicates with the first sub-gap, and the second gap includes the first sub-gap and the second sub-gap.

[0016] The first magnet, the second magnet, and the third magnet are arranged in a high-low mating structure. A low magnetic circuit structure is designed to mate with the first voice coil, and a high magnetic circuit structure is designed to mate with the second voice coil, so that the first voice coil and the second voice coil can make full use of the driving magnetic field provided by the magnetic circuit assembly, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core.

[0017] In an implementation, the speaker core further includes a second magnetic conductive plate, a third magnetic conductive plate, and a fourth magnetic conductive plate.

[0018] The second magnetic conductive plate is located on a surface of the first magnet that faces away from the first magnetic conductive plate. The third magnetic conductive plate is located on a surface of the second magnet that faces away from the first magnetic conductive plate, and is located on an inner side of the second magnetic conductive plate. A third gap is formed between the third magnetic conductive plate and the second magnetic conductive plate, and the third gap communicates with the first gap. The fourth magnetic conductive plate is located on a surface of the third magnet that faces away from the first magnetic conductive plate, and is located on an inner side of the third magnetic conductive plate. A fourth gap is formed between the fourth magnetic conductive plate and the third

magnetic conductive plate, and the fourth gap communicates with the second gap.

[0019] The end portion of the first voice coil that faces away from the sound diaphragm is further located in the third gap, and the end portion of the second voice coil that faces away from the sound diaphragm is further located in the fourth gap. That is, the end portion of the first voice coil that faces away from the sound diaphragm and the end portion of the second voice coil that faces away from the sound diaphragm are both located in the magnetic field provided by the magnetic circuit assembly. When the first voice coil and the second voice coil receive an audio signal transmitted by the flexible printed circuit, the first voice coil and the second voice coil move up and down in the Z-axis direction to cut a magnetic force line of the magnetic field, and drive the sound diaphragm to vibrate.

[0020] In an implementation, the third magnetic conductive plate includes a magnetic conductive plate body and a magnetic conductive protrusion. The magnetic conductive plate body is located on the surface of the second magnet that faces away from the first magnetic conductive plate, and a third sub-gap is formed between the magnetic conductive plate body and the fourth magnetic conductive plate. The magnetic conductive protrusion is connected to a surface of the magnetic conductive plate body that faces away from the first magnetic conductive plate, and a fourth sub-gap is formed between the magnetic conductive protrusion and the fourth magnetic conductive plate. The second sub-gap communicates with the first sub-gap and the second gap, and the fourth gap includes the third sub-gap and the fourth sub-gap.

[0021] The second magnetic conductive plate, the third magnetic conductive plate, and the fourth magnetic conductive plate are arranged in a high-low mating structure. A low magnetic circuit structure is designed to mate with the first voice coil, and a high magnetic circuit structure is designed to mate with the second voice coil, so that the first voice coil and the second voice coil can make full use of the driving magnetic field provided by the magnetic circuit assembly, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core.

[0022] In an implementation, the first voice coil has a third end face disposed opposite to the first end face, the second voice coil has a fourth end face disposed opposite to the second end face, and the third end face is flush with the fourth end face, to ensure that both the third end face of the first voice coil and the fourth end face of the second voice coil are located in the magnetic field provided by the magnetic circuit assembly. When the first voice coil and the second voice coil receive an audio signal transmitted by the flexible printed circuit, the first voice coil and the second voice coil move up and down in the Z-axis direction to cut a magnetic force line of the magnetic field, and drive the sound diaphragm to vibrate.

[0023] In an implementation, the speaker core further includes a first framework and a second framework, both

the first framework and the second framework are located on the inner side of the basket, and the first framework is connected between the sound diaphragm and the first voice coil. The second framework is connected between the sound diaphragm and the second voice coil, is located on an inner side of the first framework, and is spaced from the first framework.

[0024] A height of the first framework is greater than a height of the second framework, to ensure that both the end portion of the first voice coil that faces away from the sound diaphragm and the end portion of the second voice coil that faces away from the sound diaphragm are located in the magnetic field provided by the magnetic circuit assembly. When the first voice coil and the second voice coil receive an audio signal transmitted by the flexible printed circuit, the first voice coil and the second voice coil move up and down in the Z-axis direction to cut a magnetic force line of the magnetic field, and drive the sound diaphragm to vibrate.

[0025] In an implementation, the speaker core further includes a flexible printed circuit, the flexible printed circuit is mounted on the basket and is electrically connected to the first voice coil and the second voice coil.

[0026] The first framework is provided with a first avoidance groove, an opening of the first avoidance groove is located in a surface of the first framework facing the sound diaphragm, the first avoidance groove extends through an inner surface and an outer surface of the first framework, and avoids the flexible printed circuit, to avoid mutual interference between the first framework and the flexible printed circuit, thereby ensuring use reliability of the speaker core.

[0027] In an implementation, the third magnetic conductive plate is provided with a second avoidance groove, an opening of the second avoidance groove is located in a surface of the third magnetic conductive plate facing the basket, and the second avoidance groove extends through an inner surface and an outer surface of the third magnetic conductive plate, and avoids the flexible printed circuit, to avoid mutual interference between the third magnetic conductive plate and the flexible printed circuit, thereby ensuring use reliability of the speaker core.

[0028] In an implementation, the sound diaphragm includes a diaphragm and a dome, and the diaphragm includes a first fixing portion, a second fixing portion, and a surround portion. The first fixing portion is mounted on the basket, and the second fixing portion is located on an inner side of the first fixing portion, and is spaced from the first fixing portion. The surround portion is connected between the first fixing portion and the second fixing portion, and is recessed toward the basket. In this way, a height of the speaker core near the sound output hole can be reduced, and a cross-sectional area of the sound output hole may be increased, to reduce an airflow rate, thereby helping improve sound quality of a speaker module during external sound output and improve sound production performance of the speaker module.

[0029] The dome is mounted on the second fixing portion, and both the first voice coil and the second voice coil are mounted on the dome.

[0030] According to a second aspect, this application provides a speaker module, including a first housing and any one of the foregoing speaker cores. The speaker core is mounted in the first housing, a front sound cavity is formed between the sound diaphragm and the first housing, the first housing is provided with a sound output hole, and the front sound cavity communicates with an outside of the speaker module through the sound output hole.

[0031] In this application, the speaker core drives, by using both the first voice coil and the second voice coil, the sound diaphragm to vibrate, so as to implement sound production through vibration. The first voice coil and the second voice coil may cooperate with the magnetic circuit assembly to shorten a magnetic conduction path. A driving magnetic field provided by the magnetic circuit assembly may be fully used to improve magnetic field utilization of the magnetic circuit assembly. This is equivalent to implementing a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core. In addition, the first voice coil and the second voice coil are arranged at different height planes, so that the driving magnetic field provided by the magnetic circuit assembly can be further fully used, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker module.

[0032] In an implementation, the speaker module further includes a second housing, the second housing and the first housing are fixed to each other, the speaker core is located on inner sides of the second housing and the first housing, and a rear sound cavity is formed on a side of the sound diaphragm that faces away from the front sound cavity.

[0033] According to a third aspect, this application provides an electronic device, including a processor and any one of the foregoing speaker modules, where the speaker module is electrically connected to the processor.

[0034] In this application, the speaker core drives, by using both the first voice coil and the second voice coil, the sound diaphragm to vibrate, so as to implement sound production through vibration. The first voice coil and the second voice coil may cooperate with the magnetic circuit assembly to shorten a magnetic conduction path. A driving magnetic field provided by the magnetic circuit assembly may be fully used to improve magnetic field utilization of the magnetic circuit assembly. This is equivalent to implementing a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the speaker core. In addition, the first voice coil and the second voice coil are arranged at different height planes, so that the driving magnetic

field provided by the magnetic circuit assembly can be further fully used, to implement a high driving force of the speaker core, thereby improving sound production sensitivity of the speaker core, and helping improve sound production performance of the electronic device.

BRIEF DESCRIPTION OF DRAWINGS

[0035] To describe the technical solutions in embodiments of this application more clearly, the following describes the accompanying drawings used in embodiments of this application.

FIG. 1 is a schematic diagram of a structure of a first electronic device according to an embodiment of this application;

FIG. 2 is a schematic diagram of a cross-sectional structure of a speaker module in the electronic device shown in FIG. 1;

FIG. 3 is a schematic diagram of a structure of a speaker core in the speaker module shown in FIG. 2; FIG. 4 is a schematic diagram of an exploded structure of the speaker core shown in FIG. 3; FIG. 5 is a schematic diagram of a structure of a vibration assembly in the speaker core shown in FIG. 4;

FIG. 6 is a schematic diagram of an exploded structure of the vibration assembly shown in FIG. 5;

FIG. 7 is a schematic diagram of a cross-sectional structure of the vibration assembly shown in FIG. 5 cut along I-I;

FIG. 8 is a schematic diagram of a structure of a sound diaphragm in the vibration assembly shown in FIG. 6;

FIG. 9 is a schematic diagram of an exploded structure of the sound diaphragm shown in FIG. 8;

FIG. 10 is a schematic diagram of a cross-sectional structure of the sound diaphragm shown in FIG. 8 cut along II-II;

FIG. 11 is a schematic diagram of a partial structure of the vibration assembly shown in FIG. 5;

FIG. 12 is a schematic diagram of an assembly structure of a basket and a vibration assembly in the speaker core shown in FIG. 4;

FIG. 13 is a schematic diagram of a structure of the assembly structure of the basket and the vibration assembly shown in FIG. 12 from another angle;

FIG. 14 is a schematic diagram of a cross-sectional structure of the assembling structure of the basket and the vibration assembly shown in FIG. 12 cut along III-III;

FIG. 15 is a schematic diagram of a structure of a magnetic circuit assembly in the speaker core shown in FIG. 4;

FIG. 16 is a schematic diagram of an exploded structure of the magnetic circuit assembly shown in FIG. 15;

FIG. 17 is a schematic diagram of a cross-sectional

structure of the magnetic circuit assembly shown in FIG. 15 cut along IV-IV;

FIG. 18 is a schematic diagram of a partial structure of the magnetic circuit assembly shown in FIG. 15; FIG. 19 is a schematic diagram of a cross-sectional structure of the speaker core shown in FIG. 3 cut along V-V; and

FIG. 20 is a schematic diagram of a cross-sectional structure of a speaker core cut along V-V in a second electronic device according to this application.

DESCRIPTION OF EMBODIMENTS

[0036] The following clearly and completely describes the technical solutions in embodiments of this application with reference to the accompanying drawings in embodiments of this application.

[0037] FIG. 1 is a schematic diagram of a structure of an electronic device 1000 according to an embodiment of this application.

[0038] The electronic device 1000 may be an electronic product having an audio playing function, for example, a mobile phone, a tablet computer, a laptop computer, a vehicle head unit, a smart watch, a smart band, or a POS terminal (point of sales terminal, point of sale terminal). Next, an example in which the electronic device 1000 is a mobile phone is used for description in this embodiment of this application.

[0039] The electronic device 1000 includes a housing 100, a display module 200, a circuit board 300, a processor 400, and a speaker module 500. The display module 200, the circuit board 300, the processor 400, and the speaker module 500 are all mounted in the housing 100.

[0040] The housing 100 is provided with a speaker hole 1001, and an inner side and an outer side of the housing 100 are communicated through the speaker hole 1001. In this embodiment, the housing 100 includes a middle frame 110 and a rear cover 120. The middle frame 110 is provided with the speaker hole 1001. The rear cover 120 is mounted on a side of the middle frame 110. For example, the rear cover 120 may be detachably mounted on the middle frame 110, to facilitate maintenance and replacement of a component or a module inside the electronic device 1000, or the rear cover 120 and the middle frame 110 may be integrally formed, to increase overall strength of the housing 100. The rear cover 120 may be a battery cover of the electronic device 1000.

[0041] The display module 200 is mounted on a side of the middle frame 110 that faces away from the rear cover 120. When a user uses the electronic device 1000, the display module 200 is placed toward the user, and the rear cover 120 is placed away from the user. The display module 200 includes a cover plate and a display fixed to the cover plate (not shown in the figure). The cover plate may be made of a transparent material such as glass. The display may be a display such as LCD (liquid crystal display, liquid crystal display) or OLED (organic light-

emitting diode, organic light-emitting diode display), and is configured to display information such as an image or a text.

[0042] The circuit board 300, the processor 400, and the speaker module 500 are all mounted on the inner side of the housing 100. Specifically, the circuit board 300, the processor 400, and the speaker module 500 are all mounted on an inner side of the middle frame 110. The processor 400 is mounted on the circuit board 300, and is electrically connected to the circuit board 300. The circuit board 300 may be a main board (main board) of the electronic device 1000, and the processor 400 may be a CPU (central processing unit, central processing unit) of the electronic device 1000. The speaker module 500 is electrically connected to the circuit board 300, and is electrically connected to the processor 400 via the circuit board 300. The speaker module 500 may receive, through the circuit board 300, an audio signal sent by the processor 400, and vibrate and produce a sound based on the audio signal. The sound is diffused to an external environment through the speaker hole 1001, thereby implementing sound production of the electronic device 1000.

[0043] FIG. 2 is a schematic diagram of a cross-sectional structure of the speaker module 500 in the electronic device 1000 shown in FIG. 1.

[0044] The speaker module 500 includes a first housing 510, a second housing 520, and a speaker core 530. The first housing 510 and the second housing 520 are butted against each other, and are enclosed to form a sound cavity 501. The first housing 510 is provided with a sound output hole 511. The sound output hole 511 penetrates the first housing 510 along a thickness direction of the second housing 520, and the sound cavity 501 communicates with the external environment through the sound output hole 511. The speaker core 530 is located in the sound cavity 501, and is electrically connected to the circuit board 300, to implement an electrical connection between the speaker module 500 and the circuit board 300. The speaker core 530 includes a sound diaphragm 21, and the sound diaphragm 21 divides the sound cavity 501 into a front sound cavity 502 and a rear sound cavity 503. The front sound cavity 502 is formed between the sound diaphragm 21 and the first housing 510, and the front sound cavity 502 communicates with the sound output hole 511. The rear sound cavity 503 is located on a side of the sound diaphragm 21 that faces away from the front sound cavity 502.

[0045] FIG. 3 is a schematic diagram of a structure of the speaker core 530 in the speaker module 500 shown in FIG. 2. FIG. 4 is a schematic diagram of an exploded structure of the speaker core 530 shown in FIG. 3.

[0046] For ease of description, it is defined that a width direction of the speaker core 530 is an X-axis direction, a length direction of the speaker core 530 is a Y-axis direction, a height direction of the speaker core 530 is a Z-axis direction, and the X-axis direction, the Y-axis direction, and the Z-axis direction are perpendicular to

each other.

[0047] The speaker core 530 includes a basket 10, a vibration assembly 20, and a magnetic circuit assembly 30, both of the vibration assembly 20, and the magnetic circuit assembly 30 are mounted to the basket 10. The basket 10 has a first mounting surface 101 and a second mounting surface 102. The first mounting surface 101 and the second mounting surface 102 are disposed opposite to each other in a height direction of the basket 10. For example, the basket 10 is in a square ring shape, and both the first mounting surface 101 and the second mounting surface 102 are parallel to an XY plane.

[0048] FIG. 5 is a schematic diagram of a structure of the vibration assembly 20 in the speaker core 530 shown in FIG. 4. FIG. 6 is a schematic diagram of an exploded structure of the vibration assembly 20 shown in FIG. 5. FIG. 7 is a schematic diagram of a cross-sectional structure of the vibration assembly 20 shown in FIG. 5 cut along I-I. Cutting along I-I means cutting along a plane on which a line I-I is located. The following similar description of the accompanying drawings shall be understood in the same way.

[0049] The vibration assembly 20 includes the sound diaphragm 21, a first voice coil 22, a second voice coil 23, a first framework 24, a second framework 25, and a flexible printed circuit 26. The first voice coil 22, the second voice coil 23, the first framework 24, the second framework 25, and the flexible printed circuit 26 are all located on a lower side of the sound diaphragm 21. The second voice coil 23 is located on an inner side of the first voice coil 22, and is spaced from the first voice coil 22. The first framework 24 is located between the sound diaphragm 21 and the first voice coil 22, and is connected between the sound diaphragm 21 and the first voice coil 22. The second framework 25 is located between the sound diaphragm 21 and the second voice coil 23, is connected between the sound diaphragm 21 and the second voice coil 23, is located on an inner side of the first framework 24, and is further spaced from the first framework 24. One end of the flexible printed circuit 26 is electrically connected to the first voice coil 22 and the second voice coil 23, and the other end of the flexible printed circuit 26 is electrically connected to the circuit board 300 (as shown in FIG. 1), to implement an electrical connection between the speaker core 530 and the circuit board 300.

[0050] It should be noted that, orientation terms such as "upper", "lower", "inner side", and "outer side" are used when the speaker core 530 described in this embodiment of this application are mainly described based on a display orientation of the speaker core 530 in the accompanying drawings. A positive direction toward the Z axis is "upper", a negative direction toward the Z axis is "lower", a direction toward the middle of the speaker core 530 is "inner side", and a direction away from the middle of the speaker core 530 is "outer side". This does not constitute a limitation on an orientation of the speaker core 530 in an actual application scenario.

[0051] FIG. 8 is a schematic diagram of a structure of the sound diaphragm 21 in the vibration assembly 20 shown in FIG. 6. FIG. 9 is a schematic diagram of an exploded structure of the sound diaphragm 21 shown in FIG. 8. FIG. 10 is a schematic diagram of a cross-sectional structure of the sound diaphragm 21 shown in FIG. 8 cut along II-II.

[0052] The sound diaphragm 21 includes a body 211 and a convex portion 212. The convex portion 212 is located on an inner side of the body 211 and is connected to the body 211. The convex portion 212 protrudes upward from the body 211. To be specific, the convex portion 212 protrudes from the body 211 toward a direction away from the first voice coil 22 and the second voice coil 23. The arrangement of the convex portion 212 can save space on the lower side of the sound diaphragm 21, allowing the first voice coil 22, the second voice coil 23, the magnetic circuit assembly 30 and the like located on the lower side of the sound diaphragm 21 to have greater height dimensions. This can increase a driving force of the speaker core 530, and helps improve sound production performance of the speaker core 530. For example, the body 211 is approximately in a square ring shape, and the convex portion 212 is approximately a rounded rectangle.

[0053] A ratio of an area of the convex portion 212 to an area of the sound diaphragm 21 ranges from 1/4 to 1/3. For example, the ratio of the area of the convex portion 212 to the area of the sound diaphragm 21 may be 1/4, 7/24, or 1/3. It should be noted that the ratio of the area of the convex portion 212 to the area of the sound diaphragm 21 is small, that is, an area occupied by the convex portion 212 on the sound diaphragm 21 is small. An area, other than the convex portion 212, on the sound diaphragm 21 may be used for airflow. In this way, a height of the speaker core 530 near the sound output hole 511 may be reduced, and a cross-sectional area of the sound output hole 511 may be increased, to reduce an airflow rate, thereby helping improve sound quality of the speaker module 500 during external sound output and improving sound production performance of the speaker module 500.

[0054] In this embodiment, the sound diaphragm 21 includes a diaphragm 27 and a dome 28, and the dome 28 is mounted on the diaphragm 27. For example, the diaphragm 27 is approximately in a square ring shape. The diaphragm 27 includes a first fixing portion 271, a second fixing portion 272, and a surround portion 273. The second fixing portion 272 is located on an inner side of the first fixing portion 271, and is spaced from the first fixing portion 271. The surround portion 273 is connected between the first fixing portion 271 and the second fixing portion 272. For example, the first fixing portion 271, the second fixing portion 272, and the surround portion 273 are all approximately in a square ring shape. The surround portion 273 is capable of deforming when subjected to external force, so that the second fixing portion 272 can move relative to the first fixing portion 271.

[0055] The surround portion 273 is recessed downward from the first fixing portion 271 and the second fixing portion 272. To be specific, the surround portion 273 is recessed from the first fixing portion 271 and the second fixing portion 272 toward a direction away from the dome 28. In this way, the height of the speaker core 530 near the sound output hole 511 may be reduced, and the cross-sectional area of the sound output hole 511 may be increased, to reduce an airflow rate, thereby helping improve sound quality of the speaker module 500 during external sound output and improve sound production performance of the speaker module 500. In some other embodiments, the surround portion 273 may protrude upward from the first fixing portion 271 and the second fixing portion 272. To be specific, the surround portion 273 may protrude toward the dome 28 from the first fixing portion 271 and the second fixing portion 272, which is not specifically limited in this application.

[0056] The dome 28 is mounted to the second fixing portion 272 of the diaphragm 27. The dome 28 includes a third fixing portion 281, the convex portion 212, and a first connection portion 282. The third fixing portion 281 is located on a lower side of the second fixing portion 272, and is mounted to the second fixing portion 272, to implement assembly between the dome 28 and the diaphragm 27. The convex portion 212 is located on an inner side of the third fixing portion 281, and is spaced from the third fixing portion 281. The first connection portion 282 is connected between the third fixing portion 281 and the convex portion 212. For example, both the third fixing portion 281 and the first connection portion 282 are approximately in a square ring shape. The body 211 includes the first fixing portion 271, the second fixing portion 272, the surround portion 273, the third fixing portion 281, and the first connection portion 282.

[0057] Refer to FIG. 6 and FIG. 7. The first voice coil 22, the second voice coil 23, the first framework 24, and the second framework 25 are all located on a lower side of the dome 28. The first voice coil 22 is located on a lower side of the body 211, and is mounted to the body 211. Specifically, the first voice coil 22 is located on a lower side of the third fixing portion 281, and is mounted to the third fixing portion 281. The first voice coil 22 has a first end face 221 and a third end face 222. The first end face 221 and the third end face 222 are disposed opposite to each other in a height direction of the first voice coil 22. The first end face 221 is an end face of the first voice coil 22 facing the sound diaphragm 21, and the third end face 222 is an end face of the first voice coil 22 that faces away from the sound diaphragm 21. For example, the first voice coil 22 is a rounded rectangle.

[0058] The second voice coil 23 is located on a lower side of the convex portion 212 and is mounted to the convex portion 212. The second voice coil 23 has a second end face 231 and a fourth end face 232. The second end face 231 and the fourth end face 232 are disposed opposite to each other in a height direction of the second voice coil 23. The second end face 231 is an

end face of the second voice coil 23 facing the sound diaphragm 21, and is located on a side of the first end face 221 facing the sound diaphragm 21. The fourth end face 232 is an end face of the second voice coil 23 that faces away from the sound diaphragm 21, and is flush with the third end face 222. In some other embodiments, the fourth end face 232 may not be flush with the third end face 222, which is not specifically limited in this application. For example, the second voice coil 23 is a rounded rectangle.

[0059] A height h_1 of the first voice coil 22 is less than a height h_2 of the second voice coil 23. In this embodiment, the speaker core 530 drives, by using both the first voice coil 22 and the second voice coil 23, the sound diaphragm 21 to vibrate, so as to implement sound production through vibration. The first voice coil 22 and the second voice coil 23 may cooperate with the magnetic circuit assembly 30 to shorten a magnetic conduction path. A driving magnetic field provided by the magnetic circuit assembly 30 may be fully used to improve magnetic field utilization of the magnetic circuit assembly 30. This is equivalent to implementing a high driving force of the speaker core 530, thereby improving sound production sensitivity of the speaker core 530, and helping improve sound production performance of the speaker core 530. In addition, the first voice coil 22 and the second voice coil 23 are arranged at different height planes, so that the driving magnetic field provided by the magnetic circuit assembly 30 can be further fully used, to implement a high driving force of the speaker core 530, thereby improving sound production sensitivity of the speaker core 530, and helping improve sound production performance of the speaker core 530. Further, the height h_2 of the second voice coil 23 is greater than the height h_1 of the first voice coil 22, which is equivalent to using a long voice coil structure to drive the sound diaphragm 21, thereby implementing low distortion of the speaker core 530, and effectively improving sound quality of the speaker module 500 during external sound output.

[0060] The first framework 24 is located between the third fixing portion 281 and the first voice coil 22, and is connected between the third fixing portion 281 and the first voice coil 22. The first framework 24 has a first surface 241 and a second surface 242. The first surface 241 and the second surface 242 are disposed opposite to each other in a height direction (the Z-axis direction shown in the figure) of the first framework 24. The first surface 241 is a surface of the first framework 24 facing the sound diaphragm 21, and the second surface 242 is a surface of the first framework that faces away from the sound diaphragm 21.

[0061] The first framework 24 is provided with a first avoidance groove 243, and an opening of the first avoidance groove 243 is located in the first surface 241. The first avoidance groove 243 is recessed from the first surface 241 toward the second surface 242 (a negative direction of the Z-axis shown in the figure), and extends through an inner surface and an outer surface of the first

framework 24. There are four first avoidance grooves 243, and the four first avoidance grooves 243 are spaced apart from each other around the first framework 24. For example, the first framework 24 is in a square ring shape, and the four first avoidance grooves 243 are located at four corners of the first framework 24.

[0062] The second framework 25 is located between the convex portion 212 and the second voice coil 23, and is connected between the convex portion 212 and the second voice coil 23. For example, the second framework 25 is in a square ring shape. A height h_4 of the second framework 25 is less than a height h_3 of the first framework 24, so that both the third end face 222 of the first voice coil 22 and the fourth end face 232 of the second voice coil 23 can be located in the driving magnetic field of the magnetic circuit assembly 30. It is ensured that the first voice coil 22 and the second voice coil 23 can drive the sound diaphragm 21 to vibrate under an action of the driving magnetic field of the magnetic circuit assembly 30.

[0063] In this embodiment, the first framework 24 is used, to avoid direct contact between the first voice coil 22 and the sound diaphragm 21, and the second framework 25 is used, to avoid direct contact between the second voice coil 23 and the sound diaphragm 21. The first framework 24 and the second framework 25 may perform a heat dissipation function, to prevent the sound diaphragm 21 from being damaged due to overheating of the first voice coil 22 and the second voice coil 23, thereby ensuring use reliability of the speaker core 530. In some other embodiments, the speaker core 530 may not include the first framework 24, and the first voice coil 22 may be directly mounted to the sound diaphragm 21, and/or, the speaker core 530 may not include the second framework 25, and the second voice coil 23 may be directly mounted to the sound diaphragm 21. This simplifies a structure of the speaker core 530 and helps implement a thin and light design of the speaker core 530.

[0064] Refer to FIG. 6 and FIG. 11. FIG. 11 is a schematic diagram of a partial structure of the vibration assembly 20 shown in FIG. 5. The sound diaphragm 21 is not shown in FIG. 11.

[0065] The flexible printed circuit 26 includes four sub-flexible printed circuits 29, and the four sub-flexible printed circuits 29 are all connected to the second framework 25, and are spaced apart from each other around the second framework 25. Specifically, one end of each sub-flexible printed circuit 29 is electrically connected to both the first voice coil 22 and the second voice coil 23, and the other end of each sub-flexible printed circuit 29 is electrically connected to the circuit board 300. For example, each sub-flexible printed circuit 29 may be electrically connected to both the first voice coil 22 and the second voice coil 23 via a conductive wire (not shown in the figure). Each sub-flexible printed circuit 29 penetrates one first avoidance groove 243. In other words, each first avoidance groove 243 avoids one sub-flexible printed circuit 29, to avoid mutual interference between the first

framework 24 and the flexible printed circuit 26, thereby ensuring use reliability of the speaker core 530.

[0066] For example, the four sub-flexible printed circuits 29 are of a same structure. Each sub-flexible printed circuit 29 includes a fourth fixing portion 291, an electrical connection portion 292, and a second connection portion 293. The fourth fixing portion 291 is located on a lower side of the first fixing portion 271 of the diaphragm 27. The electrical connection portion 292 is located on an inner side of the fourth fixing portion 291 and on the lower side of the dome 28, and is electrically connected to the first voice coil 22 and the second voice coil 23. The electrical connection portion 292 penetrates the first avoidance groove 243. That is, the first avoidance groove 243 avoids the electrical connection portion 292. The second connection portion 293 is located on a lower side of the surround portion 273 of the diaphragm 27, and is connected between the fourth fixing portion 291 and the electrical connection portion 292.

[0067] FIG. 12 is a schematic diagram of an assembly structure of the basket 10 and the vibration assembly 20 in the speaker core 530 shown in FIG. 4. FIG. 13 is a schematic diagram of a structure of the assembly structure of the basket 10 and the vibration assembly 20 shown in FIG. 12 from another angle. FIG. 14 is a schematic diagram of a cross-sectional structure of the assembling structure of the basket 10 and the vibration assembly 20 shown in FIG. 12 cut along III-III.

[0068] The vibration assembly 20 is mounted on the first mounting surface 101 of the basket 10. A portion of the vibration assembly 20 is fixed relative to the basket 10, and another portion of the vibration assembly 20 may vibrate relative to the basket 10. Specifically, the sound diaphragm 21 is mounted on the first mounting surface 101 of the basket 10. The first voice coil 22, the second voice coil 23, the first framework 24, and the second framework 25 are all located on an inner side of the basket 10, and are spaced from the basket 10. The flexible printed circuit 26 is mounted on the second mounting surface 102 of the basket 10. The first fixing portion 271 of the diaphragm 27 is mounted on the first mounting surface 101 of the basket 10, and the fourth fixing portion 291 of the sub-flexible printed circuit 29 is located on a lower side of the basket 10 and is mounted on the second mounting surface 102 of the basket 10.

[0069] When the first voice coil 22 and the second voice coil 23 move relative to the basket 10, the first voice coil 22 and the second voice coil 23 drive the dome 28 of the sound diaphragm 21, the first framework 24, and the second framework 25 to move relative to the basket 10. For the diaphragm 27 of the sound diaphragm 21, the first fixing portion 271 is fixed relative to the basket 10, the second fixing portion 272 is driven by the dome 28 to move relative to the basket 10, and the surround portion 273 is driven by the second fixing portion 272 to move relative to the basket 10 and is deformed. For the flexible printed circuit 26, the fourth fixing portion 291 of the sub-flexible printed circuit 29 is fixed relative to the basket 10,

the electrical connection portion 292 of the sub-flexible printed circuit 29 moves relative to the basket 10 following movement of the first voice coil 22 and the second voice coil 23, and the second connection portion 293 of the sub-flexible printed circuit 29 is driven by the electrical connection portion 292 to move relative to the basket 10.

[0070] FIG. 15 is a schematic diagram of a structure of the magnetic circuit assembly 30 in the speaker core 530 shown in FIG. 4. FIG. 16 is a schematic diagram of an exploded structure of the magnetic circuit assembly 30 shown in FIG. 15. FIG. 17 is a schematic diagram of a cross-sectional structure of the magnetic circuit assembly 30 shown in FIG. 15 cut along IV-IV.

[0071] The magnetic circuit assembly 30 includes a first magnetic conductive plate 31, a first magnet 32, a second magnet 33, a third magnet 34, a second magnetic conductive plate 35, a third magnetic conductive plate 36, and a fourth magnetic conductive plate 37. The first magnet 32, the second magnet 33, the third magnet 34, the second magnetic conductive plate 35, the third magnetic conductive plate 36, and the fourth magnetic conductive plate 37 are all located on an upper side of the first magnetic conductive plate 31.

[0072] The first magnetic conductive plate 31 has a third surface 311 and a fourth surface 312. The third surface 311 and the fourth surface 312 are disposed opposite to each other in a thickness direction of the first magnetic conductive plate 31. The third surface 311 is a surface of the first magnetic conductive plate 31 facing the basket 10, and the fourth surface 312 is a surface of the first magnetic conductive plate 31 that faces away from the basket 10. For example, both the third surface 311 and the fourth surface 312 are parallel to the XY plane.

[0073] FIG. 18 is a schematic diagram of a partial structure of the magnetic circuit assembly 30 shown in FIG. 15. The second magnetic conductive plate 35, the third magnetic conductive plate 36, and the fourth magnetic conductive plate 37 are not shown in FIG. 18.

[0074] The first magnet 32, the second magnet 33, and the third magnet 34 are all located on the third surface 311. The first magnet 32 is located at an edge of the third surface 311. The first magnet 32 includes two first magnet portions 321 and two second magnet portions 322. The two first magnet portions 321 are spaced apart in the X-axis direction. The two second magnet portions 322 are spaced apart in the Y-axis direction, and are spaced apart from the two first magnet portions 321. One first corner gap 323 is formed between each first magnet portion 321 and one second magnet portion 322.

[0075] The second magnet 33 is located on an inner side of the first magnet 32, and a first gap 331 is formed between the second magnet 33 and the first magnet 32. The first gap 331 communicates with four first corner gaps 323. For example, both the first gap 331 and the second magnet 33 are in an elliptical ring shape. The third magnet 34 is located on an inner side of the second magnet 33. A second gap 341 is formed between the

third magnet 34 and the second magnet 33. For example, the second gap 341 is in an elliptical ring shape. A height h_6 of the third magnet 34 is greater than a height h_5 of the second magnet 33.

[0076] Refer to FIG. 15 to FIG. 17. The second magnetic conductive plate 35 is located on a surface of the first magnet 32 that faces away from the first magnetic conductive plate 31. The second magnetic conductive plate 35 includes a magnetic conductive frame 351, two first magnetic conductive portions 352, and two second magnetic conductive portions 353. The magnetic conductive frame 351 is located on surfaces that are of the two first magnet portions 321 and the two second magnet portions 322 and that are away from the first magnetic conductive plate 31. The two first magnetic conductive portions 352 and the two second magnetic conductive portions 353 are all located on an inner side of the magnetic conductive frame 351 and are connected to the magnetic conductive frame 351. Each first magnetic conductive portion 352 is located on a surface of one first magnet portion 321 that faces away from the first magnetic conductive plate 31, and each second magnetic conductive portion 353 is located on a surface of one second magnetic portion 322 that faces away from the first magnetic conductive plate 31. One second corner gap 354 is formed between each first magnetic conductive portion 352 and one second magnetic conductive portion 353, and each second corner gap 354 communicates with one first corner gap 323.

[0077] The third magnetic conductive plate 36 is located on a surface of the second magnet 33 that faces away from the first magnetic conductive plate 31, and is located on an inner side of the second magnetic conductive plate 35, and a third gap 361 is formed between the third magnetic conductive plate 36 and the second magnetic conductive plate 35. The third gap 361 communicates with all the first gap 331 and the four second corner gaps 354. The third magnetic conductive plate 36 is provided with a second avoidance groove 362, and an opening of the second avoidance groove 362 is located on a surface of the third magnetic conductive plate 36 that faces away from the second magnet 33. The second avoidance groove 362 extends through an inner surface and an outer surface of the third magnetic conductive plate 36, and communicates with the third gap 361. There are four second avoidance grooves 362, and the four second avoidance grooves 362 are spaced apart from each other around the third magnetic conductive plate 36. For example, the third magnetic conductive plate 36 is in a square ring shape, and the four second avoidance grooves 362 are located at four corners of the third magnetic conductive plate 36.

[0078] In this embodiment, the third magnetic conductive plate 36 includes a magnetic conductive plate body 363 and a magnetic conductive protrusion 364. The magnetic conductive plate body 363 is located on the surface of the second magnet 33 that faces away from the first magnetic conductive plate 31. The magnetic con-

ductive protrusion 364 is connected to a surface of the magnetic conductive plate body 363 that faces away from the second magnet 33, and is located on a side of the magnetic conductive plate body 363 that faces away from the second magnetic conductive plate 35. An inner surface of the magnetic conductive protrusion 364 is flush with an inner surface of the magnetic conductive plate body 363, and an outer surface of the magnetic conductive protrusion 364 is located on a side of an outer surface of the magnetic conductive plate body 363 that faces away from the second magnetic conductive plate 35. In this case, the inner surface of the third magnetic conductive plate 36 includes the inner surface of the magnetic conductive plate body 363 and the inner surface of the magnetic conductive protrusion 364, and the outer surface of the third magnetic conductive plate 36 is the outer surface of the magnetic conductive plate body 363. In some other embodiments, the inner surface of the magnetic conductive protrusion 364 may not be flush with the inner surface of the magnetic conductive plate body 363.

[0079] The fourth magnetic conductive plate 37 is located on a surface of the third magnet 34 that faces away from the first magnetic conductive plate 31, and is located on an inner side of the third magnetic conductive plate 36, and a fourth gap 371 is formed between the fourth magnetic conductive plate 37 and the third magnetic conductive plate 36. Specifically, a third sub-gap 372 is formed between the fourth magnetic conductive plate 37 and the magnetic conductive plate body 363, and the third sub-gap 372 communicates with the second gap 341 and the four second avoidance grooves 362. A fourth sub-gap 373 is formed between the fourth magnetic conductive plate 37 and the magnetic conductive protrusion 364, and the fourth sub-gap 373 communicates with the third sub-gap 372 and the four second avoidance grooves 362. The fourth gap 371 includes the third sub-gap 372 and the fourth sub-gap 373. For example, the fourth gap 371 is a square ring shape.

[0080] FIG. 19 is a schematic diagram of a cross-sectional structure of the speaker core 530 shown in FIG. 3 cut along V-V.

[0081] The magnetic circuit assembly 30 is mounted on the second mounting surface 102 of the basket 10. The magnetic circuit assembly 30 is fixed relative to the basket 10 and provides a driving magnetic field for the vibration assembly 20. Specifically, the first magnetic conductive plate 31 is located on a side of the basket 10 that faces away from the sound diaphragm 21, and is spaced from the basket 10. The first magnet 32, the second magnet 33, the third magnet 34, and the second magnetic conductive plate 35 are all located between the first magnetic conductive plate 31 and the basket 10. The second magnetic conductive plate 35 is mounted on the second mounting surface 102 of the basket 10. The third magnetic conductive plate 36 and the fourth magnetic conductive plate 37 are located an inner side of the basket 10. In this case, the four second avoidance

grooves 362 of the third magnetic conductive plate 36 respectively avoid electrical connection portions 292 of the four sub-flexible printed circuits 29, to avoid interference between the magnetic circuit assembly 30 and the flexible printed circuit 26, and ensure use reliability of the speaker core 530.

[0082] An end portion of the first voice coil 22 that faces away from the sound diaphragm 21 is located in the first gap 331 and the third gap 361, and an end portion of the second voice coil 23 that faces away from the sound diaphragm 21 is located in the second gap 341 and the fourth gap 371. In some other embodiments, the end portion of the first voice coil 22 that faces away from the sound diaphragm 21 may be located in the first gap 331 or the third gap 361, and/or the end portion of the second voice coil 23 that faces away from the sound diaphragm 21 may be located in the second gap 341 or the fourth gap 371. That is, the end portion of the first voice coil 22 that faces away from the sound diaphragm 21 and the end portion of the second voice coil 23 that faces away from the sound diaphragm 21 are both located in the magnetic field provided by the magnetic circuit assembly 30. When the first voice coil 22 and the second voice coil 23 receive an audio signal transmitted by the flexible printed circuit 26, the first voice coil 22 and the second voice coil 23 move up and down in the Z-axis direction to cut a magnetic force line of the magnetic field, and drive the sound diaphragm 21 and the flexible printed circuit 26 to vibrate.

[0083] In the magnetic circuit assembly 30 of the speaker core 530 shown in this embodiment, the first magnet 32, the second magnet 33, the third magnet 34, the second magnetic conductive plate 35, the third magnetic conductive plate 36, and the fourth magnetic conductive plate 37 are arranged in a high-low mating structure. A low magnetic circuit structure is designed to mate with the first voice coil 22, and a high magnetic circuit structure is designed to mate with the second voice coil 23, so that the first voice coil 22 and the second voice coil 23 can make full use of the driving magnetic field provided by the magnetic circuit assembly 30, to implement a high driving force of the speaker core 530, thereby improving sound production sensitivity of the speaker core 530, and helping improve sound production performance of the speaker core 530.

[0084] FIG. 20 is a schematic diagram of a cross-sectional structure of a speaker core cut along IV-IV in a second electronic device according to this application.

[0085] A difference between the speaker core 530 shown in this embodiment and the speaker core 530 shown in the foregoing first embodiment lies in that a second magnet 33 includes a magnet body 332 and a magnet protrusion 333. The magnet body 332 is located on a third surface 311. The magnet body 332 is in a square ring shape. The magnet protrusion 333 is connected to a surface of the magnet body 332 that faces away from the third surface 311, and is located on a side of the magnet body 332 that faces away from a first magnet 32. An inner surface of the magnet protrusion

333 is flush with an inner surface of the magnet body 332, and an outer surface of the magnet protrusion 333 is located on a side of an outer surface of the magnet body 332 that faces away from the first magnet 32. In this case, an inner surface of the second magnet 33 includes the inner surface of the magnet body 332 and the inner surface of the magnet protrusion 333, and an outer surface of the second magnet 33 includes the outer surface of the magnet body 332. In some other embodiments, the inner surface of the magnet protrusion 333 may not be flush with the inner surface of the magnet body 332.

[0086] Specifically, a first sub-gap 342 is formed between the magnet body 332 and a third magnet 34. A second sub-gap 343 is formed between the magnet protrusion 333 and the third magnet 34, and the second sub-gap 343 communicates with the first sub-gap 342 and a fourth gap 371. A second gap 341 includes the first sub-gap 342 and the second sub-gap 343.

[0087] In this embodiment, the speaker core 530 drives, by using both a first voice coil 22 and a second voice coil 23, a sound diaphragm 21 to vibrate, so as to implement sound production through vibration. The first voice coil 22 and the second voice coil 23 may cooperate with a magnetic circuit assembly 30 to shorten a magnetic conduction path. A driving magnetic field provided by the magnetic circuit assembly 30 may be fully used by the first voice coil 22 and the second voice coil 23 to improve magnetic field utilization of the magnetic circuit assembly 30. This is equivalent to implementing a high driving force of the speaker core 530, thereby improving sound production sensitivity of the speaker core 530, and helping improve sound production performance of the speaker core 530. In addition, the first voice coil 22 and the second voice coil 23 are arranged at different height planes, to mate with a high-low mating structure in the magnetic circuit assembly 30, so that the driving magnetic field provided by the magnetic circuit assembly 30 can be further fully used, to implement a high driving force of the speaker core 530, thereby improving sound production sensitivity of the speaker core 530, and helping improve sound production performance of the speaker core 530. Further, a height h_2 of the second voice coil 23 is greater than a height h_1 of the first voice coil 22, which is equivalent to using a long voice coil structure to drive the sound diaphragm 21, thereby implementing low distortion of the speaker core 530, and effectively improving sound quality of a speaker module 500 during external sound output. In addition, a convex portion 212 that cooperates with the second voice coil 23 is designed on the sound diaphragm 21, so that the speaker core 530 may be designed with a lower height near a sound output hole 511, to increase a sound output area, thereby reducing an airflow rate and improving sound quality of the speaker module 500 during external sound output.

[0088] The foregoing descriptions are merely specific implementations of this application, but the protection scope of this application is not limited thereto. Any variation or replacement readily figured out by a person skilled

in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. Embodiments of this application and features in embodiments may be combined with each other, provided that there is no conflict. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

Claims

1. A speaker core, comprising a basket, a sound diaphragm, a first voice coil, and a second voice coil, wherein the sound diaphragm is mounted on the basket, both the first voice coil and the second voice coil are located on an inner side of the basket and are mounted on the sound diaphragm, and the second voice coil is located on an inner side of the first voice coil and is spaced from the first voice coil; and the first voice coil has a first end face facing the sound diaphragm, the second voice coil has a second end face facing the sound diaphragm, and the second end face is located on a side of the first end face facing the sound diaphragm.
2. The speaker core according to claim 1, wherein the sound diaphragm comprises a body and a convex, the body is mounted on the basket, and the convex is connected to the body and protrudes from the body toward a direction away from the basket; and the first voice coil is mounted on the body, and the second voice coil is mounted on the convex.
3. The speaker core according to claim 2, wherein a ratio of an area of the convex to an area of the sound diaphragm ranges from 1/4 to 1/3.
4. The speaker core according to any one of claims 1 to 3, wherein a height of the second voice coil is greater than a height of the first voice coil.
5. The speaker core according to claim 4, wherein the speaker core further comprises a first magnetic conductive plate, a first magnet, a second magnet, and a third magnet, the first magnetic conductive plate is located on a side of the basket that faces away from the sound diaphragm, and is spaced from the basket, the first magnet, the second magnet, and the third magnet are all located on a surface of the first magnetic conductive plate facing the basket, the second magnet is located on an inner side of the first magnet, a first gap is formed between the second magnet and the first magnet, the third magnet is located on an inner side of the second magnet, and a second gap is formed between the third magnet and the second magnet; and an end portion of the first voice coil that faces away from the sound diaphragm is located in the first gap,

and an end portion of the second voice coil that faces away from the sound diaphragm is located in the second gap.

6. The speaker core according to claim 5, wherein the second magnet comprises a magnet body and a magnet protrusion, the magnet body is located on the surface of the first magnetic conductive plate facing the basket, a first sub-gap is formed between the magnet body and the third magnet, the magnet protrusion is connected to a surface of the magnet body that faces away from the first magnetic conductive plate, a second sub-gap is formed between the magnet protrusion and the third magnet, the second sub-gap communicates with the first sub-gap, and the second gap comprises the first sub-gap and the second sub-gap.
7. The speaker core according to claim 5 or 6, wherein the speaker core further comprises a second magnetic conductive plate, a third magnetic conductive plate, and a fourth magnetic conductive plate; the second magnetic conductive plate is located on a surface of the first magnet that faces away from the first magnetic conductive plate, the third magnetic conductive plate is located on a surface of the second magnet that faces away from the first magnetic conductive plate, and is located on an inner side of the second magnetic conductive plate, a third gap is formed between the third magnetic conductive plate and the second magnetic conductive plate, the third gap communicates with the first gap, the fourth magnetic conductive plate is located on a surface of the third magnet that faces away from the first magnetic conductive plate, and is located on an inner side of the third magnetic conductive plate, a fourth gap is formed between the fourth magnetic conductive plate and the third magnetic conductive plate, and the fourth gap communicates with the second gap; and the end portion of the first voice coil that faces away from the sound diaphragm is further located in the third gap, and the end portion of the second voice coil that faces away from the sound diaphragm is further located in the fourth gap.
8. The speaker core according to claim 7, wherein the third magnetic conductive plate comprises a magnetic conductive plate body and a magnetic conductive protrusion, the magnetic conductive plate body is located on the surface of the second magnet that faces away from the first magnetic conductive plate, a third sub-gap is formed between the magnetic conductive plate body and the fourth magnetic conductive plate, the magnetic conductive protrusion is

connected to a surface of the magnetic conductive plate body that faces away from the first magnetic conductive plate, a fourth sub-gap is formed between the magnetic conductive protrusion and the fourth magnetic conductive plate, the second sub-gap communicates with the first sub-gap and the second gap, and the fourth gap comprises the third sub-gap and the fourth sub-gap.

9. The speaker core according to any one of claims 5 to 8, wherein the first voice coil has a third end face disposed opposite to the first end face, the second voice coil has a fourth end face disposed opposite to the second end face, and the third end face is flush with the fourth end face.
10. The speaker core according to claim 9, wherein the speaker core further comprises a first framework and a second framework, both the first framework and the second framework are located on the inner side of the basket, the first framework is connected between the sound diaphragm and the first voice coil, and the second framework is connected between the sound diaphragm and the second voice coil, is located on an inner side of the first framework, and is spaced from the first framework; and a height of the first framework is greater than a height of the second framework.
11. The speaker core according to claim 10, wherein the speaker core further comprises a flexible printed circuit, and the flexible printed circuit is mounted on the basket and is electrically connected to the first voice coil and the second voice coil; and the first framework is provided with a first avoidance groove, an opening of the first avoidance groove is located in a surface of the first framework facing the sound diaphragm, and the first avoidance groove extends through an inner surface and an outer surface of the first framework, and avoids the flexible printed circuit.
12. The speaker core according to claim 11, wherein the third magnetic conductive plate is provided with a second avoidance groove, and an opening of the second avoidance groove is located in a surface of the third magnetic conductive plate facing the basket, and the second avoidance groove extends through an inner surface and an outer surface of the third magnetic conductive plate, and avoids the flexible printed circuit.
13. The speaker core according to any one of claims 1 to 12, wherein the sound diaphragm comprises a diaphragm and a dome, the diaphragm comprises a first fixing portion, a second fixing portion, and a surround portion, the first fixing portion is mounted on the basket, the second fixing portion is located on an

inner side of the first fixing portion and is spaced from the first fixing portion, and the surround portion is connected between the first fixing portion and the second fixing portion, and is recessed toward the basket; and the dome is mounted on the second fixing portion, and both the first voice coil and the second voice coil are mounted on the dome.

14. A speaker module, comprising a first housing and the speaker core according to any one of claims 1 to 13, wherein the speaker core is mounted in the first housing, a front sound cavity is formed between the sound diaphragm and the first housing, the first housing is provided with a sound output hole, and the front sound cavity communicates with an outside of the speaker module through the sound output hole.
15. The speaker module according to claim 14, wherein the speaker module further comprises a second housing, the second housing and the first housing are fixed to each other, the speaker core is located on inner sides of the second housing and the first housing, and a rear sound cavity is formed on a side of the sound diaphragm that faces away from the front sound cavity.
16. An electronic device, comprising a processor and the speaker module according to claim 14 or 15, wherein the speaker module is electrically connected to the processor.

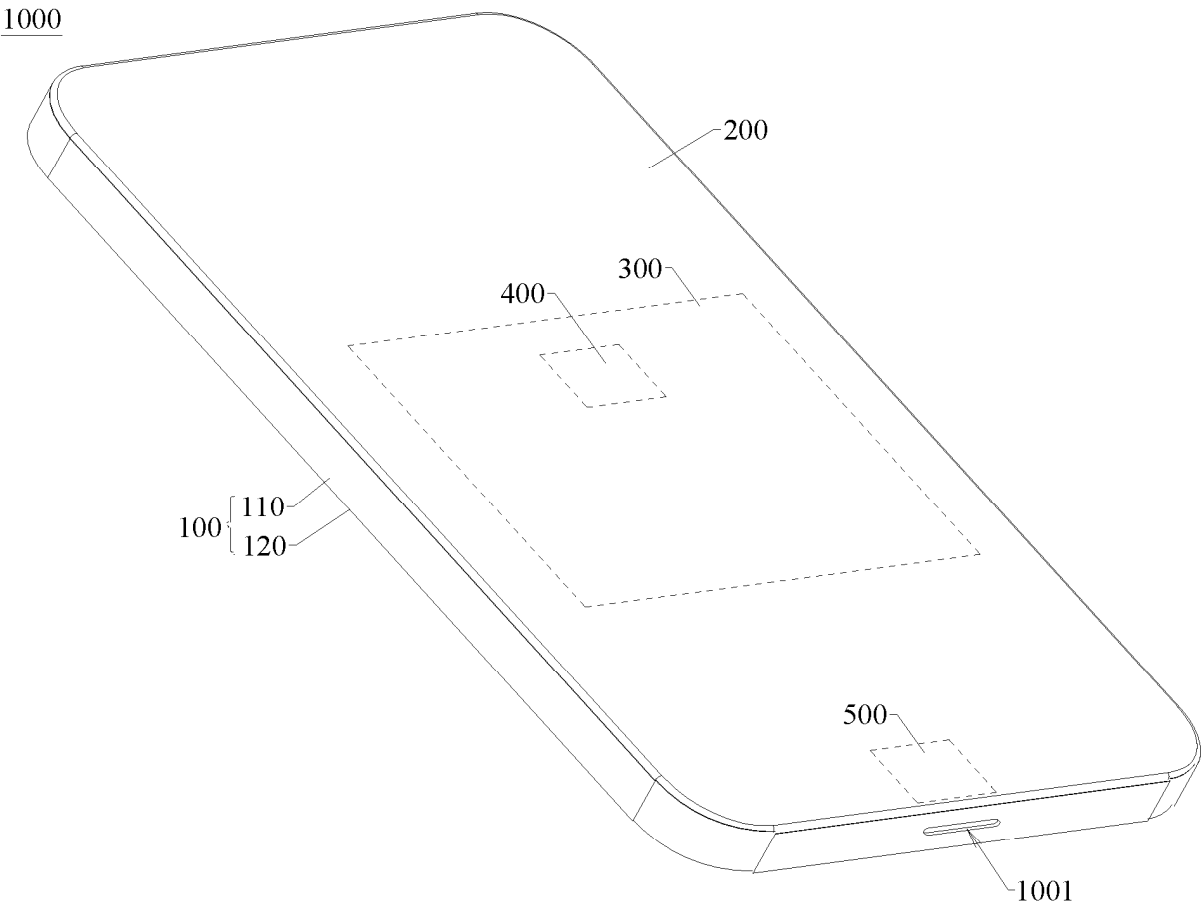


FIG. 1

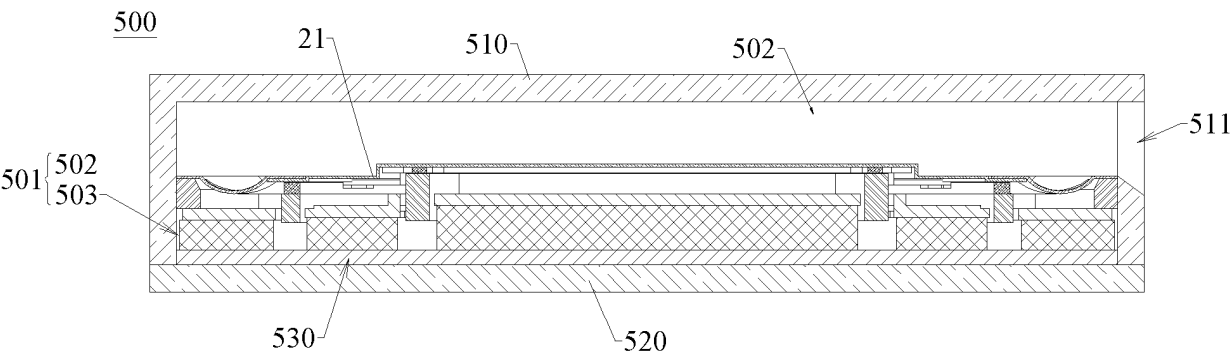


FIG. 2

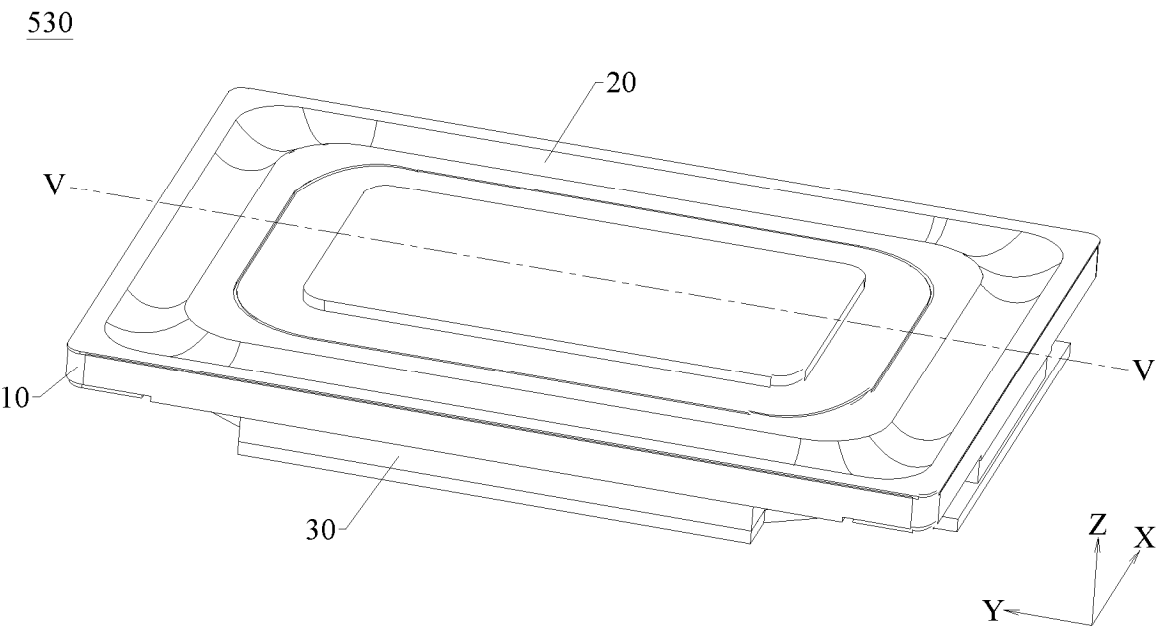


FIG. 3

530

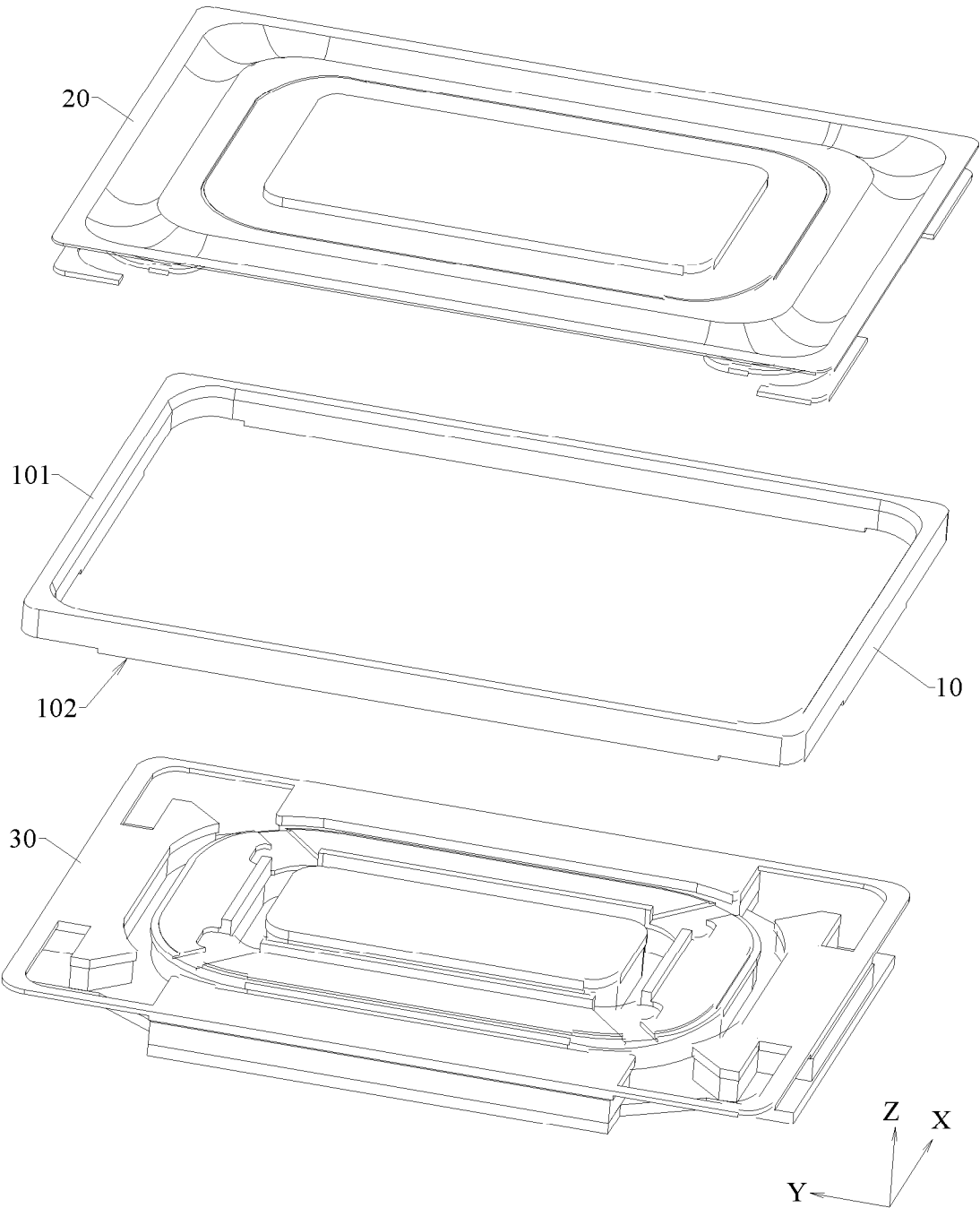


FIG. 4

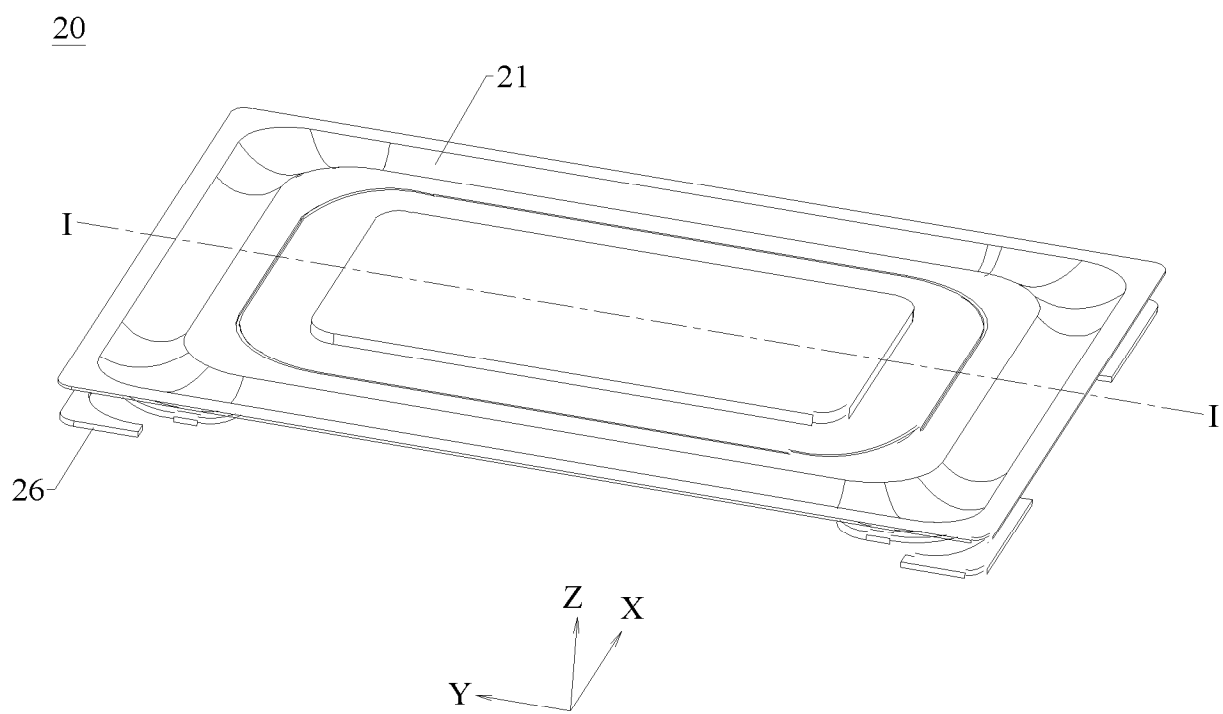


FIG. 5

20

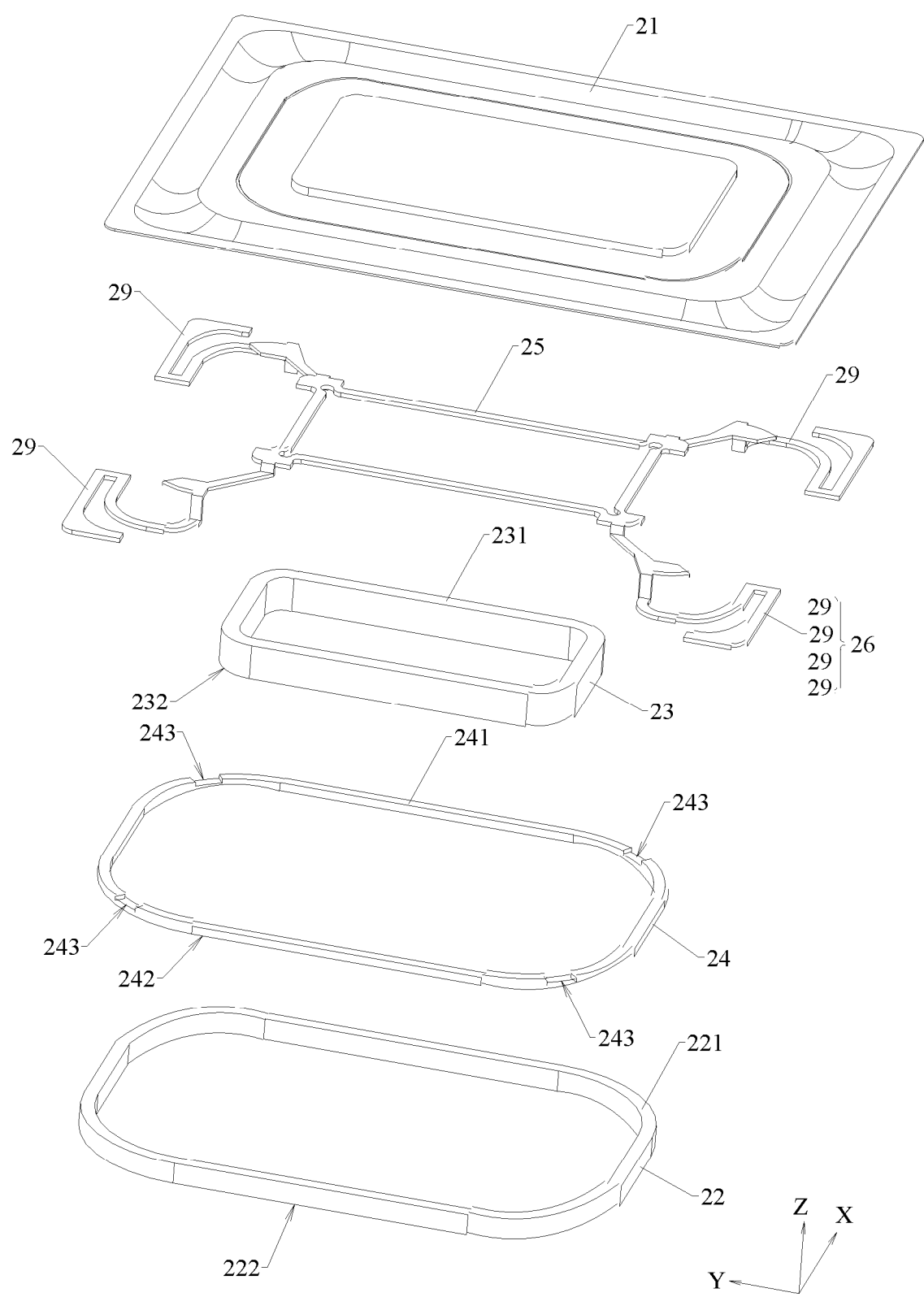


FIG. 6

20

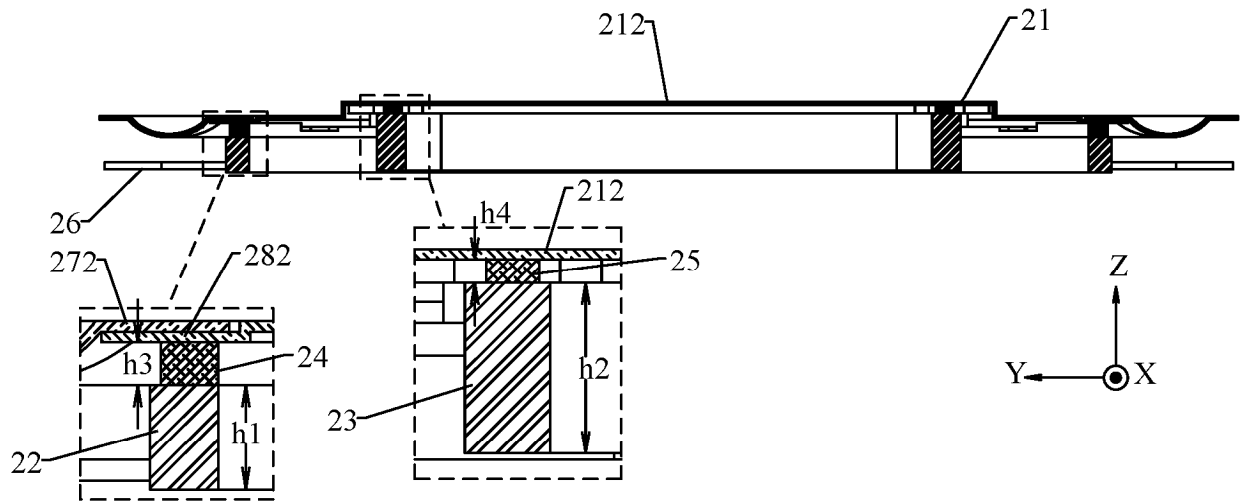


FIG. 7

21

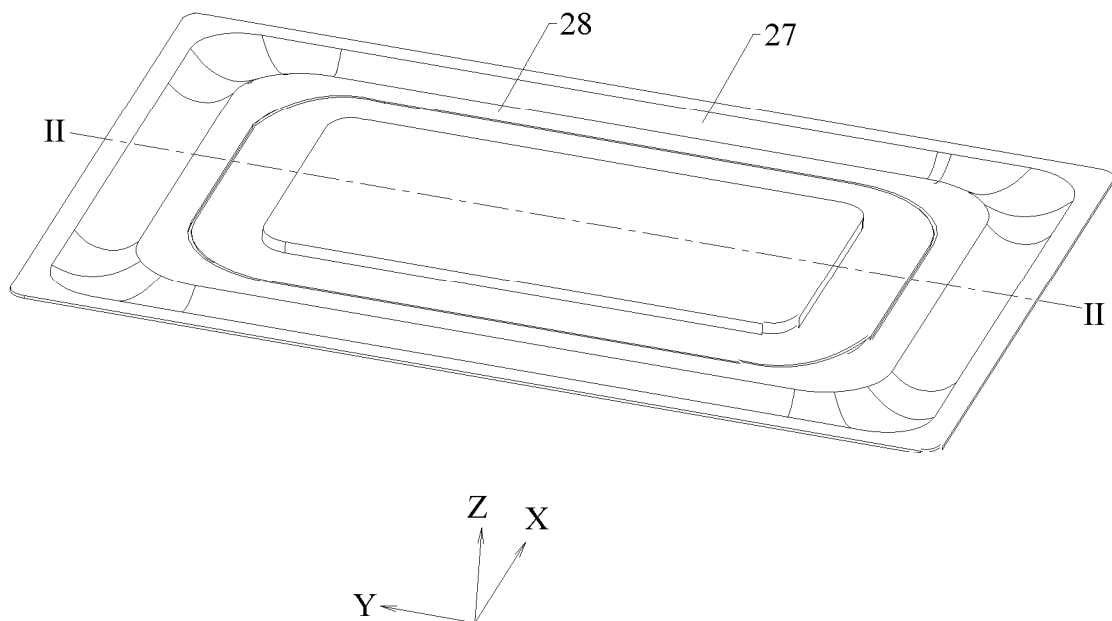


FIG. 8

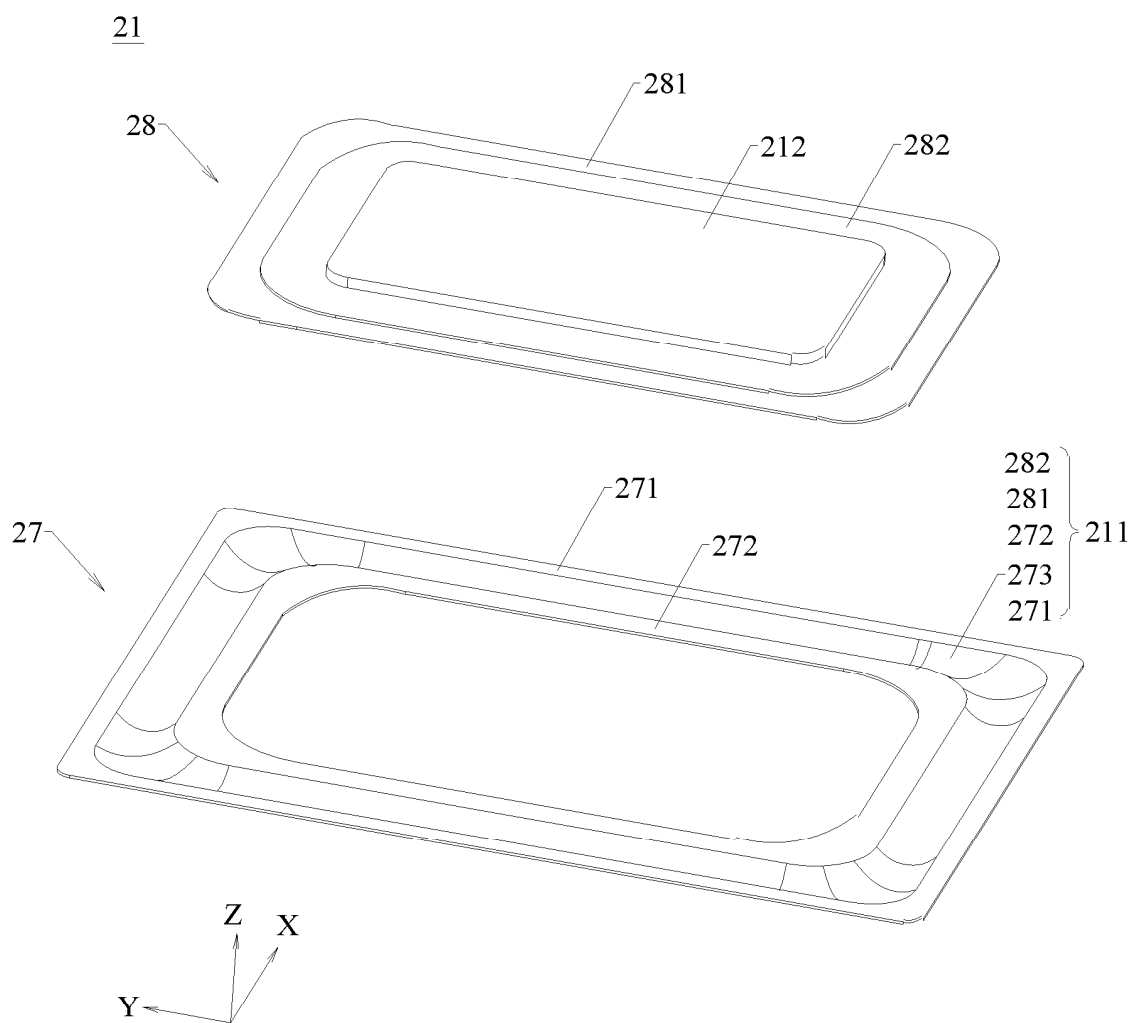


FIG. 9

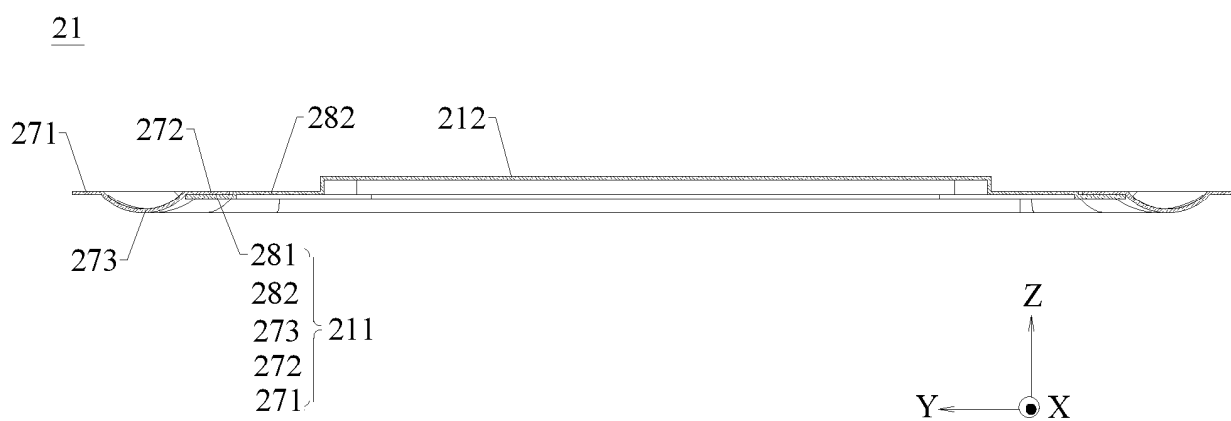


FIG. 10

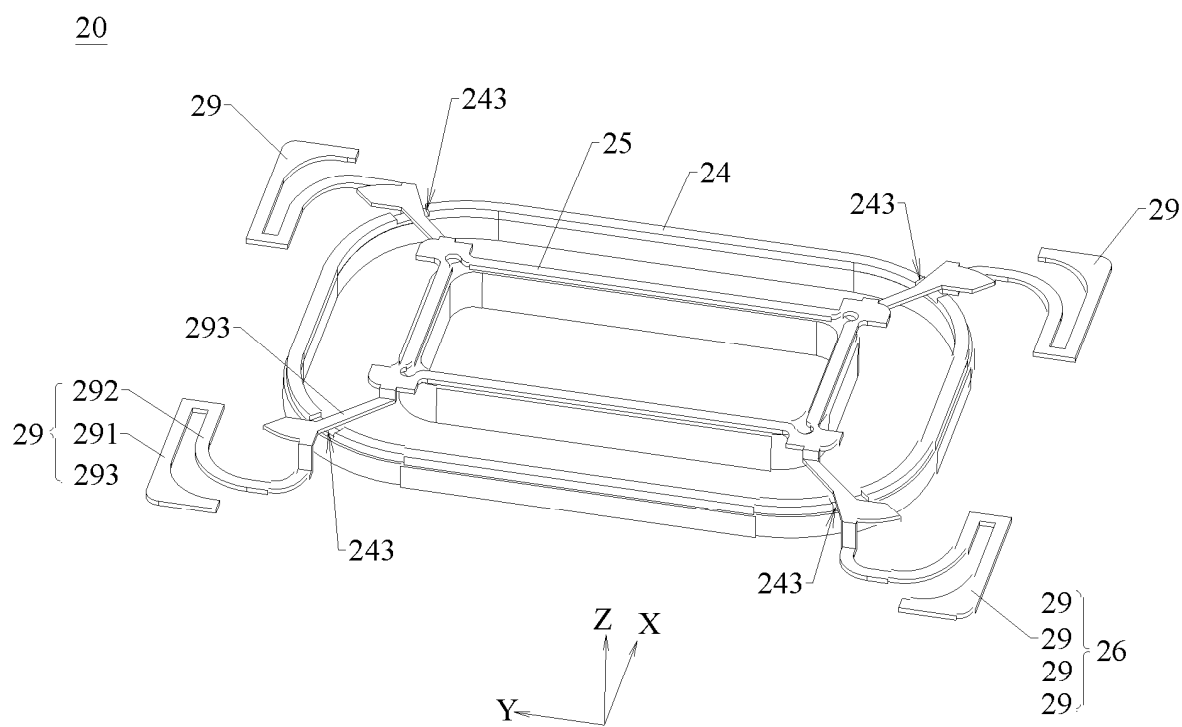


FIG. 11

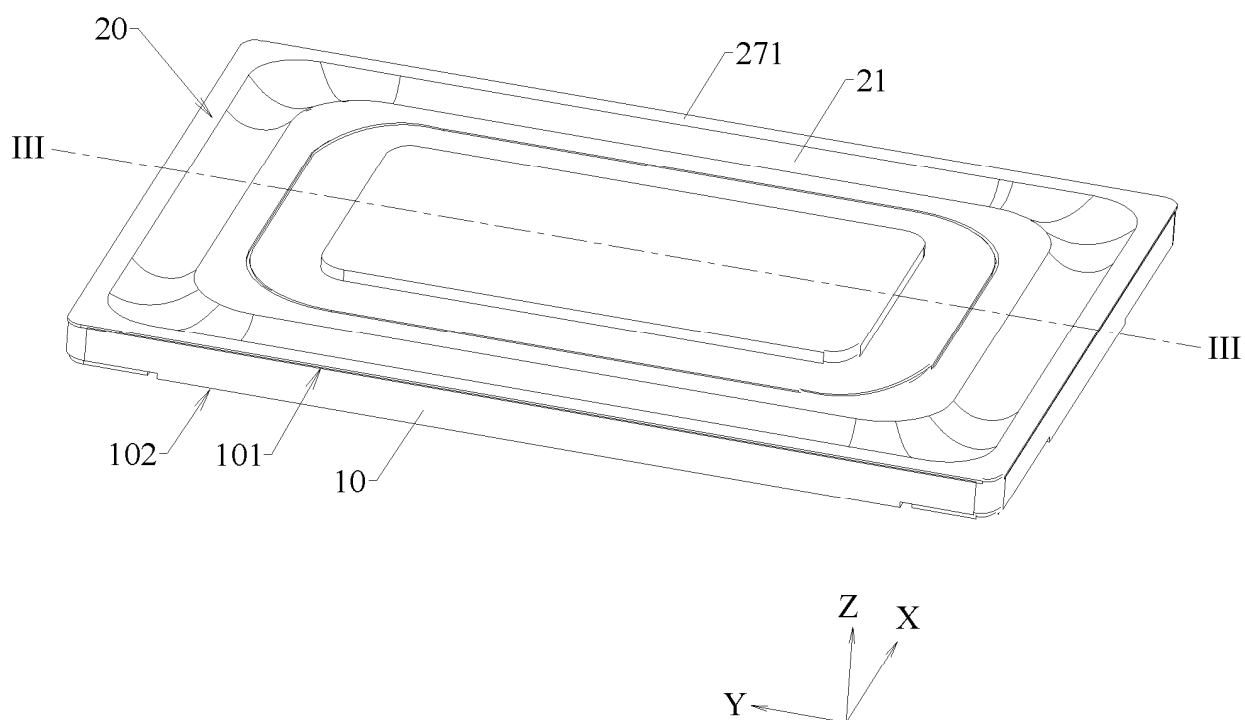


FIG. 12

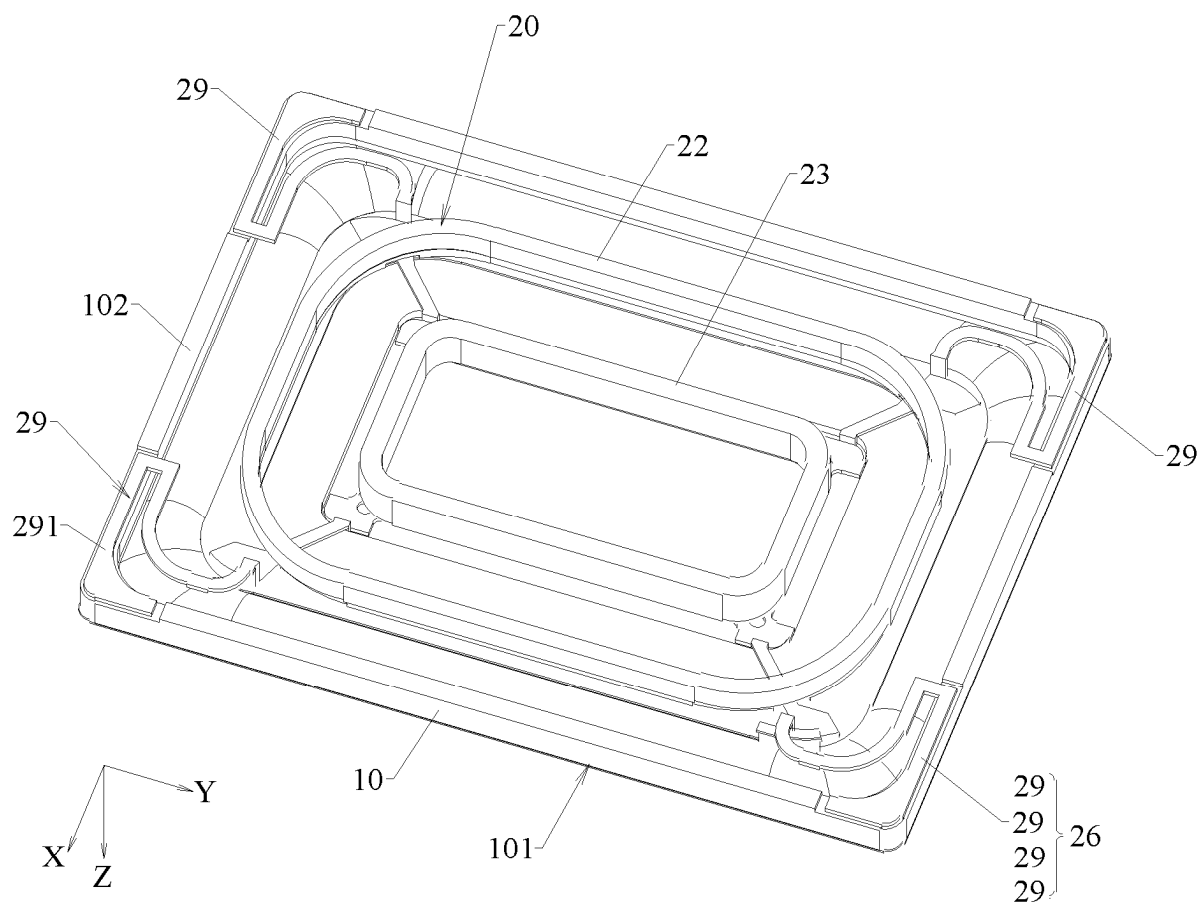


FIG. 13

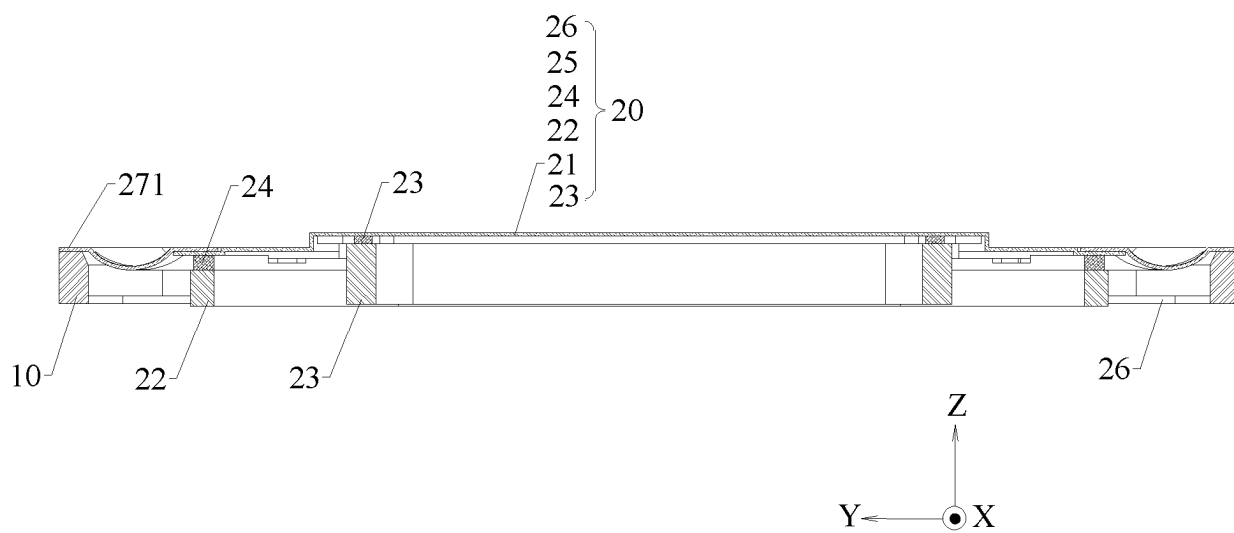


FIG. 14

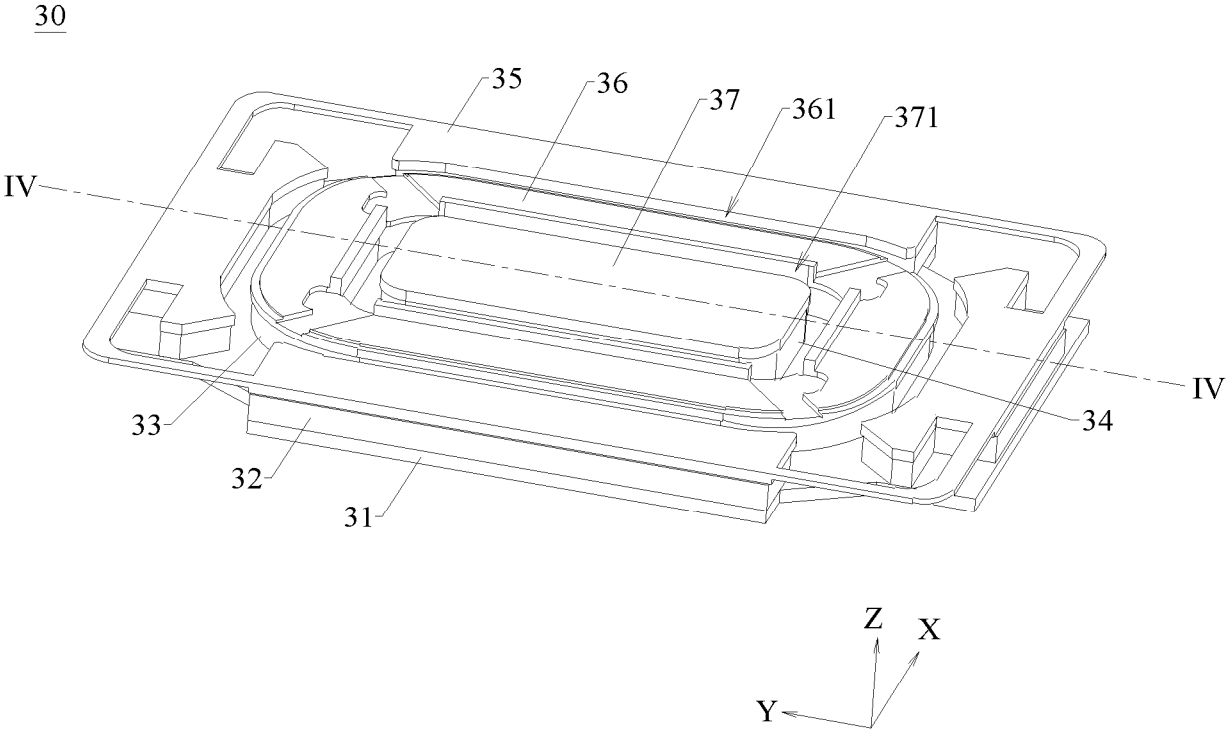


FIG. 15

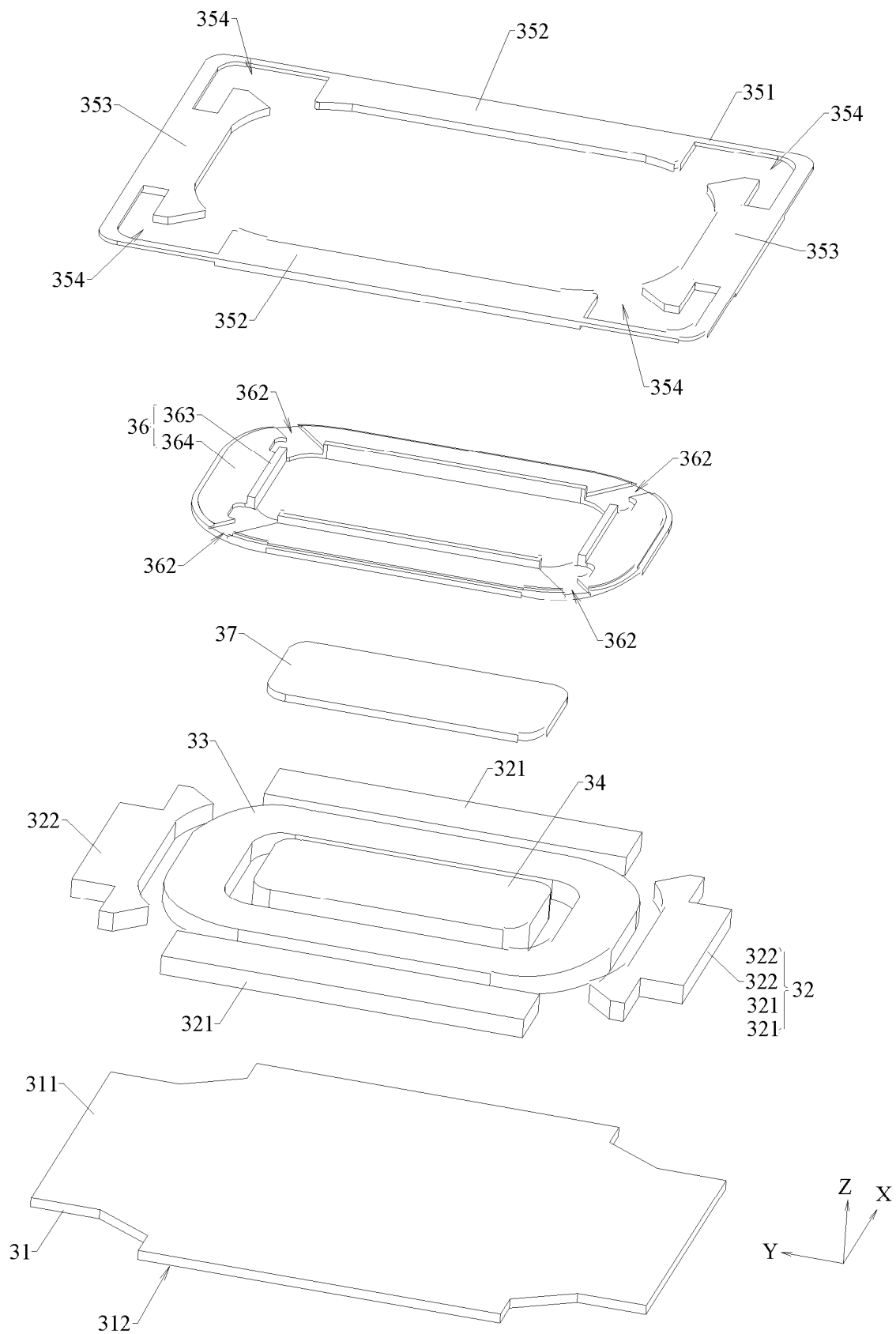


FIG. 16

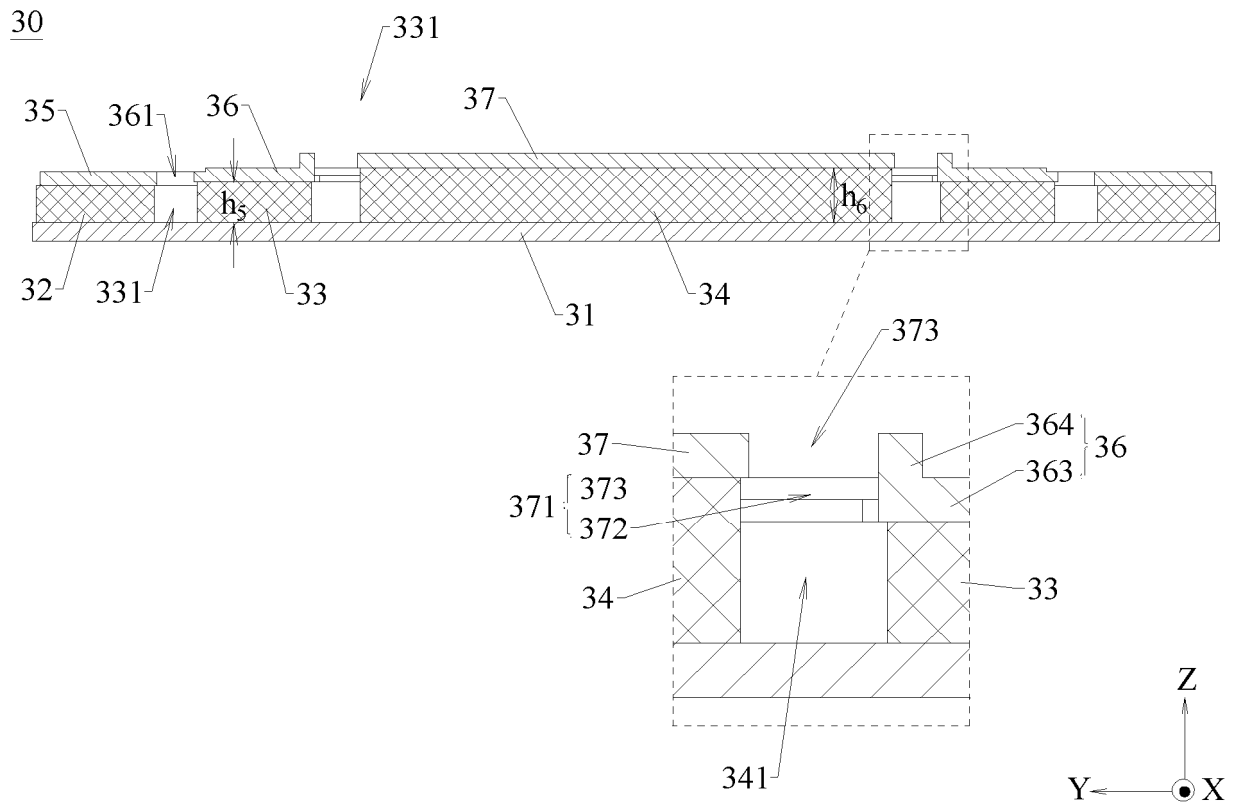


FIG. 17

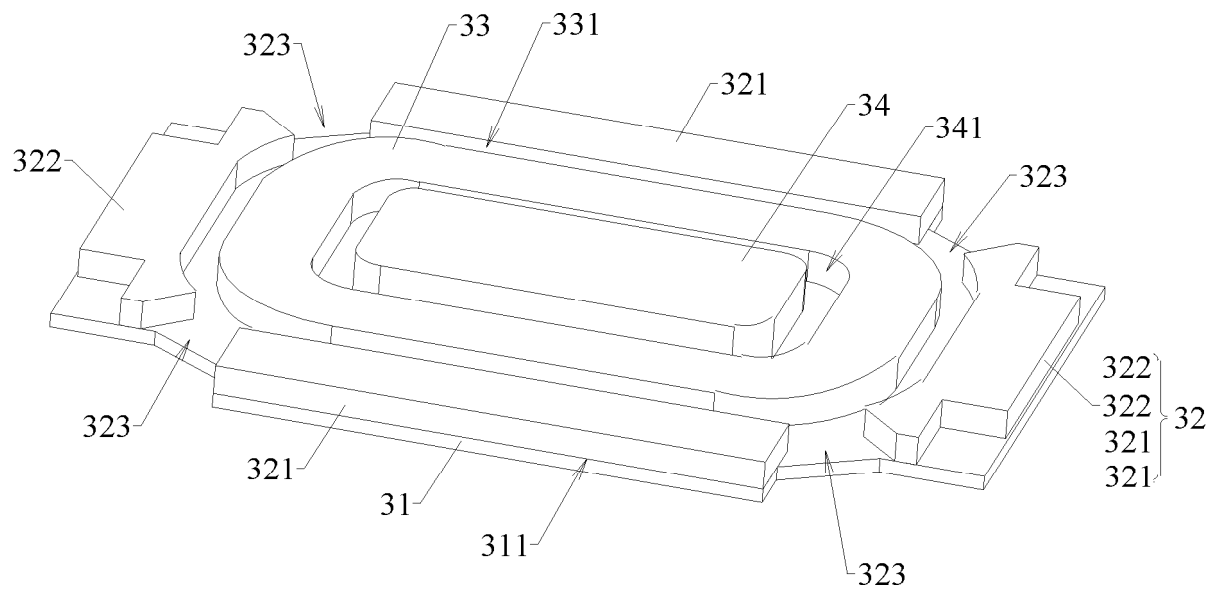


FIG. 18

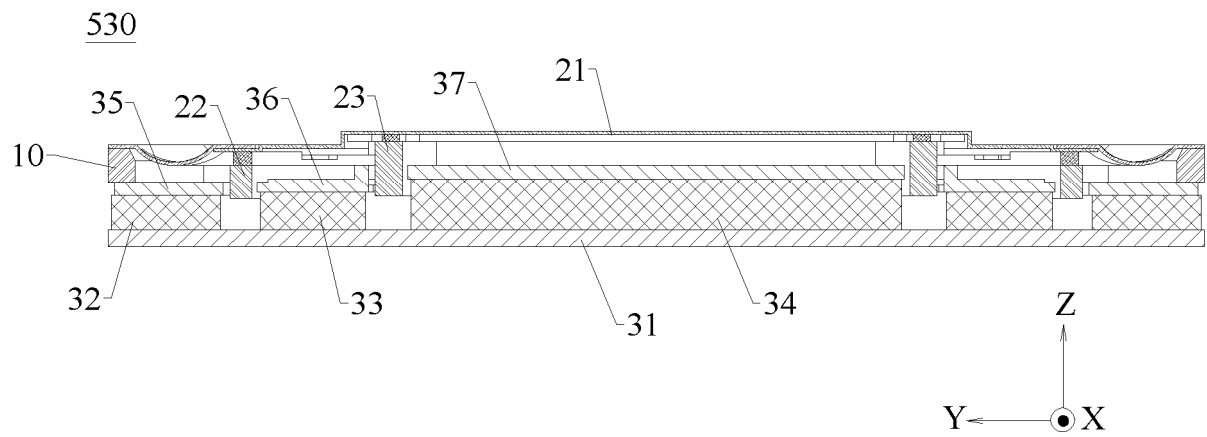


FIG. 19

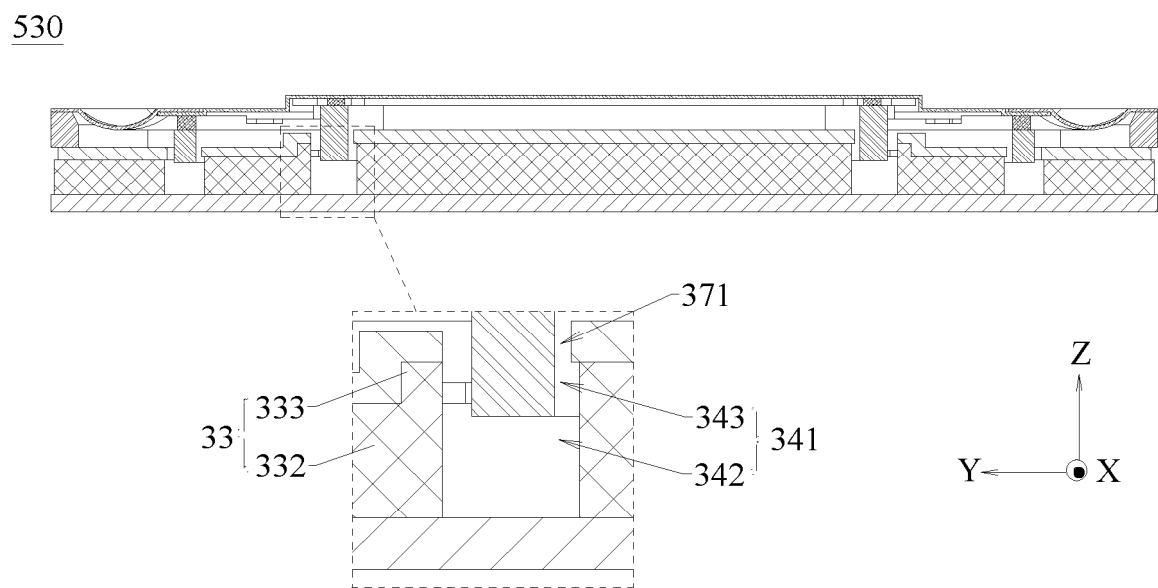


FIG. 20

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/140209

A. CLASSIFICATION OF SUBJECT MATTER

H04R 9/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04R

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

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

CNTXT, ENTXT, VEN, CNKI: 第二, 双, 音膜, 音圈, 振膜, 同轴, 面, 靠近, 朝向, coaxial, secondary, double, diaphragm, coil, surface, close, toward

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 216775018 U (GOERTEK INC.) 17 June 2022 (2022-06-17) description, paragraphs 42-76	1-16
A	CN 115884051 A (HUAWEI TECHNOLOGIES CO., LTD.) 31 March 2023 (2023-03-31) entire document	1-16
A	WO 2021232458 A1 (AAC ACOUSTIC TECHNOLOGIES (SHENZHEN) CO., LTD.; AAC MICROTECH (CHANGZHOU) CO., LTD.) 25 November 2021 (2021-11-25) entire document	1-16

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

23 January 2025

Date of mailing of the international search report

10 February 2025

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
China No. 6, Xitucheng Road, Jimenqiao, Haidian District,
Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2024/140209

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	216775018	U	17 June 2022	None	
CN	115884051	A	31 March 2023	None	
WO	2021232458	A1	25 November 2021	None	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202410050495 [0001]