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(54) **SPEAKER**

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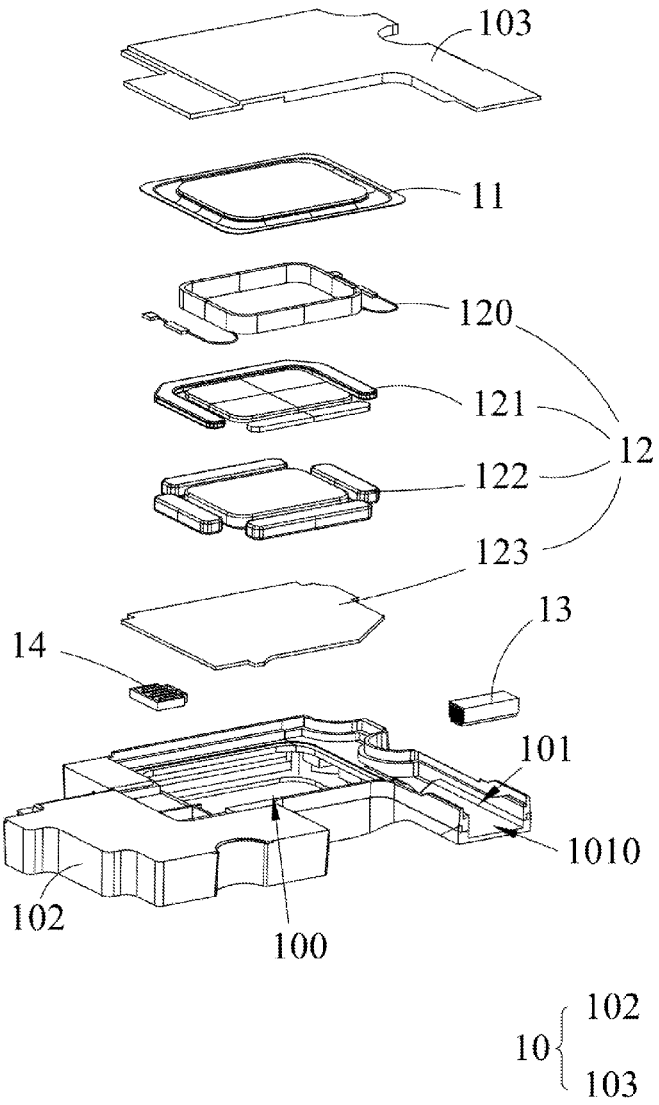
(57) **ABSTRACT**

The present disclosure provides a speaker which includes a case component, a vibration plate, a driving component, a first adjustment unit, and a second adjustment unit. The case component has an accommodating space and a sound outlet channel. The accommodating space communicates with the sound outlet channel. The vibration plate is disposed in the accommodating space. The driving component is disposed in the accommodating space and configured to drive the vibration plate to vibrate. The first adjustment unit is disposed in the sound outlet channel, and the first adjustment unit is constituted of acoustic metamaterials. The second adjustment unit is disposed on one side of the vibration plate, and the second adjustment unit is constituted of acoustic metamaterials.



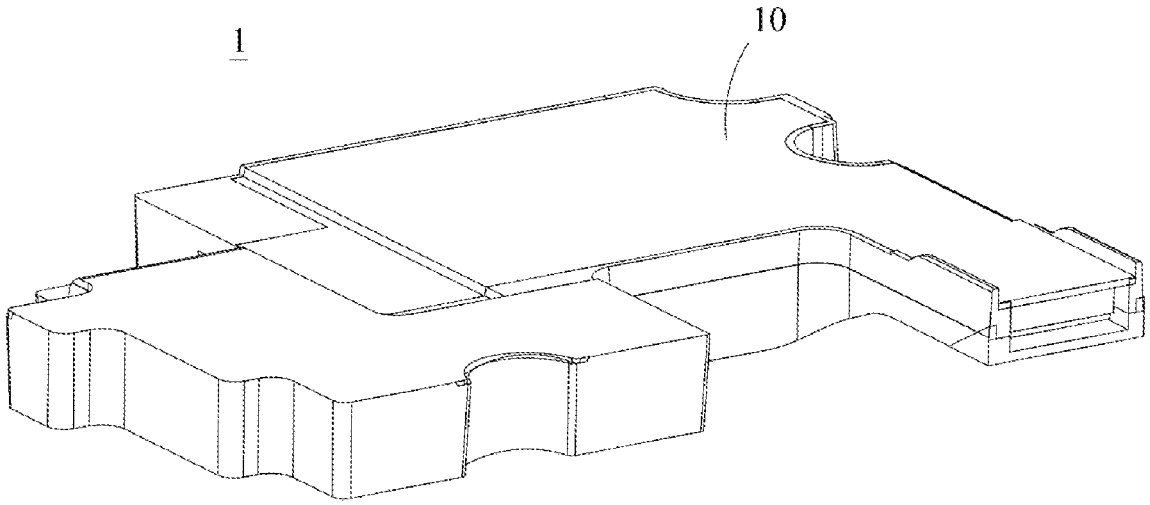


FIG. 1

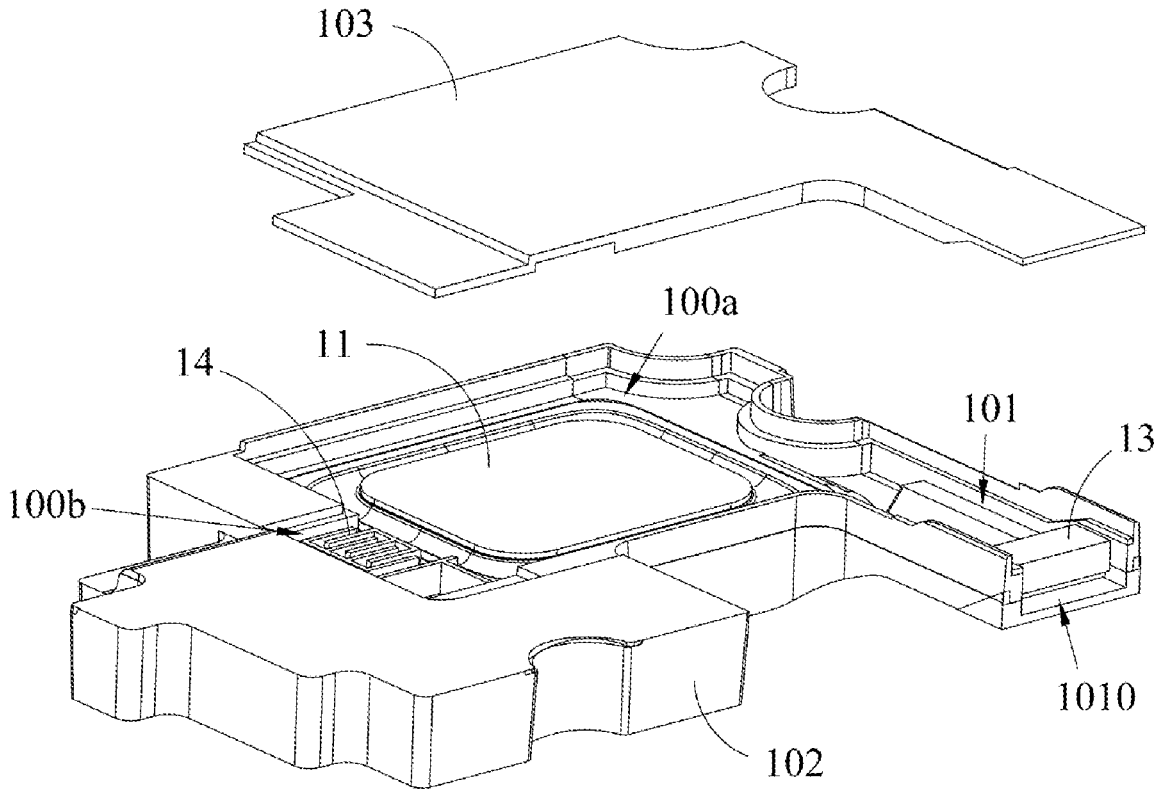


FIG. 2

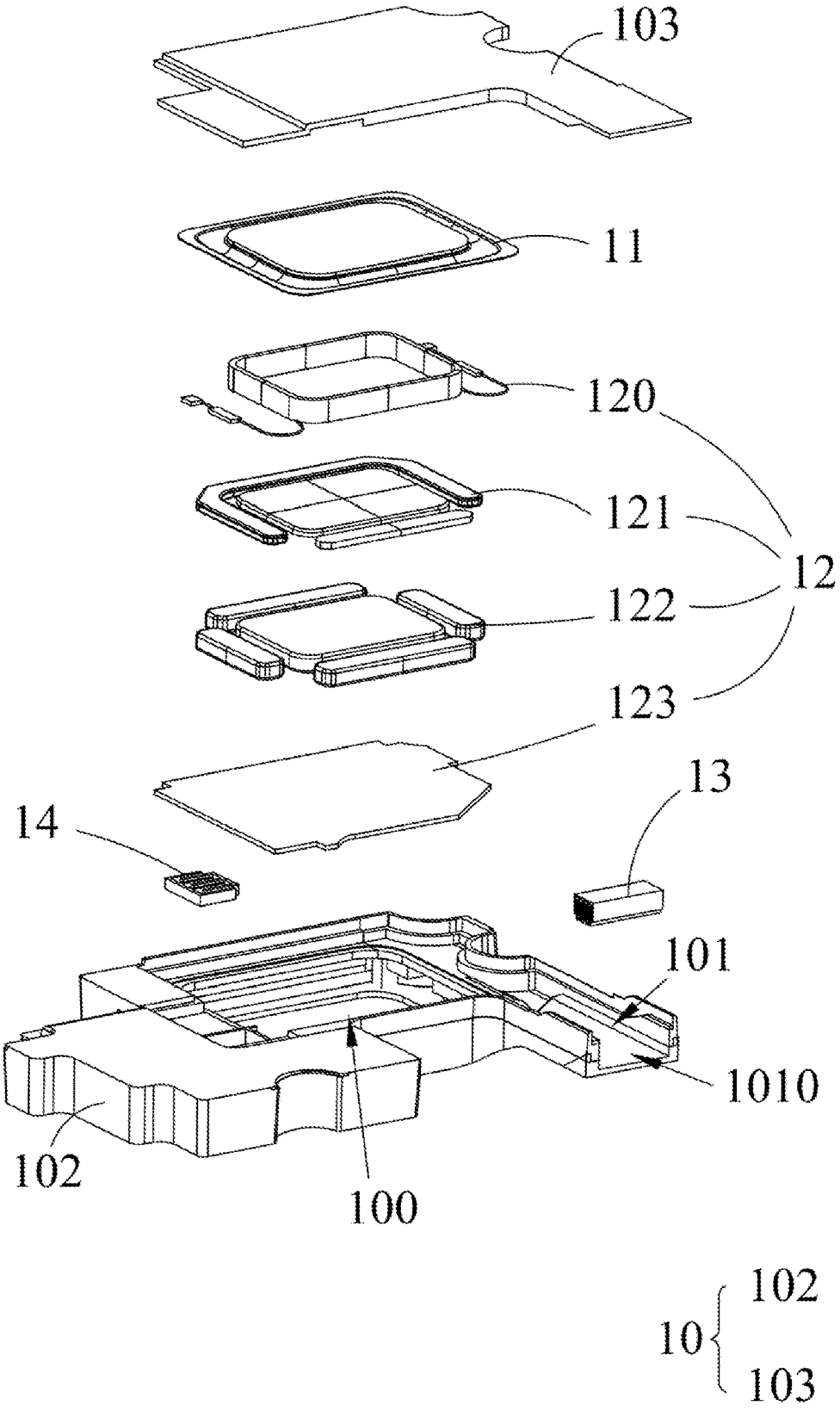


FIG. 3

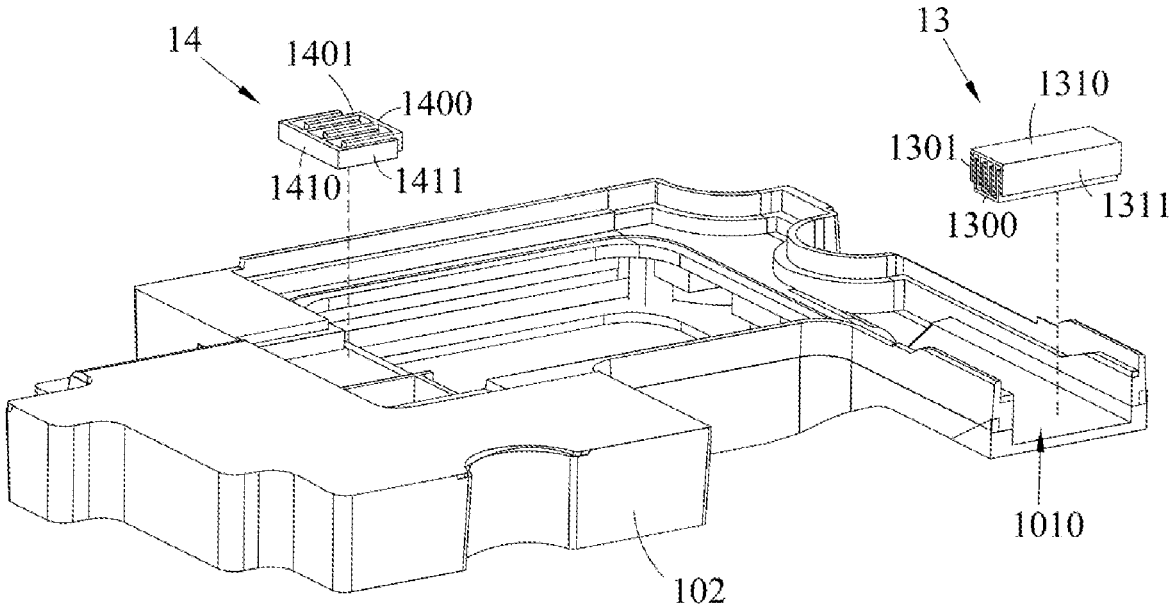


FIG. 4

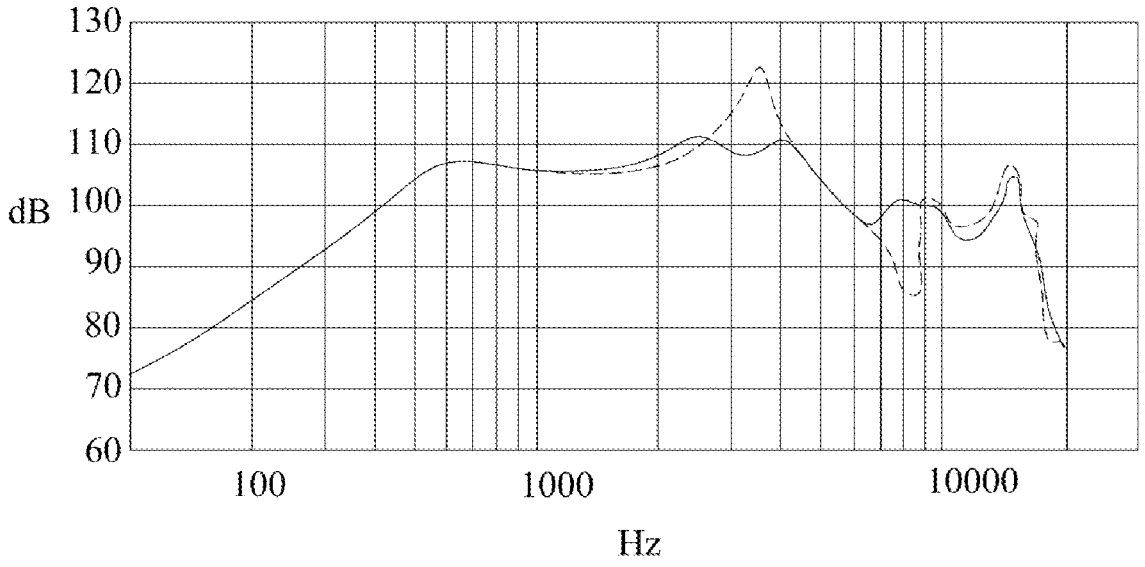


FIG. 5

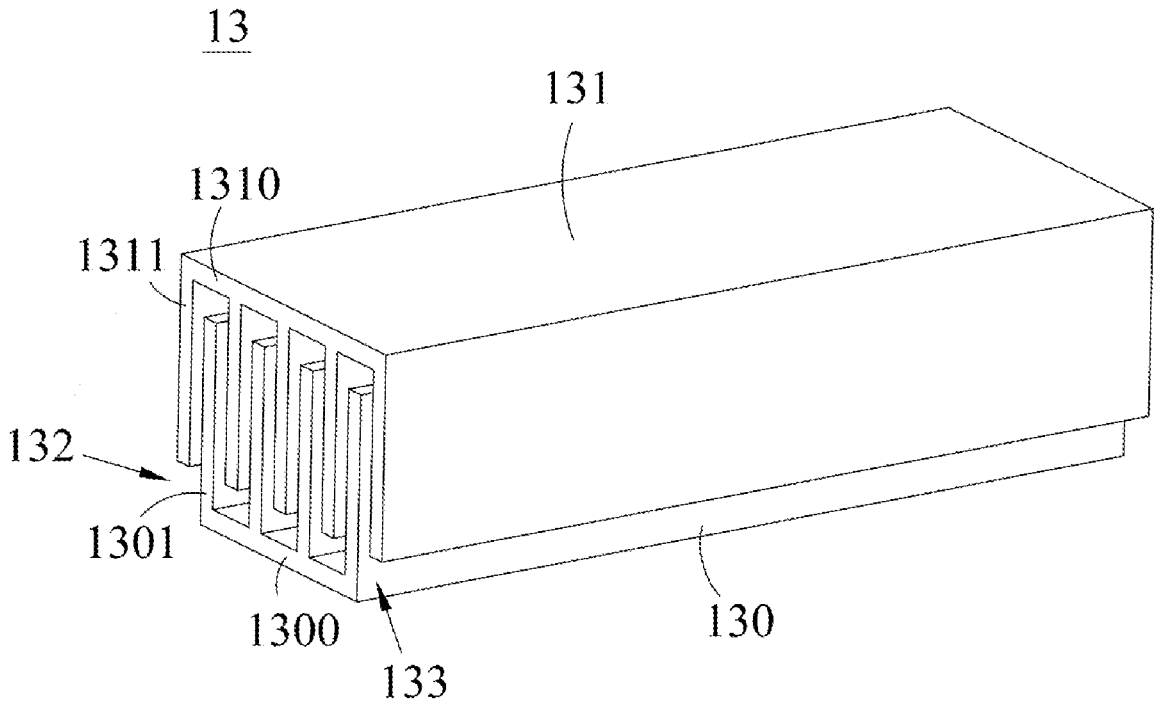


FIG. 6

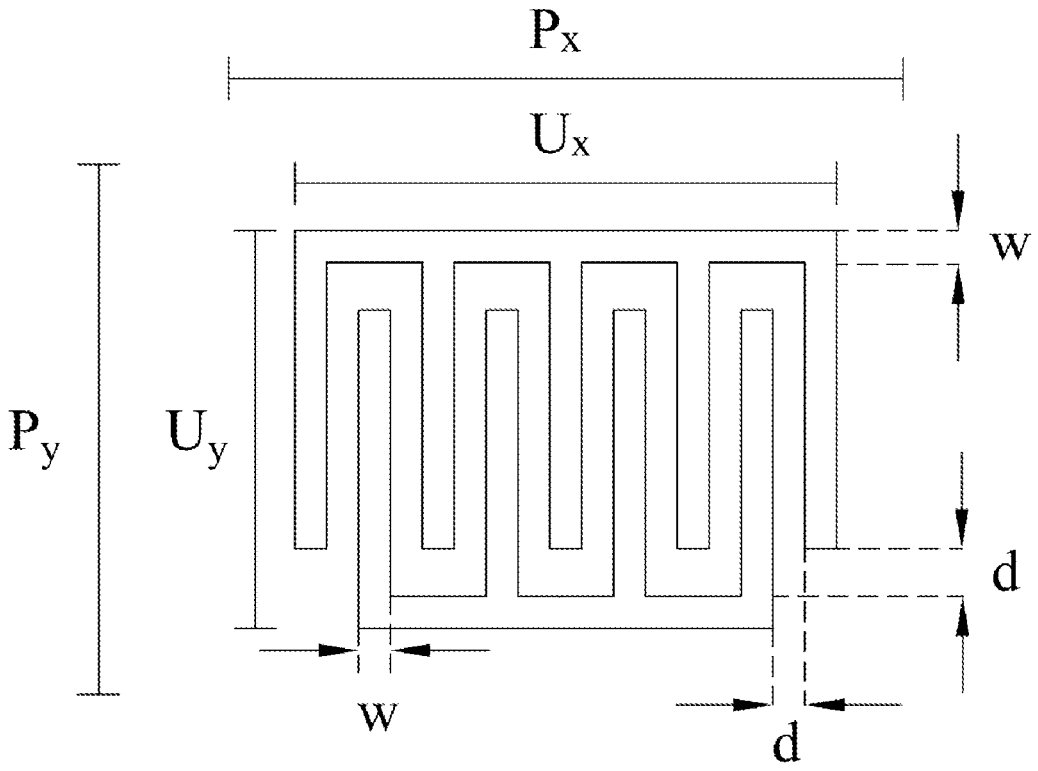


FIG. 7

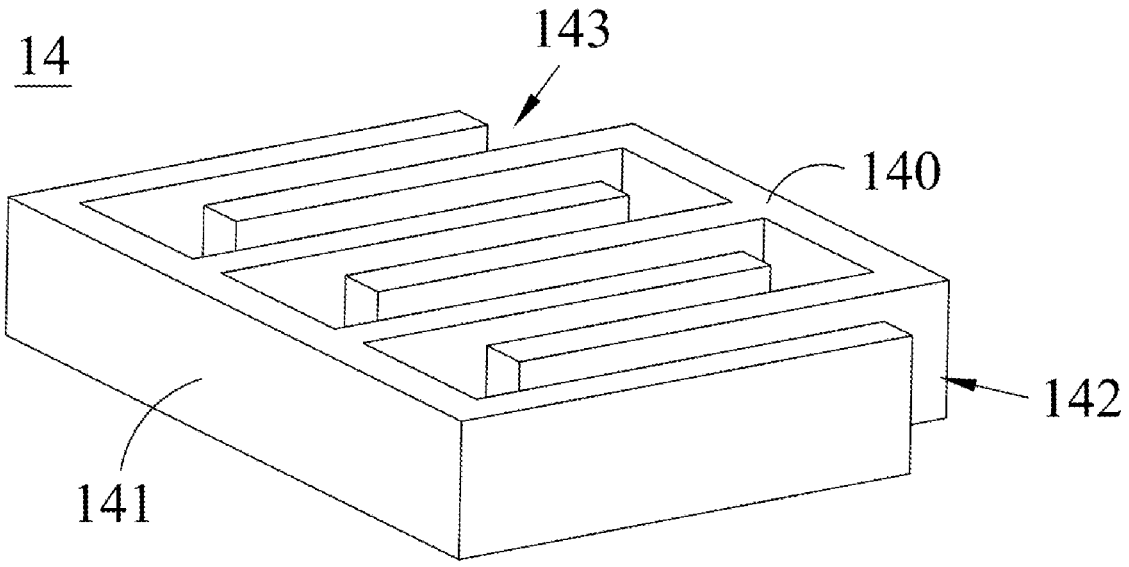


FIG. 8

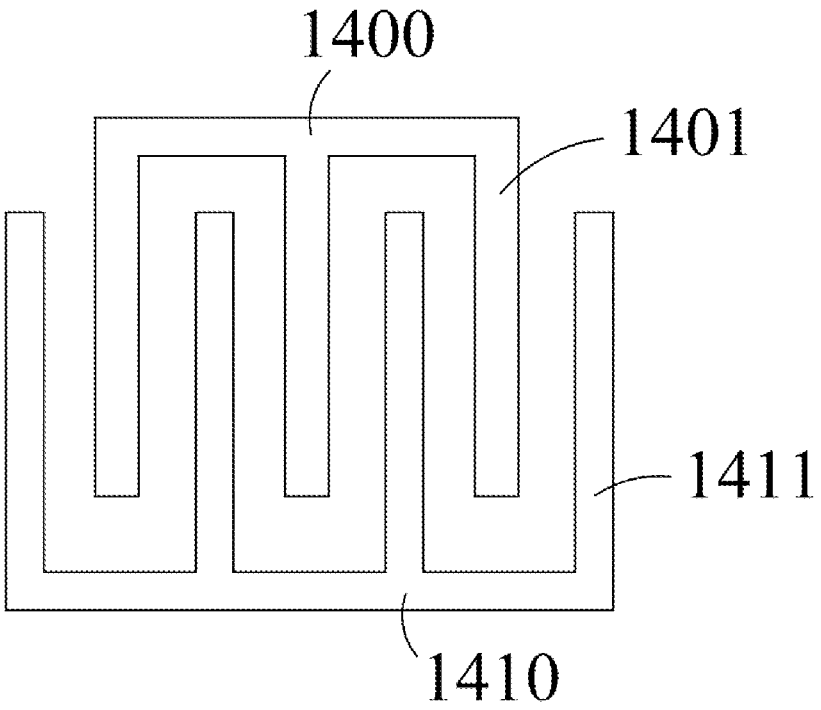


FIG. 9

SPEAKER

CROSS REFERENCE TO RELATED DISCLOSURE

[0001] This application claims the priority benefit of China Patent Application Number CN202111085449.9, filed on Sep. 16, 2021, the full disclosure of which is incorporated herein by reference.

BACKGROUND

Technical Field

[0002] The present disclosure is related to a speaker, and in particular, a speaker having acoustic metamaterials.

Related Art

[0003] Speakers are devices that convert electronic signals into sound. Specifically, a speaker consists of a case, a magnet, a coil, and a diaphragm. When current is passed through the coil, the coil generates a magnetic field. The magnetic field generated by the coil interacts with the magnetic field of the magnet to make the coil be closer to or away from the magnet. Finally, the coil vibrates the diaphragm to produce sounds during the process that the coil is closer to or away from the magnet. The produced sound may be provided to a user for listening through the resonance of the casing.

[0004] For a micro-speaker with a side sound outlet design, the resonance area (also be referred to "front cavity") formed by the diaphragm and the case generates a sharp acoustic peak and valley, and the high-frequency sensitivity sharp declines. As a result, the user feels extremely uncomfortable after listening to the deviated audio, thereby greatly reducing the user experience.

[0005] In order to solve the problems mentioned above, the acoustic curve is generally improved by disposing an additional acoustic cavity or another diaphragm in the speaker. However, the additional acoustic cavity affects other components in the speaker, resulting in a drop of low frequency sensitivity. On the other hand, the structure of the two diaphragms has extremely high requirements on the fineness of the product, and a slight tolerance will lead to a large deviation of the acoustic curve. Therefore, how to improve the user experience without decreasing the sound quality of the speaker and increasing the difficulty of production has become an urgent issue to be solved in the art.

SUMMARY

[0006] The embodiments of the present disclosure disclose a speaker, in order to solve the problem that sharp acoustic peaks and valleys appear in the frequency response curve of the current speaker at a specific frequency.

[0007] In order to solve the above technical problems, the present disclosure is implemented as follows.

[0008] A speaker is provided, which includes a case component, a vibration plate, a driving component, a first adjustment unit, and a second adjustment unit. The case component has an accommodating space and a sound outlet channel. The accommodating space communicates with the sound outlet channel. The vibration plate is disposed in the accommodating space. The driving component is disposed in the accommodating space and configured to drive the vibration plate to vibrate. The first adjustment unit is disposed in the sound outlet channel, and the first adjustment unit is constituted of acoustic metamaterials. The second adjustment unit is disposed on one side of the vibration plate, and the second adjustment unit is constituted of acoustic metamaterials.

[0009] In some embodiments, the first adjustment unit is configured to adjust a frequency response curve of the speaker in a frequency range of 6-10 kHz, and the second adjustment unit is configured to adjust the frequency response curve of the speaker in a frequency range of 2-5 kHz.

[0010] In some embodiments, the accommodating space is divided into a first accommodating space and a second accommodating space by the vibrating plate. The second adjustment unit is in the first accommodating space. The driving component is in the second accommodating space. The sound outlet channel has a sound outlet, and one end of the sound outlet channel away from the sound outlet communicates with the first accommodating space.

[0011] In some embodiments, the first adjustment unit includes a first body and a second body. The first body has a first side plate and a plurality of first spacer plates, and the plurality of first spacer plates are disposed on the first side plate at intervals. The second body is oppositely disposed on one side of the first body, wherein the second body has a second side plate and a plurality of second spacer plates. The second side plate is disposed on one side of the plurality of first spacer plates away from the first side plate. The plurality of second spacer plates are disposed on the second side plate at intervals. The plurality of second spacer plates and the plurality of first spacer plates are alternately disposed and parallel to each other.

[0012] In some embodiments, the first adjustment unit includes a first adjustment inlet and a first adjustment outlet. The first adjustment inlet and the first adjustment outlet respectively are between two adjacent ones of the plurality of first spacer plates and the plurality of second spacer plates. The first adjustment inlet is closer to the first accommodating space, and the first adjustment outlet is closer to the sound outlet.

[0013] In some embodiments, each of the plurality of first spacer plates is between two adjacent ones of the plurality of second spacer plates.

[0014] In some embodiments, the accommodating space is divided into a first accommodating space and a second accommodating space by the vibration plate. The driving component is in the second accommodating space. The case component further has a side space, and the side space communicates with the first accommodating space. The first accommodating space is between the side space and the sound outlet channel, and the second adjustment unit is in the side space.

[0015] In some embodiments, the second adjustment unit includes a third body and a fourth body. The third body has a third side plate and a plurality of third spacer plates, and the plurality of third spacer plates are disposed on the third side plate at intervals. The fourth body is oppositely disposed on one side of the fourth body, wherein the fourth body has a fourth side plate and a plurality of fourth spacer plates. The fourth side plate is disposed on one side of the plurality of third spacer plates away from the third side plate. The plurality of fourth spacer plates are disposed on the fourth side plate at intervals. The plurality of third spacer

plates and the plurality of fourth spacer plates are alternately disposed and parallel to each other.

[0016] In some embodiments, the second adjustment unit includes a second adjustment outlet and a third adjustment outlet. The second adjustment outlet and the third adjustment outlet respectively are between two adjacent ones of the fourth spacer plate and the third spacer plate, and the second adjustment outlet and the third adjustment outlet both face the first accommodating space.

[0017] In some embodiments, each of the plurality of third spacer plates is between two adjacent ones of the plurality of fourth spacer plates.

[0018] The speaker of the present disclosure improves the frequency response curve by the first adjustment unit disposed on the sound outlet channel and the second adjustment unit disposed on one side of the vibration plate. More specifically, the first adjustment unit and the second adjustment unit are respectively constituted of acoustic metamaterials, so the frequency response curve may be effectively improved without taking up too much space. In addition, the speaker's sound quality is not affected and the difficulty of speaker production does not increase by the acoustic metamaterials. As a result, the present disclosure achieves a speaker with an excellent frequency response curve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The figures described herein are used to provide a further understanding of the present disclosure and constitute a part of the present disclosure. The exemplary embodiments and descriptions of the present disclosure are used to illustrate the present disclosure and do not limit the present disclosure, in which:

[0020] FIG. **1** is a schematic diagram of a speaker according to an embodiment of the present disclosure;

[0021] FIG. **2** is an exploded view of a speaker according to an embodiment of the present disclosure;

[0022] FIG. **3** is another exploded view of a speaker according to an embodiment of the present disclosure;

[0023] FIG. **4** is a schematic diagram of a case component, a first adjustment unit, and a second adjustment unit according to an embodiment of the present disclosure;

[0024] FIG. **5** is a test result of a frequency response curve of an embodiment of the present disclosure;

[0025] FIG. **6** is a perspective view of a first adjustment unit according to an embodiment of the present disclosure;

[0026] FIG. **7** is a top view of a first adjustment unit according to an embodiment of the present disclosure;

[0027] FIG. **8** is a perspective view of a second adjustment unit according to an embodiment of the present disclosure; and

[0028] FIG. **9** is a side view of a second adjustment unit according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0029] In order to make the objectives, technical solutions, and advantages of the present disclosure clearer, the technical solutions of the present disclosure will be described clearly and completely in conjunction with specific embodiments and the figures of the present disclosure. Obviously, the described embodiments are only a part of the embodiments of the present disclosure, rather than all the embodiments. Based on the embodiments in the present disclosure, all other embodiments obtained by a person of ordinary skill in the art without creative work fall within the protection scope of this disclosure.

[0030] The following description is of the best-contemplated mode of carrying out the present disclosure. This description is made for the purpose of illustrating the general principles of the present disclosure and should not be taken in a limiting sense. The scope of the present disclosure is best determined by reference to the appended claims.

[0031] FIG. **1** to FIG. **3** are a schematic diagram, an exploded view, and another exploded view of a speaker according to an embodiment of the present disclosure, and FIG. **4** is a schematic diagram of a case component, a first adjustment unit, and a second adjustment unit according to an embodiment of the present disclosure. As shown in the figure, the speaker **1** includes a case component **10**, a vibration plate **11**, a driving component **12**, a first adjustment unit **13**, and a second adjustment unit **14**. The case component **10** has an accommodating space **100** and a sound outlet channel **101**, and the accommodating space **100** communicates with the sound outlet channel **101**. The vibration plate **11** is disposed in the accommodating space **100**. The driving component **12** is disposed in the accommodating space **100** and configured to drive the vibration plate **11** to vibrate. The first adjustment unit **13** is disposed in the sound outlet channel **101** and constituted of acoustic metamaterials. The second adjustment unit **14** is disposed on one side of the vibration plate **11** and is constituted of acoustic metamaterials.

[0032] Acoustic metamaterials are artificially fabricated composite structures. With the structure size much smaller than the wavelength of sound waves, acoustic metamaterials have many special properties that natural materials do not have. That is, acoustic metamaterial changes acoustical physical properties thereof by adjusting the size, so as not to be limited by the physical properties of the material (eg, making the refractive index of a certain space greater than 1). Specifically, acoustic metamaterials are made of solid materials with a specific shape, and the rest of the space is filled with air. FIG. **6** and FIG. **7** respectively are a perspective view and a top view of the first adjustment unit according to an embodiment of the present disclosure. As shown in FIG. **7**, the solid materials of the acoustic metamaterial have a thickness w, a unit length U_x, a unit width U_y, and an interval width d between the solid materials. Furthermore, the acoustic metamaterial also has a space length P_x and a space width P_y that may respond to the surroundings (for example, the space size where local resonance actually occurs), and the space length P_x and space width P_y are respectively greater than or equal to the unit length U_x and the unit width U_y. Furthermore, the design of the acoustic metamaterial needs to conform to the following formula:

$$d=1.7w, U_x=9w+8d=22.6w$$

$$r=P_x/P_y$$

$$U_y=U_x/r$$

$$n_{eff}*k_0*1=\pi/2$$

$$k_0=2*\pi*\mathrm{freq}_0/c_0$$

[0033] Wherein, n_{eff} is the refractive index (eg, the refractive index nair of air is 1), 1 is Px*Py, and c0 is the speed

of sound in air (343 m/s). As a result, the dimensions of the acoustic metamaterial may be calculated according to the desired physical properties (eg, a specific refractive index) when designing an acoustic metamaterial.

[0034] Based on the principles mentioned above, the present disclosure achieves the effect of improving the response frequency curve by disposing a first adjustment unit **13** and a second adjustment unit **14**. From the structure of the speaker **1**, the accommodating space **100** of the case component **10** may be divided into a first accommodating space **100***a* (or may be referred to as a front cavity) and a second accommodating space (or may be referred to as a rear cavity) by the vibration plate **11**. Wherein, the second adjustment unit **14** is in the first accommodating space **100***a*, and the driving component **12** is in the second accommodating space. In addition, the sound outlet channel **101** has a sound outlet **1010**, and one end of the sound outlet channel **101** away from the sound outlet **1010** communicates with the first accommodating space **100***a*. The first adjustment unit **13** is on one end of the sound outlet channel **101** adjacent to the sound outlet **1010**. That is, the present disclosure achieves an excellent frequency response curve by disposing the relative positions among the driving component **12**, the vibration plate **11**, the first adjustment unit **13**, and the second adjustment unit **14** as described above.

[0035] In some embodiments, the first adjustment unit **13** is configured to adjust the frequency response curve of the speaker **1** in the frequency range of 6 to 10 kHz, and the second adjustment unit **14** is configured to adjust the frequency of the speaker **1** in the frequency range of 2 to 5 kHz. frequency response curve. "Adjustment" herein may be in two cases, one is to decrease the frequency response of the frequency range, and the other is to increase the frequency response of the frequency range. It should be noted that the frequency range mentioned above is only an example. The first adjustment unit **13** and the second adjustment unit **14** of the present disclosure may also be adjusted by changing the dimensions (for example, the thickness w, the unit length U_x and the unit width U_y mentioned above. etc.) to extend the frequency range.

[0036] FIG. **5** is a test result of a frequency response curve according to an embodiment of the present disclosure. The solid line is the frequency response curve with the first adjustment unit **13** and the second adjustment unit **14**, and the dotted line is the frequency response curve without the first adjustment unit **13** and the second adjustment unit **14**. As shown in the figure, the speaker of the prior art has a sharp peak at the position in the frequency range of 2-5 kHz. In addition, the frequency response of the speaker of the prior art drops sharply at the position in the frequency range of 6-10 kHz. That is, there is a trough of the frequency response. On the other hand, after disposing the acoustic metamaterial with a specific size, the frequency response curve of the speaker is greatly optimized, thereby exhibiting a smooth curve. That is, the speaker of the present disclosure achieves excellent sound quality by disposing the adjustment unit. In order to make the present disclosure more understandable and clear, various implementation aspects of the present disclosure and the details of the components are described in detail hereinafter.

[0037] As shown in FIG. **2** and FIG. **4**, in some embodiments, the first adjustment unit **13** may be directly formed in the sound outlet channel **101** by an injection molding process. However, the present disclosure is not limited thereto. In other embodiments, the first adjustment unit **13** may also be formed by die casting, forging, or 3D printing and then be disposed in the sound outlet channel **101** by an adhesive.

[0038] In some embodiments, the solid material of the first adjustment unit **13** may include a metal, such as aluminum. In some embodiments, the solid material of the first adjustment unit **13** may include plastic, such as polycarbonate. However, the present disclosure is not limited thereto. Any material recognized by a person having ordinary skill in the art may be used in the present disclosure.

[0039] As shown in FIG. **6** and FIG. **7**, in some embodiments, the first adjustment unit **13** may include a first body **130** and a second body **131**. The first body **130** has a first side plate **1300** and a plurality of first spacer plates **1301**, and the plurality of first spacer plates **1301** are disposed on the first side plate **1300** at intervals. The second body **131** is oppositely disposed on one side of the first body **130**, wherein the second body **131** has a second side plate **1310** and a plurality of second spacer plates **1311**. The second side plate **1310** is disposed on one side of the plurality of first spacer plates **1301** away from the first side plate **1300**, and the plurality of second spacer plates **1311** are disposed on the second side plate **1310** at intervals. The plurality of second spacer plates **1311** and the plurality of first spacer plates **1301** are alternately disposed and parallel to each other.

[0040] In some embodiments, each of the plurality of first spacer plates **1301** is between two adjacent ones of the plurality of second spacer plates **1311**. That is, the two outermost spacer plates of the first adjustment unit **13** are the second spacer plates **1311**. For example, the number of the plurality of first spacer plates **1301** is four, and the number of the plurality of second spacer plates **1311** is five. However, the present disclosure is not limited thereto. In other embodiments, the number of the plurality of first spacer plates **1301** may be two, three, five, or more than five, and the number of the plurality of second spacer plates **1311** may be three, four, six, or more than six. As long as the number of the plurality of second spacer plates **1311** is more than the number of the plurality of first spacer plates **1301** by one.

[0041] It should be noted that the present disclosure is not limited to the configuration mentioned above, the configuration may be determined according to the actual situation. For example, in other embodiments, the number of the plurality of first spacer plates **1301** may be the same as the number of the plurality of second spacer plates **1311**. That is, the first adjustment unit **13** is composed of first body **130** and second body **131** symmetrical to each other, and the two outermost spacer plates of the first adjustment unit **13** respectively are the first spacer plate **1301** and the second spacer plate **1311**.

[0042] As shown in FIG. **4**, in some embodiments, the first side plate **1300** and the second side plate **1310** are placed horizontally on the sound outlet channel **101**, and the two outermost second spacer plates **1311** face the opening direction of the sound outlet channel **101**. That is, the acoustic metamaterial of the first adjustment unit **13** observed in FIG. **7** is toward the left and right side walls surrounding the sound outlet channel **101**. It should be noted that the disposing method mentioned above is only an example, and the present disclosure is not limited thereto. In other embodiments, the acoustic metamaterial of the first adjustment unit **13** observed in FIG. **7** may also face the opening direction of the sound outlet channel **101**.

[0043] In some embodiments, the first adjustment unit **13** includes a first adjustment inlet **132** and a first adjustment outlet **133**. The first adjustment inlet **132** and the first adjustment outlet **133** respectively are between adjacent first spacer plates **1301** and second spacer plates **1311**. The first adjustment inlet **132** is close to the first accommodating space **100***a*, and the first adjustment outlet **133** is close to the sound outlet **1010**. That is, the sound emitted by the vibration plate **11** enters the first adjustment unit **13** through the first adjustment inlet **132** and exits the first adjustment unit **13** through the first adjustment outlet **133** after being interfered.

[0044] As shown in FIG. **2**, in some embodiments, the second adjustment unit **14** may be directly formed on one side of the vibration plate **11** by an injection molding process. However, the present disclosure is not limited thereto. In other embodiments, the second adjustment unit **14** may also be formed by die casting, forging, or 3D printing and then be disposed on one side of the vibration plate **11** by an adhesive.

[0045] In some embodiments, the case component **10** may also have a side space **100***b*. The side space **100***b* communicates with the first accommodating space **100***a*. For example, there may be a plate with a channel between the side space **100***b* and the first accommodating space **100***a*, and the side space **100***b* communicates with the first accommodating space **100***a* via the channel. The first accommodating space **100***a* is between the side space **100***b* and the sound outlet channel **101**. For example, the side space **100***b* is at a side of the first accommodating space **100***a*, and the sound outlet channel **101** is at an opposite side of the first accommodating space **100***a*. In this case, the second adjustment unit **14** may not be disposed in the first accommodating space **100***a* but in the side space **100***b*. That is, the case component **10** may be designed with a dedicated accommodating area corresponding to the second adjustment unit **14** to better accommodate the second adjustment unit **14**. Compared with the disposing method mentioned above, the present embodiment provides an implementation aspect with the disposing position slightly offset but with the same effect. It should be noted that, in some cases, the side space **100***b* may also be regarded as a part of the first accommodating space **100***a* (because they communicate with each other). In such cases, the second adjustment unit **14** may be disposed in the side space **100***b* of the first accommodating space **100***a*. Therefore, the implementation aspects herein are only to explain the present disclosure from different aspects, not to limit the present disclosure.

[0046] In some embodiments, the solid material of the second adjustment unit **14** may include a metal, such as aluminum. In some embodiments, the solid material of the second adjustment unit **14** may include a plastic, such as polycarbonate. However, the present disclosure is not limited thereto. Any material recognized by a person having ordinary skill in the art may be used in the present disclosure.

[0047] FIG. **8** and FIG. **9** respectively are a perspective view and a side view of the second adjustment unit according to an embodiment of the present disclosure. As shown in the figure, in some embodiments, the second adjustment unit **14** includes a third body **140** and a fourth body **141**. The third body **140** has a third side plate **1400** and a plurality of third spacer plates **1401**. The plurality of third spacer plates **1401** are disposed on the third side plate **1400** at intervals. The fourth body **141** is oppositely disposed to one side of the third body **140**, wherein the fourth body **141** has a fourth side plate **1410** and a plurality of fourth spacer plates **1411**. The fourth side plate **1410** is disposed on one side of the plurality of third spacer plates **1401** away from the third side plate **1400**, and the plurality of fourth spacer plates **1411** are disposed on the fourth side plate **1410** at intervals. The plurality of third spacer plates **1401** and the plurality of fourth spacer plates **1411** are interleaved and parallel to each other.

[0048] In some embodiments, each of the plurality of third spacer plates **1401** is between two adjacent ones of the plurality of fourth spacer plates **1411**. Similar to the configuration of the first adjustment unit **13**, the two outermost spacer plates of the second adjustment unit **14** are fourth spacer plates **1411**. In some embodiments, the number of the plurality of third spacer plates **1401** is three, and the number of the plurality of fourth spacer plates **1411** is four. However, the present disclosure is not limited thereto. In other embodiments, the number of the plurality of third spacer plates **1401** may be two, four, five, or more than five, and the number of the plurality of fourth spacer plates **1411** may be three, five, six, or more than six. As long as the number of the plurality of fourth spacer plates **1411** is more than the number of the plurality of third spacer plates **1401** by one. However, the present disclosure is not limited to the configuration mentioned above, and the configuration may be determined according to actual situations. For a detailed description, please refer to the first adjustment unit **13**. The description is omitted herein.

[0049] As shown in FIG. **2** and FIG. **4**, in some embodiments, the third side plate **1400** and the fourth side plate **1410** are vertically erected on one side of the vibration plate **11**, and the third side plate **1400** and the fourth side plate **1410** face the accommodating space **100**. In addition, the plurality of third spacer plates **1401** and the plurality of fourth spacer plates **1411** are vertically erected on one side of the vibration plate **11** and face the opening direction of the sound outlet channel **101**. That is, the acoustic metamaterial of the second adjustment unit **14** observed in FIG. **8** faces the top cover **103** of the speaker **1** (as shown in FIG. **2**).

[0050] In some embodiments, the second adjustment unit **14** includes a second adjustment outlet **142** and a third adjustment outlet **143**. The second adjustment outlet **142** and the third adjustment outlet **143** respectively are between adjacent third spacer plates **1401** and fourth spacer plates **1411**. The second adjustment outlet **142** and third adjustment outlet **143** both face the first accommodating space **100***a*. That is, the sound emitted by the vibration plate **11** may enter the second adjustment unit **14** through the second adjustment outlet **142**, and exits the second adjustment unit **14** through the third adjustment outlet **143** after being interfered. Alternatively, the sound emitted by the vibration plate **11** may enter the second adjustment unit **14** through the third adjustment outlet **143**, and exits the second adjustment unit **14** through the second adjustment outlet **142** after being interfered.

[0051] As shown in FIG. **3**, in some embodiments, the driving component **12** may include a coil **120**, an upper pole piece **121**, a magnet **122**, and a lower pole piece **123**. The coil **120** is disposed on the vibration plate **11**. The upper pole piece **121** is disposed on the coil **120**. The magnet **122** is disposed on the upper pole piece **121**. The lower pole piece **123** is disposed on the magnet **122**. Wherein, the coil **120** is

configured to receive current and form a magnetic field. The formed magnetic field interacts with the upper pole piece **121**, the magnet **122**, and the lower pole piece **123** so that the coil **120** drives the vibration plate **11** located thereon to vibrate.

[0052] In some embodiments, the case component **10** may include a case **102** and a top cover **103**. The case **102** has an accommodating space **100** therein. The top cover **103** is disposed on the case **102** and covers the accommodating space **100** of the case **102** and the components located in the accommodating space **100**.

[0053] In summary, the speaker of the present disclosure improves the frequency response curve by the first adjustment unit disposed on the sound outlet channel and the second adjustment unit disposed on one side of the vibration plate. More specifically, the first adjustment unit and the second adjustment unit are respectively constituted of acoustic metamaterialss, so the frequency response curve may be effectively improved without taking up too much space. In addition, the speaker's sound quality is not affected and the difficulty of speaker production does not increase by the acoustic metamaterials. As a result, the present disclosure achieves a speaker with an excellent frequency response curve.

[0054] Although the present disclosure has been explained in relation to its preferred embodiment, it does not intend to limit the present disclosure. It will be apparent to those skilled in the art having regard to this present disclosure that other modifications of the exemplary embodiments beyond those embodiments specifically described here may be made without departing from the spirit of the invention. Accordingly, such modifications are considered within the scope of the invention as limited solely by the appended claims.

What is claimed is:

1. A speaker, comprising:

a case component having an accommodating space and a sound outlet channel, wherein the accommodating space communicates with the sound outlet channel;

a vibration plate disposed in the accommodating space;

a driving component disposed in the accommodating space, wherein the driving component is configured to drive the vibration plate to vibrate;

a first adjustment unit disposed in the sound outlet channel, wherein the first adjustment unit is constituted of acoustic metamaterials, and

a second adjustment unit disposed on one side of the vibration plate, wherein the second adjustment unit is constituted of acoustic metamaterials.

2. The speaker of claim **1**, wherein the first adjustment unit is configured to adjust a frequency response curve of the speaker in a frequency range of 6-10 kHz, and the second adjustment unit is configured to adjust the frequency response curve of the speaker in a frequency range of 2-5 kHz.

3. The speaker of claim **1**, wherein the accommodating space is divided into a first accommodating space and a second accommodating space by the vibrating plate, the second adjustment unit is in the first accommodating space, the driving component is in the second accommodating space, the sound outlet channel has a sound outlet, and one end of the sound outlet channel away from the sound outlet communicates with the first accommodating space.

4. The speaker of claim **3**, wherein the first adjustment unit comprises:

a first body, wherein the first body has a first side plate and a plurality of first spacer plates, the plurality of first spacer plates are disposed on the first side plate at intervals; and

a second body oppositely disposed on one side of the first body, wherein the second body has a second side plate and a plurality of second spacer plates, the second side plate is disposed on one side of the plurality of first spacer plates away from the first side plate, the plurality of second spacer plates are disposed on the second side plate at intervals, and the plurality of second spacer plates and the plurality of first spacer plates are alternately disposed and parallel to each other.

5. The speaker of claim **4**, wherein the first adjustment unit comprises a first adjustment inlet and a first adjustment outlet, the first adjustment inlet and the first adjustment outlet are respectively between two adjacent ones of the plurality of first spacer plates and the plurality of second spacer plates, the first adjustment inlet is closer to the first accommodating space, and the first adjustment outlet is closer to the sound outlet.

6. The speaker of claim **4**, wherein each of the plurality of first spacer plates is between two adjacent ones of the plurality of second spacer plates.

7. The speaker of claim **4**, wherein the first adjustment unit is configured to adjust a frequency response curve of the speaker in a frequency range of 6-10 kHz, and the second adjustment unit is configured to adjust the frequency response curve of the speaker in a frequency range of 2-5 kHz.

8. The speaker of claim **4**, wherein the case component further has a side space, the side space forms a part of the first accommodating space, the first accommodating space is between the side space and the sound outlet channel, and the second adjustment unit is in the side space.

9. The speaker of claim **1**, wherein the accommodating space is divided into a first accommodating space and a second accommodating space by the vibration plate, the driving component is in the second accommodating space, the case component further has a side space, the side space communicates with the first accommodating space, the first accommodating space is between the side space and the sound outlet channel, and the second adjustment unit is in the side space.

10. The speaker of claim **9**, wherein the side space is at a side of the first accommodating space, and the sound outlet channel is at an opposite side of the first accommodating space.

11. The speaker of claim **9**, wherein the second adjustment unit comprises:

a third body, wherein the third body has a third side plate and a plurality of third spacer plates, the plurality of third spacer plates are disposed on the third side plate at intervals; and

a fourth body oppositely disposed on one side of the fourth body, wherein the fourth body has a fourth side plate and a plurality of fourth spacer plates, the fourth side plate is disposed on one side of the plurality of third spacer plates away from the third side plate, the plurality of fourth spacer plates are disposed on the fourth side plate at intervals, and the plurality of third spacer plates and the plurality of fourth spacer plates are alternately disposed and parallel to each other.

12. The speaker of claim **11**, wherein the second adjustment unit comprises a second adjustment outlet and a third adjustment outlet, the second adjustment outlet and the third adjustment outlet are respectively between two adjacent ones of the plurality of fourth spacer plates and the plurality of third spacer plates, and the second adjustment outlet and the third adjustment outlet both face the first accommodating space.

13. The speaker of claim **11**, wherein each of the plurality of third spacer plates is between two adjacent ones of the plurality of fourth spacer plates.

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