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Ren et al.

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(54) **SOUND DEVICE**

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(Continued)

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(Continued)

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See application file for complete search history.

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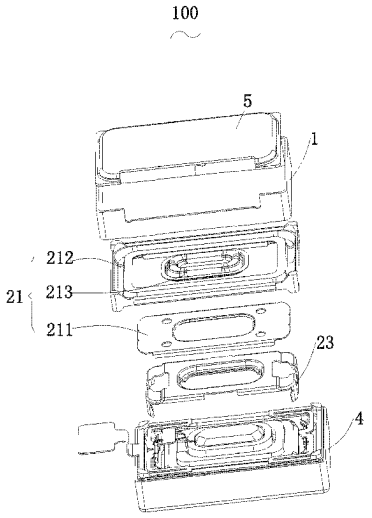
(57) **ABSTRACT**

A sound device includes a frame, a vibration system, and a magnetic circuit system. The vibration system is supported on the frame. The magnetic circuit system has magnetic gaps. The vibration system includes a vibrating diaphragm, a voice coil, and a framework. The voice coil is inserted into the magnetic gaps to drive the vibrating diaphragm to vibrate and produce sound. The framework is configured to connect the vibrating diaphragm and the voice coil. The vibrating diaphragm includes an annular dome portion, an annular first folding ring portion, and an annular second folding ring portion. The dome portion is connected to the first folding ring portion and the second folding ring portion. The framework includes a framework flat plate wall and framework glue containing portions. Compared with related art, the sound device is wider in frequency band and better in high-frequency performance.

9 Claims, 5 Drawing Sheets



(51) **Int. Cl.**
H04R 7/18 (2006.01)
H04R 9/02 (2006.01)
H04R 9/04 (2006.01)

(52) **U.S. Cl.**
CPC ***H04R 9/045*** (2013.01); *H04R 2400/11* (2013.01)

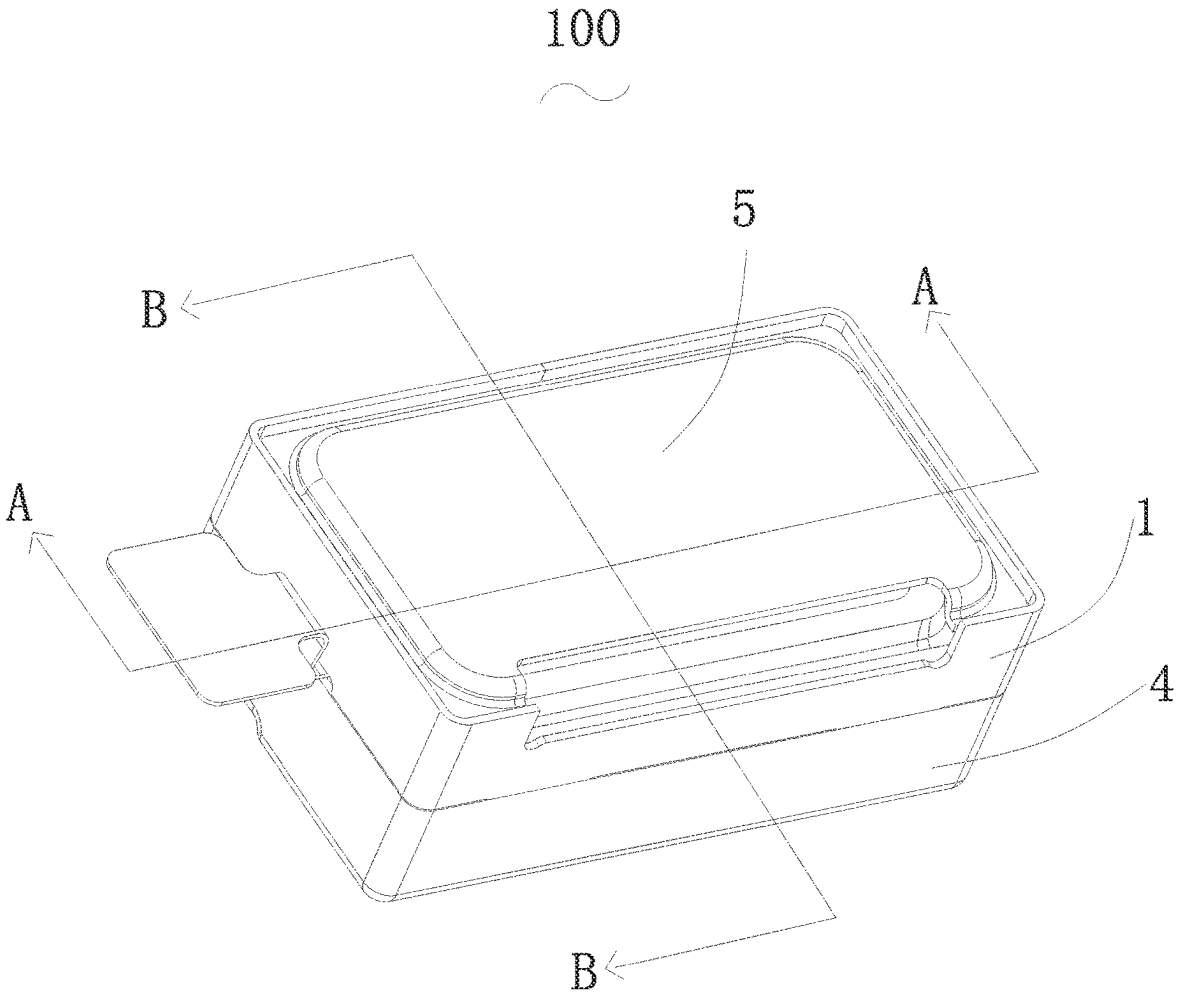


FIG. 1

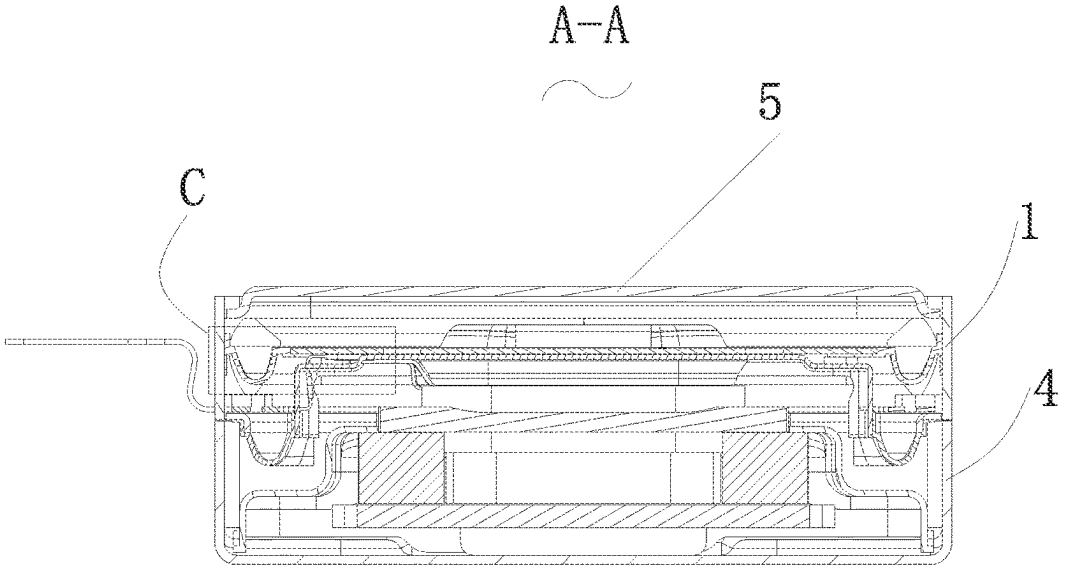


FIG. 2

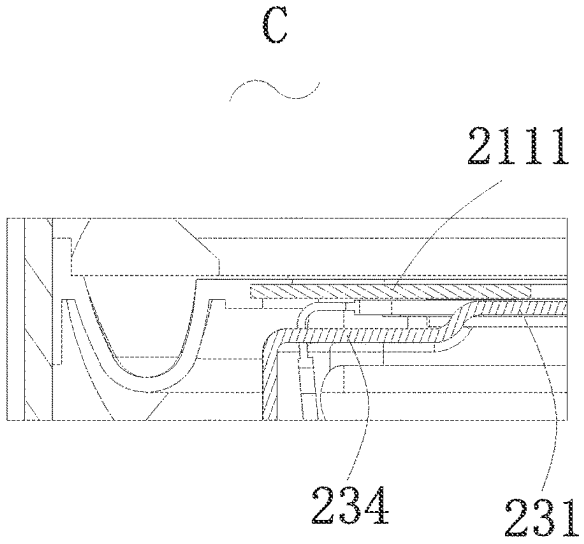


FIG. 3

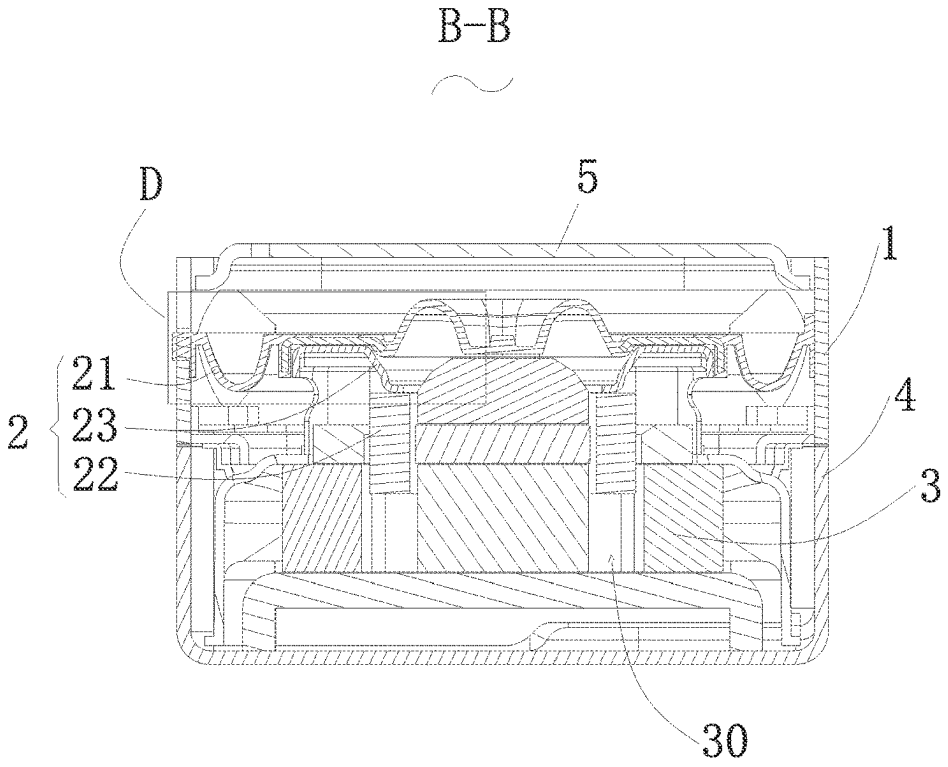

B–B
D
5
1
21
2
23
22
4
3
30

FIG. 4

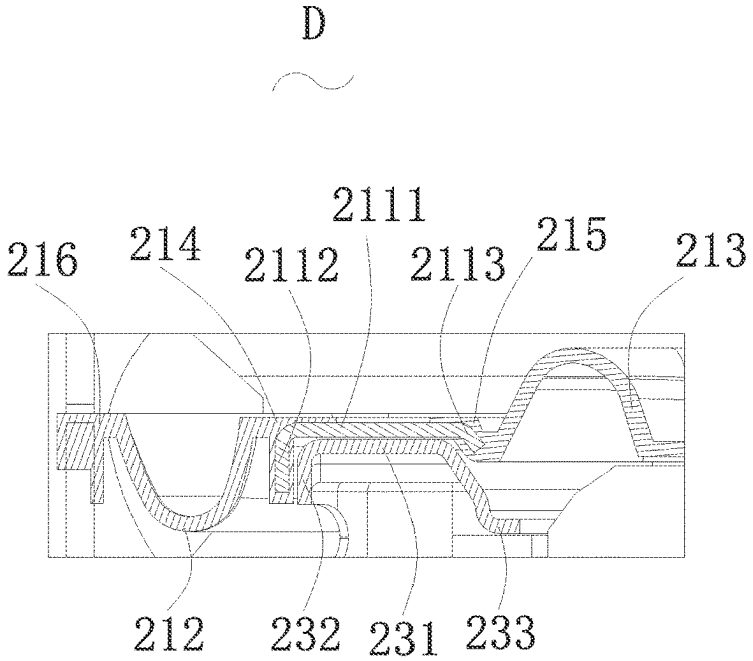

D
2111
216
214
2112
2113
215
213
212
232
231
233

FIG. 5

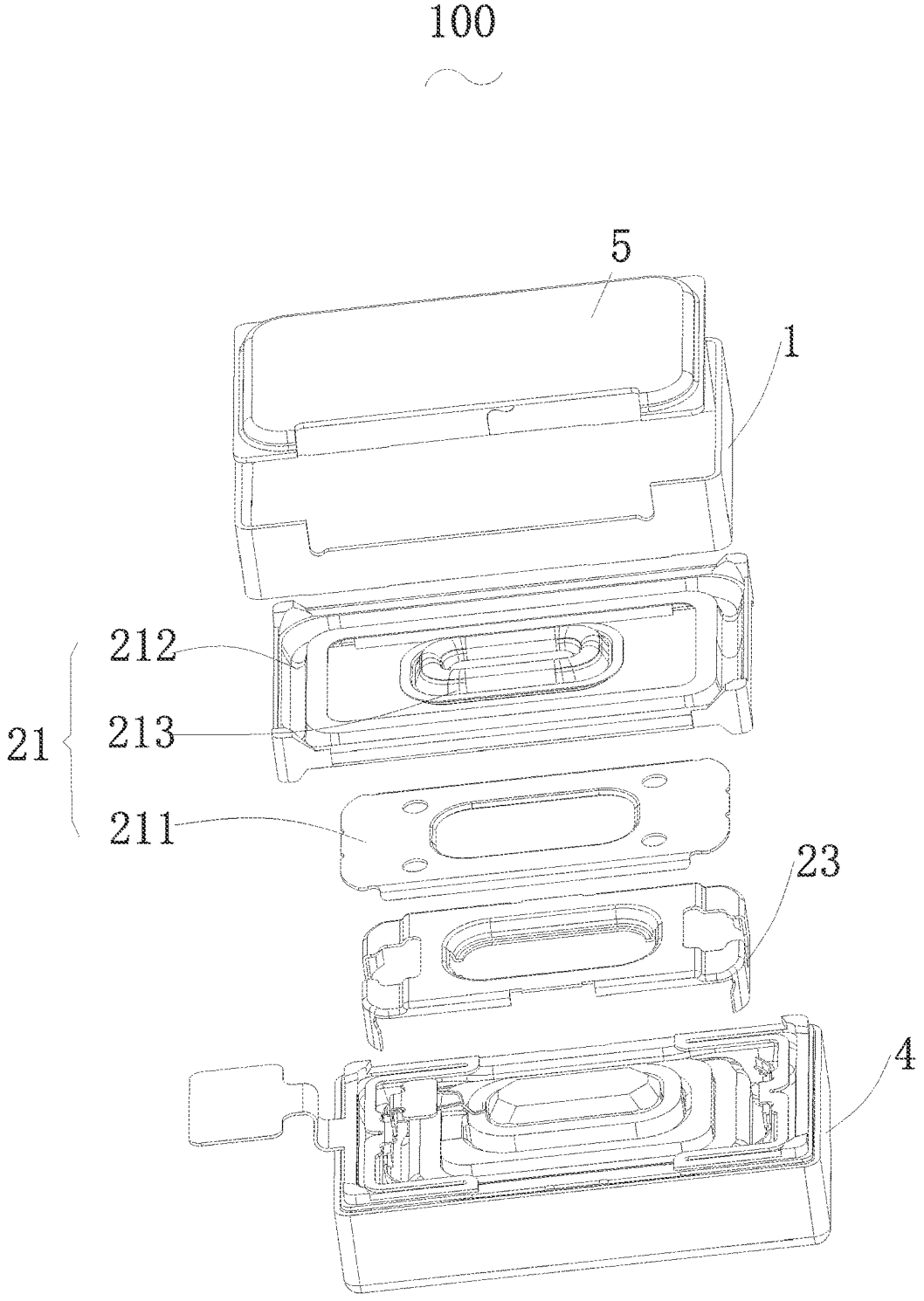


FIG. 6

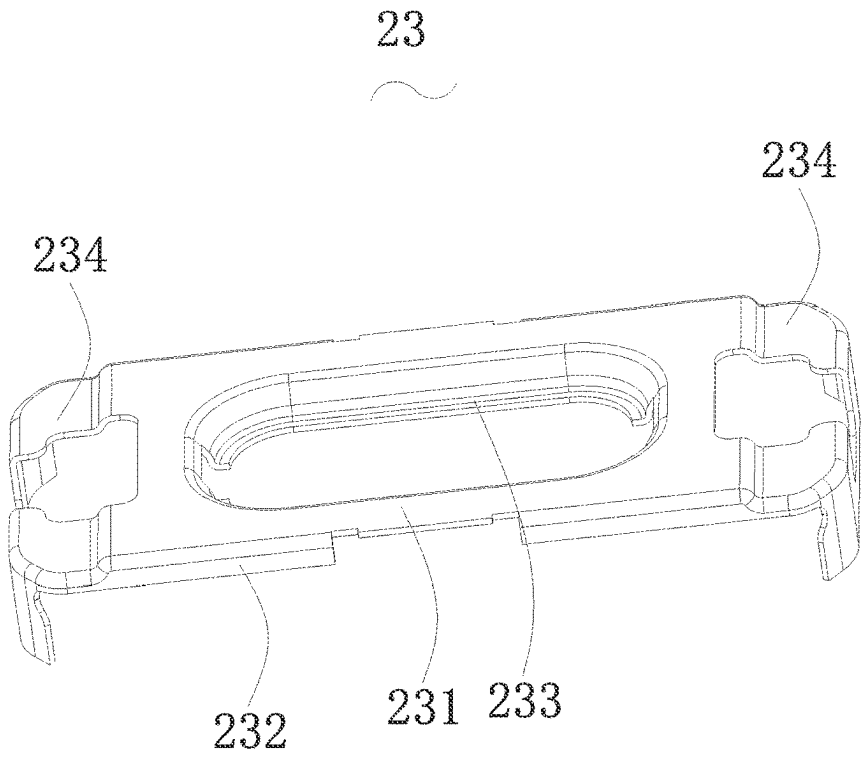

23
234
234
232
231
233

FIG. 7

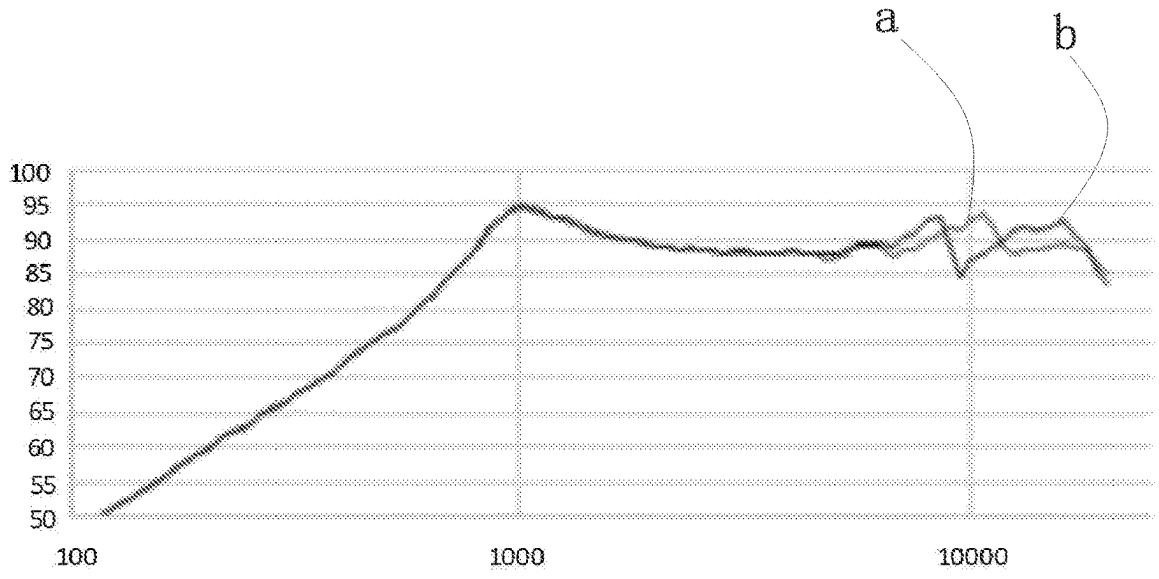

a
b
100
95
90
85
80
75
70
65
60
55
50
100
1000
10000

FIG. 8

SOUND DEVICE

TECHNICAL FIELD

The present disclosure relates to a field of electroacoustic conversion, and in particular to a sound device for electronic sound box products.

BACKGROUND

Sound devices are further known as speakers or loudspeakers and are applied to sound boxes for converting audio signals into sound for playing.

In the related art, the sound devices include a frame, a vibration system, and a magnetic circuit system. The vibration system is fixed on the frame, and the magnetic circuit system has magnetic gaps. The magnetic circuit system drives the vibration system to vibrate and produce sound. The vibration system includes a vibrating diaphragm, a dome, a voice coil, and a framework. The vibrating diaphragm is fixed on the frame, the dome is attached to the vibrating diaphragm, the voice coil is inserted into the magnetic gaps, and the framework is connected to the dome and the voice coil.

However, in the sound device of the related technologies, the dome and the framework are generally of a planar structure, resulting in insufficient strength of the dome and the framework, so that frequency band of the sound device is narrow and sound production effect is poor.

Therefore, it is necessary to provide a new sound device to solve above technical problems.

SUMMARY

The present disclosure aims to provide a sound device having a wider frequency band and better high-frequency performance.

In order to achieve above aims, the present disclosure provides the sound device, including a frame, a vibration system, and a magnetic circuit system. The vibration system is supported on the frame. The magnetic circuit system has magnetic gaps. The vibration system includes a vibrating diaphragm, a voice coil, and a framework. The voice coil is inserted into the magnetic gaps to drive the vibrating diaphragm to vibrate and produce sound. The framework is configured to connect the vibrating diaphragm and the voice coil. The vibrating diaphragm includes a dome portion, a first folding ring portion, and a second folding ring portion. The dome portion, the first folding ring portion, and the second folding ring portion are all annular. The first folding ring portion surrounds the second folding ring portion. The first folding ring portion and the second folding ring portion are mutually spaced. The dome portion is disposed between the first folding ring portion and the second folding ring portion. The dome portion is connected to the first folding ring portion and the second folding ring portion. The framework includes a framework flat plate wall and framework glue containing portions. The framework glue containing portions are bent from the framework flat plate wall to the magnetic circuit system. The framework flat plate wall is connected to the dome portion. The framework glue containing portions and the dome portion are disposed at intervals.

Furthermore, the dome portion includes a dome body, where the dome body is annular. The framework glue containing portions are in a flat plate shape. The framework glue containing portions are parallel to the dome body.

Furthermore, there are two framework glue containing portions. The two framework glue containing portions are symmetrically disposed on two sides of long shafts of the framework flat plate wall.

Furthermore, the vibrating diaphragm further includes a first fixing portion and a second fixing portion. The first fixing portion is bent and extends from one side, close to the second folding ring portion, of the first folding ring portion. The second fixing portion is bent and extends from one side, close to the first folding ring portion, of the second folding ring portion. The dome portion further includes a first dome extension wall and a second dome extension wall. The first dome extension wall and the second dome extension wall are bent and extend from the dome body to a direction close to the magnetic circuit system. The first dome extension wall is connected to the first fixing portion. The second dome extension wall is connected to the second fixing portion.

Furthermore, the framework further includes a first framework extension wall and a second framework extension wall. The framework flat plate wall is attached to one side, close to the voice coil, of the dome body. The first framework extension wall is formed by bending and extending from one side, close to the first folding ring portion, of the framework flat plate wall towards the magnetic circuit system. The first framework extension wall and the first dome extension wall are oppositely disposed at intervals. The second framework extension wall extends from one side, close to the second folding ring portion, of the framework flat plate wall towards the voice coil. The second framework extension wall is fixedly connected to the voice coil.

Furthermore, the first framework extension wall and the first fixing portion are disposed at intervals.

Furthermore, the first dome extension wall is formed by extending the dome body in a vibration direction of the vibrating diaphragm. The first framework extension wall is formed by extending one side, close to the first folding ring portion, of the framework flat plate wall in the vibration direction.

Furthermore, the first folding ring portion and the second folding ring portion are both of an arc-shaped structure. Arc-shaped concave directions of the first folding ring portion and the second folding ring portion are opposite.

Furthermore, the arc-shaped concave direction of the first folding ring portion is in a direction close to the voice coil. The arc-shaped concave direction of the second folding ring portion is in a direction distal from the voice coil.

Furthermore, the vibrating diaphragm further includes a third fixing portion. The third fixing portion is bent and extends from one side, distal from the second folding ring portion, of the first folding ring portion. The third fixing portion is fixed on an inner peripheral side of the frame.

Compared with related art, the sound device of the present disclosure includes the frame, the vibration system, and the magnetic circuit system. The vibration system is supported on the frame. The magnetic circuit system has the magnetic gaps. The vibration system includes the vibrating diaphragm, the voice coil, and the framework. The voice coil is inserted into the magnetic gaps to drive the vibrating diaphragm to vibrate and produce sound. The framework is configured to connect the vibrating diaphragm and the voice coil. The vibrating diaphragm includes the dome portion, the first folding ring portion, and the second folding ring portion. The dome portion, the first folding ring portion, and the second folding ring portion are all annular. The first folding ring portion surrounds the second folding ring portion. The first folding ring portion and the second folding ring portion

are mutually spaced. The dome portion is disposed between the first folding ring portion and the second folding ring portion. The dome portion is connected to the first folding ring portion and the second folding ring portion. The framework includes the framework flat plate wall and framework glue containing portions. The framework glue containing portions are bent from the framework flat plate wall to the magnetic circuit system. The framework flat plate wall is connected to the dome portion. The framework glue containing portions and the dome portion are disposed at intervals. Therefore, by bending the framework from the framework flat plate wall to the magnetic circuit system, where the framework includes the framework glue containing portions, it is conducive to enhancing strength of the vibration system, which improves impact of division vibration on performance, expands high frequency of the sound device, and improves high-frequency performance of the sound device to a certain extent.

BRIEF DESCRIPTION OF DRAWINGS

In order to more clearly illustrate technical solutions in embodiments of the present disclosure, drawings required in description of the embodiments are briefly described below. Obviously, the drawings in the following description are merely some embodiments of the present disclosure. For a person of ordinary skill in art, other drawings may be obtained according to the drawings without creative efforts.

FIG. **1** is a three-dimensional structural schematic diagram of a sound device according to one embodiment of the present disclosure.

FIG. **2** is a cross-sectional schematic diagram taken along the line A-A shown in FIG. **1**.

FIG. **3** is a schematic diagram of an enlarged view of portion C shown in FIG. **2**.

FIG. **4** is a cross-sectional schematic diagram taken along the line B-B shown in FIG. **1**.

FIG. **5** is a schematic diagram of an enlarged view of portion D shown in FIG. **4**.

FIG. **6** is a partial exploded schematic diagram of the sound device according to one embodiment of the present disclosure.

FIG. **7** is a structural schematic diagram of a framework of the sound device according to one embodiment of the present disclosure.

FIG. **8** is frequency response curve graphs of the sound device and another sound device according to one embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

Technical solutions in embodiments of the present disclosure are clearly and completely described below with reference to accompanying drawings in the embodiments of the present disclosure. Obviously, the described embodiments are only a part of the embodiments of the present disclosure, not all of the embodiments. Based on the embodiments of the present disclosure, all other embodiments obtained by a person of ordinary skill in art without creative efforts shall fall within a protection scope of the present disclosure.

Referring to FIGS. **1-7**, the present disclosure provides a sound device **100**, including a frame **1**, a vibration system **2**, a magnetic circuit system **3**, a rear cover **4**, and a front cover **5**. The magnetic circuit system **3** has magnetic gaps **30**. The rear cover **4** is configured to accommodate the magnetic circuit system **3**, and the rear cover **4** is fixed on the frame **1**. The front cover **5** covers one side, distal from the rear cover **4**, of the frame **1**. The vibration system **2** and the magnetic circuit system **3** are respectively supported on the frame **1**. The magnetic circuit system **3** drives the vibration system **2** to vibrate and produce sound.

In the present embodiment, the vibration system **2** includes a vibrating diaphragm **21**, a voice coil **22**, and a framework **23**. The voice coil **22** is inserted into the magnetic gaps **30** to drive the vibrating diaphragm **21** to vibrate and produce sound. The framework **23** is configured to connect the vibrating diaphragm **21** and the voice coil **22**.

The vibrating diaphragm **21** includes a dome portion **211**, a first folding ring portion **212**, and a second folding ring portion **213**. The dome portion **211**, the first folding ring portion **212**, and the second folding ring portion **213** are all annular. The first folding ring portion **212** surrounds the second folding ring portion **213**. The first folding ring portion **212** and the second folding ring portion **213** are mutually spaced. The dome portion **211** is disposed between the first folding ring portion **212** and the second folding ring portion **213**. The dome portion **211** is connected to the first folding ring portion **212** and the second folding ring portion **213**. The vibrating diaphragm **21** further includes a first fixing portion **214**, a second fixing portion **215**, and a third fixing portion **216**. The first fixing portion **214** is bent and extends from one side, close to the second folding ring portion **213**, of the first folding ring portion **212**. The second fixing portion **215** is bent and extends from one side, close to the first folding ring portion **212**, of the second folding ring portion **213**. The third fixing portion **216** is bent and extends from one side, distal from the second folding ring portion **213**, of the first folding ring portion **212**. The third fixing portion **216** is fixed on an inner peripheral side of the frame **1**.

The dome portion **211** further includes a dome body **2111** and a first dome extension wall **2112**, where the dome body **2111** is annular. The first dome extension wall **2112** is bent and extend from the dome body **2111** to a direction close to the magnetic circuit system **3**. The first dome extension wall **2112** is connected to the first fixing portion **214**.

The first folding ring portion **212** and the second folding ring portion **213** are both of an arc-shaped structure. Arc-shaped concave directions of the first folding ring portion **212** and the second folding ring portion **213** are opposite. More specifically, the arc-shaped concave direction of the first folding ring portion **212** is in a direction close to the voice coil **22**. The arc-shaped concave direction of the second folding ring portion **213** is in a direction distal from the voice coil **22**.

The framework **23** includes a framework flat plate wall **231**, a first framework extension wall **232**, a second framework extension wall **233**, and framework glue containing portions **234**. The framework flat plate wall **231** is attached to one side, close to the voice coil **22**, of the dome body **2111**. The first framework extension wall **232** is formed by bending and extending from one side, close to the first folding ring portion **212**, of the framework flat plate wall **231** towards the magnetic circuit system. The first framework extension wall **232** and the first dome extension wall **2112** are oppositely disposed at intervals. The second framework extension wall **233** extends from one side, close to the second folding ring portion **213**, of the framework flat plate wall **231** towards the voice coil **22**. The second framework extension wall **233** is fixedly connected to the voice coil **22**. The framework glue containing portions **234** are formed by bending and extending from the framework flat plate wall **231** to the magnetic circuit system. The framework glue

containing portions **234** and the dome portion **211** are disposed at intervals. The framework glue containing portions **234** are in a flat plate shape. The framework glue containing portions **234** are parallel to the dome body **2111**. In the embodiment, there are two framework glue containing portions **234**. The two framework glue containing portions **234** are symmetrically disposed on two sides of long shafts of the framework flat plate wall **231**.

Furthermore, the first dome extension wall **2112** is formed by extending the dome body **2111** in a vibration direction of the vibrating diaphragm **21**. The first framework extension wall **232** is formed by extending one side, close to the first folding ring portion **212**, of the framework flat plate wall **231** in the vibration direction.

The first framework extension wall **232** and the first fixing portion **214** are disposed at intervals. That is, the first framework extension wall **232** and the first dome extension wall **2112** are disposed at intervals, and there is a gap between the first framework extension wall **232** and the first dome extension wall **2112**.

In the present embodiment, the dome portion **211** further includes a second dome extension wall **2113**, the second dome extension wall **2113** is bent and extends from one side, distal from the first dome extension wall **2112**, of the dome body **2111** to a direction of the magnetic circuit system **3**. A certain angle is formed between a bending direction of the second dome extension wall **2113** and the vibration direction. That is, the second dome extension wall **2113** is not bent along the vibration direction. The second dome extension wall **2113** is connected to the second fixing portion **215**.

As shown in FIG. **8**, FIG. **8** is frequency response curve graphs of the sound device **100** and another sound device according to one embodiment of the present disclosure. The sound device of the present disclosure and other sound devices are mainly different in structure. The curve "a" represents a frequency response curve of the sound device **100** of the present disclosure. The curve "b" represents a frequency response curve of another sound device. More specifically, the curve "a" is a frequency response curve of the framework having the framework glue containing portions **234**. The curve "b" is a frequency response curve of the framework on which no framework glue containing portions **234** are disposed. It should be seen that the sound device **100** of the present disclosure has better high-frequency performance.

Compared with related art, the sound device of the present disclosure includes the frame, the vibration system, and the magnetic circuit system. The vibration system is supported on the frame. The magnetic circuit system has the magnetic gaps. The vibration system includes the vibrating diaphragm, the voice coil, and the framework. The voice coil is inserted into the magnetic gaps to drive the vibrating diaphragm to vibrate and produce sound. The framework is configured to connect the vibrating diaphragm and the voice coil. The vibrating diaphragm includes the dome portion, the first folding ring portion, and the second folding ring portion. The dome portion, the first folding ring portion, and the second folding ring portion are all annular. The first folding ring portion surrounds the second folding ring portion. The first folding ring portion and the second folding ring portion are mutually spaced. The dome portion is disposed between the first folding ring portion and the second folding ring portion. The dome portion is connected to the first folding ring portion and the second folding ring portion. The framework includes the framework flat plate wall and framework glue containing portions. The framework glue containing portions are bent from the framework flat plate wall to the magnetic circuit system. The framework flat plate wall is connected to the dome portion. The framework glue containing portions and the dome portion are disposed at intervals. Therefore, by bending the framework from the framework flat plate wall to the magnetic circuit system, where the framework includes the framework glue containing portions, it is conducive to enhancing strength of the vibration system, which improves impact of division vibration on performance, expands high frequency of the sound device, and improves the high-frequency performance of the sound device to a certain extent.

The above are only the embodiments of the present disclosure. It should be noted that, for the person of ordinary skill in the art, improvements are made without departing from concepts of the present disclosure, but these are all within the protection scope of the present disclosure.

What is claimed is:

1. A sound device, comprising:

a frame;

a vibration system; and

a magnetic circuit system;

wherein the vibration system is supported on the frame, the magnetic circuit system has magnetic gaps; the vibration system comprises a vibrating diaphragm, a voice coil, and a framework; the voice coil is inserted into the magnetic gaps to drive the vibrating diaphragm to vibrate and produce sound, the framework is configured to connect the vibrating diaphragm and the voice coil; the vibrating diaphragm comprises a dome portion, a first folding ring portion, and a second folding ring portion; the dome portion, the first folding ring portion, and the second folding ring portion are all annular; the first folding ring portion surrounds the second folding ring portion, the first folding ring portion and the second folding ring portion are mutually spaced; the dome portion is disposed between the first folding ring portion and the second folding ring portion, the dome portion is connected to the first folding ring portion and the second folding ring portion;

the framework comprises a framework flat plate wall and framework glue containing portions, the framework glue containing portions are bent from the framework flat plate wall to the magnetic circuit system; the framework flat plate wall is connected to the dome portion, and the framework glue containing portions and the dome portion are disposed at intervals;

the vibrating diaphragm further comprises a first fixing portion and a second fixing portion; the first fixing portion is bent and extends from one side, close to the second folding ring portion, of the first folding ring portion; the second fixing portion is bent and extends from one side, close to the first folding ring portion, of the second folding ring portion;

the dome portion further comprises a first dome extension wall and a second dome extension wall, the first dome extension wall and the second dome extension wall are bent and extend from the dome body to a direction close to the magnetic circuit system, the first dome extension wall is connected to the first fixing portion, and the second dome extension wall is connected to the second fixing portion.

2. The sound device according to claim **1**, wherein the dome portion comprises a dome body, where the dome body is annular, the framework glue containing portions are in a flat plate shape, and the framework glue containing portions are parallel to the dome body.

3. The sound device according to claim 2, wherein the framework comprises two framework glue containing portions, the two framework glue containing portions are symmetrically disposed on two sides of long shafts of the framework flat plate wall.

4. The sound device according to claim 1, wherein the framework further comprises a first framework extension wall and a second framework extension wall, the framework flat plate wall is attached to one side, close to the voice coil, of the dome body; the first framework extension wall is formed by bending and extending from one side, close to the first folding ring portion, of the framework flat plate wall towards the magnetic circuit system; the first framework extension wall and the first dome extension wall are oppositely disposed at intervals; the second framework extension wall extends from one side, close to the second folding ring portion, of the framework flat plate wall towards the voice coil; and the second framework extension wall is fixedly connected to the voice coil.

5. The sound device according to claim 4, wherein the first framework extension wall and the first fixing portion are disposed at intervals.

6. The sound device according to claim 4, wherein the first dome extension wall is formed by extending the dome body in a vibration direction of the vibrating diaphragm; and the first framework extension wall is formed by extending one side, close to the first folding ring portion, of the framework flat plate wall in the vibration direction.

7. The sound device according to claim 1, wherein the first folding ring portion and the second folding ring portion are both of an arc-shaped structure, and arc-shaped concave directions of the first folding ring portion and the second folding ring portion are opposite.

8. The sound device according to claim 7, wherein the arc-shaped concave direction of the first folding ring portion is in a direction close to the voice coil, and the arc-shaped concave direction of the second folding ring portion is in a direction distal from the voice coil.

9. The sound device according to claim 1, wherein the vibrating diaphragm further comprises a third fixing portion; the third fixing portion is bent and extends from one side, distal from the second folding ring portion, of the first folding ring portion; and the third fixing portion is fixed on an inner peripheral side of the frame.

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