(19) National Intellectual Property Administration of the People's Republic of China

(12) Utility Model Patent

(10) Authorization Announcement No.: CN 205017577 U
(45) Authorization Announcement Date: 2016.02.03

(21) Application No.: 201520812643.6

(22) Application Date: 2015.10.19

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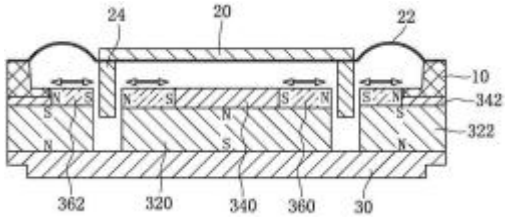
Agent: Li Najuan

(51) Int. CI.
HO4R 9/06(2006.01)
HO4R 9/02(2006.01)

Claims 1 page Description 4 page Drawings 3 pages

(54) Utility Model Title
Micro loudspeaker

(57) Abstract
The present utility model discloses a micro loudspeaker, which relates to the technical field of electroacoustic products, and comprises a housing. The housing accommodates a vibration system and a magnetic circuit system. The magnetic circuit system comprises a magnetic conductive component, on which a first magnet and a spring washer are sequentially secured. The magnetization direction of the first magnet is vertical, and an annular second magnet is also arranged on the first magnet. The second magnet and the spring washer are both secured on the surface of the first magnet that is close to the vibration system, with the magnetization direction of the second magnet being horizontal; furthermore, the magnetic pole of the second magnet located at the edge of the first magnet is the same as the magnetic pole of the first magnet on that side, while the magnetic pole of the second magnet located at the center of the first magnet is opposite to the magnetic pole of the first magnet on that side. The micro loudspeaker of the present utility model has a high magnetic flux density, a strong magnetic field force acting on a voice coil, high sensitivity, and overall good acoustic performance.



1. A micro loudspeaker, comprising a housing. The housing accommodates a vibration system and a magnetic circuit system. The magnetic circuit system comprises a magnetic conductive component, on which a first magnet and a spring washer are sequentially secured. The magnetization direction of the first magnet is vertical, characterized in that an annular second magnet is also arranged on the first magnet. The second magnet and the spring washer are both secured on the surface of the first magnet that is close to the vibration system, with the magnetization direction of the second magnet being horizontal; furthermore, the magnetic pole of the second magnet located at the edge of the first magnet is the same as the magnetic pole of the first magnet on that side, while the magnetic pole of the second magnet located at the center of the first magnet is opposite to the magnetic pole of the first magnet on that side.

2. The micro loudspeaker according to Claim 1, characterized in that the magnetic conductive component is a magnetic conductive plate, and the first magnet comprises an inner magnet secured at the center of the magnetic conductive plate and an outer magnet secured at the edge of the magnetic conductive plate. The spring washer comprises an inner spring washer secured on the inner magnet and an outer spring washer secured on the outer magnet, and a magnetic gap is provided between the inner magnet and the outer magnet.

3. The micro loudspeaker according to Claim 2, characterized in that the second magnet comprises an inner annular magnet secured on the inner magnet, with the inner annular magnet secured at the edge of the inner magnet close to the magnetic gap, and the inner spring washer located on the inner side of the inner annular magnet.

4. The micro loudspeaker according to Claim 2, characterized in that the second magnet comprises an outer annular magnet secured on the outer magnet, with the outer annular magnet secured at the edge of the outer magnet close to the magnetic gap, and the outer spring washer located on the outer side of the outer annular magnet.

5. The micro loudspeaker according to Claim 2, characterized in that the second magnet comprises an inner annular magnet secured on the inner magnet and an outer annular magnet secured on the outer magnet. The inner annular magnet is secured at the edge of the inner magnet close to the magnetic gap, with the inner spring washer located on the inner side of the inner annular magnet; the outer annular magnet is secured at the edge of the outer magnet close to the magnetic gap, with the outer spring washer located on the outer side of the outer annular magnet.

6. The micro loudspeaker according to Claim 1, characterized in that the magnetic conductive component is a frame, with the first magnet and the spring washer sequentially secured at the center of the frame, and a magnetic gap is provided between the first magnet and the side wall of the frame; the second magnet is secured at the edge of the first magnet close to the magnetic gap, with the spring washer located on the inner side of the second magnet.

7. The micro loudspeaker according to any one of Claims 1 to 6, characterized in that the magnetic circuit system has a circular structure, and the second magnet is a circular annular magnet.

8. The micro loudspeaker according to any one of Claims 1 to 6, characterized in that the magnetic circuit system has a rectangular structure, and the second magnet is a rectangular annular magnet.

Micro Loudspeaker

Technical Field

[0001] The present utility model relates to the technical field of electroacoustic products, specifically to a micro loudspeaker.

Background

[0002] The micro loudspeaker is an important acoustic component of portable electronic equipment, and is configured to convert electrical signals into sound signals, functioning as an energy conversion device. An existing micro loudspeaker comprises a vibration system and a magnetic circuit system, wherein the magnetic circuit system comprises a magnet and a magnetic gap. A voice coil in the vibration system is located within the magnetic gap. In the existing micro loudspeaker, the magnetization direction of the magnets is vertical, which is the same as the vibration direction of the voice coil. This structure results in a low magnetic flux density in the micro loudspeaker, with fewer magnetic line of force passing through the voice coil, leading to a smaller magnetic field force acting on the voice coil, resulting in low sensitivity and poor overall acoustic performance of the micro loudspeaker.

Summary of the Utility Model

[0003] Aiming at the above deficiencies, a technical problem to be solved by the present utility model is to provide a micro loudspeaker with high magnetic flux density, high sensitivity, and good overall acoustic performance.

[0004] To solve the aforementioned technical problem, the technical solution of the present utility model is:

[0005] A micro loudspeaker, comprising a housing. The housing accommodates a vibration system and a magnetic circuit system. The magnetic circuit system comprises a magnetic conductive component, on which a first magnet and a spring washer are sequentially secured. The magnetization direction of the first magnet is vertical, and an annular second magnet is also arranged on the first magnet. The second magnet and the spring washer are both secured on the surface of the first magnet that is close to the vibration system, with the magnetization direction of the second magnet being horizontal; furthermore, the magnetic pole of the second magnet located at the edge of the first magnet is the same as the magnetic pole of the first magnet on that side, while the magnetic pole of the second magnet located at the center of the first magnet is opposite to the magnetic pole of the first magnet on that side.

[0006] As an embodiment, the magnetic conductive component is a magnetic conductive plate, and the first magnet comprises an inner magnet secured at the center of the magnetic conductive plate and an outer magnet secured at the edge of the magnetic conductive plate. The spring washer comprises an inner spring washer secured on the inner magnet and an outer spring washer secured on the outer magnet, and a magnetic gap is provided between the inner magnet and the outer magnet.

[0007] Wherein, the second magnet comprises an inner annular magnet secured on the inner magnet, with the inner annular magnet secured at the edge of the inner magnet close to the magnetic gap, and the inner spring washer located on the inner side of the inner annular magnet.

[0008] Wherein, the second magnet comprises an outer annular magnet secured on the outer magnet, with the outer annular magnet secured at the edge of the outer magnet close to the magnetic gap, and the outer spring washer located on the outer side of the outer annular magnet.

[0009] Wherein, the second magnet comprises an inner annular magnet secured on the inner magnet and an outer annular magnet secured on the outer magnet. The inner annular magnet is secured at the edge of the inner magnet close to the magnetic gap, with the inner spring washer located on the inner side of the inner

annular magnet; the outer annular magnet is secured at the edge of the outer magnet close to the magnetic gap, with the outer spring washer located on the outer side of the outer annular magnet.

[0010] As another embodiment, the magnetic conductive component is a frame, with the first magnet and the spring washer sequentially secured at the center of the frame, and a magnetic gap is provided between the first magnet and the side wall of the frame; the second magnet is secured at the edge of the first magnet close to the magnetic gap, with the spring washer located on the inner side of the second magnet

[0011] Wherein, the magnetic circuit system has a circular structure, and the second magnet is a circular annular magnet.

[0012] Wherein, the magnetic circuit system has a rectangular structure, and the second magnet is a rectangular annular magnet.

[0013] After the aforementioned technical solution is adopted, the beneficial effects of the present utility model are as follows:

[0014] The magnetic circuit system of the micro loudspeaker in the present utility model comprises a magnetic conductive component, on which a first magnet and a spring washer are sequentially secured. The magnetization direction of the first magnet is vertical, and an annular second magnet is also provided on the first magnet. The second magnet and the spring washer are both secured on the surface of the first magnet that is close to the vibration system, with the magnetization direction of the second magnet being horizontal. Furthermore, the magnetic pole of the second magnet located at the edge of the first magnet is the same as the magnetic pole of the first magnet on that side, while the magnetic pole of the second magnet located at the center of the first magnet is opposite to the magnetic pole of the first magnet on that side. The magnetization direction of the second magnet is perpendicular to the magnetization direction of the first magnet. After the magnetic field of the second magnet is superimposed with the magnetic field of the first magnet and passes through the magnetic gap, the magnetic flux density in the magnetic gap area is greatly increased, resulting in an increased number of magnetic lines of force passing through the voice coil, as shown in FIG. 3. This enhances the magnetic field force acting on the voice coil, improves the sensitivity of the micro loudspeaker, and consequently enhances the overall acoustic performance of the micro loudspeaker.

[0015] In summary, the micro loudspeaker of the present utility model addresses technical problems such as low magnetic flux density in the existing micro loudspeaker. The micro loudspeaker of the present utility model has a high magnetic flux density, a strong magnetic field force acting on a voice coil, high sensitivity, and overall good acoustic performance.

Brief Description of the Drawings

[0016] FIG. 1 is a schematic diagram of the section structure of Embodiment 1 of the micro loudspeaker of the present utility model;

[0017] FIG. 2 is a schematic diagram of the internal structure of the Embodiment 1 of the micro loudspeaker of the present utility model - excluding the vibration system;

[0018] FIG. 3 is an imitated diagram of the magnetic line of force distribution of the micro loudspeaker of the present utility model;

[0019] FIG. 4 is a schematic diagram of the internal structure of the Embodiment 2 of the micro loudspeaker of the present utility model - excluding the vibration system;

[0020] FIG. 5 is a schematic diagram of the internal structure of the Embodiment 3 of the micro loudspeaker of the present utility model - excluding the vibration system;

[0021] FIG. 6 is a schematic diagram of the internal structure of the Embodiment 4 of the micro loudspeaker of the present utility model - excluding the vibration system;

[0022] In the figures: 10. Housing; 20. Dome; 22. Vibrating diaphragm; 24. Voice coil; 30. Magnetic conductive plate; 320. Inner magnet; 322. Outer magnet; 340. Inner spring washer; 342. Outer spring washer; 360. Inner annular magnet; 362. Outer annular magnet.

Detailed Description of the Embodiments

[0023] A more detailed illustration of the present utility model is provided as below in conjunction with the accompanying drawings and embodiments.

[0024] In the Description, the term “inner side” refers to the side closer to the center of the micro loudspeaker, while term “outer side” refers to the side farther away from the center of the micro loudspeaker. The term “upper direction” refers to the direction where the vibration system is located, while the term “lower direction” refers to the direction where the magnetic circuit system is located.

[0025] Embodiment 1:

[0026] As shown in FIG. 1 and FIG. 2 together, a micro loudspeaker, comprising a housing 10. The housing 10 accommodates a vibration system and a magnetic circuit system. The magnetic circuit system has a circular structure. The magnetic circuit system comprises a magnetic conductive component, which in the embodiment is a magnetic conductive plate 30. A first magnet and a spring washer are sequentially secured on the magnetic conductive plate 30, with the magnetization direction of the first magnet being vertical. The first magnet comprises an inner magnet 320 secured at the center of the magnetic conductive plate 30 and an outer magnet 322 secured at the edge of the magnetic conductive plate 30. The spring washer comprises an inner spring washer 340 secured on the inner magnet 320 and an outer spring washer 342 secured on the outer magnet 322. The inner magnet 320 and the inner spring washer 340 form the inner magnetic circuit of the magnetic circuit system, while the outer magnet 322 and the outer spring washer 342 form the outer magnetic circuit of the magnetic circuit system. There is a magnetic gap between the inner magnetic circuit and outer magnetic circuit, and the end of the voice coil 24 of the vibration system is located within the magnetic gap.

[0027] As shown in FIG. 1 and FIG. 2 together, a circular annular second magnet is also secured on the first magnet, and both the second magnet and the spring washer are secured on the surface of the first magnet that is close to the vibration system. The magnetization direction of the second magnet is horizontal, meaning that the magnetization direction of the second magnet is perpendicular to the magnetization direction of the first magnet. The second magnet comprises an inner annular magnet 360 secured on the inner magnet 320, as well as an outer annular magnet 362 secured on the outer magnet 322. The inner annular magnet 360 is secured at the edge of the inner magnet 320 that is close to the magnetic gap, with the inner spring washer 340 located on the inner side of the inner annular magnet 360. The outer annular magnet 362 is secured at the edge of the outer magnet 322 that is close to the magnetic gap, with the outer spring washer 342 surrounding the outer side of the outer annular magnet 362.

[0028] The magnetic pole of the second magnet located at the edge of the first magnet is the same as the magnetic pole of the first magnet on that side, while the magnetic pole of the second magnet located at the center of the first magnet is opposite to the magnetic pole of the first magnet on that side. As shown in FIG. 1: if the magnetic pole of the inner magnet 320 has the S pole on the lower side and the N pole on the upper side, the outer side of the inner annular magnet 360 (i.e., the side located at the edge of the inner magnet 320) has the N pole, and the inner side (i.e., the side located at the center of the inner magnet 320 and connected to the inner spring washer 340) has the S pole. If the magnetic pole of the outer magnet 322 has the N pole on the lower side and the S pole on the upper side, the outer side of the outer annular magnet 362 (i.e., the side located at the center of the outer magnet 322 and connected to the outer spring washer 342) has the N pole, and the inner side (i.e., the side located at the edge of the outer magnet 322) has the S pole. At this point, the magnetic field of the first magnet and the magnetic field of the second magnet will be

superimposed and be directed to the position of the magnetic gap. As shown in FIG. 3, this increases the magnetic flux density at the magnetic gap, significantly increasing the number of magnetic lines of force passing through the voice coil 24.

[0029] As shown in FIG. 1, the vibration system comprises a vibrating diaphragm 22, of which the edge is secured to the end face of the housing 10. The voice coil 24 is secured on the side of the vibrating diaphragm 22 that is close to the magnetic circuit system, while the center of the opposite side of the vibrating diaphragm 22 is secured with a dome 20. The voice coil 24 is subjected to the force of the magnetic field, causing it to move up and down in a reciprocating motion according to the magnitude and direction of the alternating current passing through its winding. The vibrating diaphragm 22 and the dome 20 vibrate along with the up and down movement of the voice coil 24, enabling the air to produce sound, thus completing the energy conversion between electrical signal and sound signal.

[0030] Embodiment 2:

[0031] The embodiment is basically the same as Embodiment 1, with the following differences:

[0032] As shown in FIG. 4, the second magnet only comprises the outer annular magnet 362 secured to the outer magnet. The outer annular magnet 362 is secured at the edge of the outer magnet that is close to the magnetic gap, with the outer spring washer 342 surrounding the outer side of the outer annular magnet 362.

[0033] Embodiment 3:

[0034] The embodiment is basically the same as Embodiment 1, with the following differences:

[0035] As shown in FIG. 5, the second magnet only comprises the inner annular magnet 360 secured to the inner magnet. The inner annular magnet 360 is secured at the edge of the inner magnet that is close to the magnetic gap, with the inner spring washer 340 located on the inner side of the inner annular magnet 360.

[0036] Embodiment 4:

[0037] The embodiment is basically the same as Embodiment 1, Embodiment 2 and Embodiment 3, with the following differences:

[0038] As shown in FIG. 6, the magnetic circuit system has a rectangular structure, and the second magnet has a rectangular annular magnet. FIG. 6 only illustrates the structure that is the same as Embodiment 3 in the embodiment. The structures that are the same as Embodiment 1 and Embodiment 2 can be easily drawn by a person skilled in the art based on FIG. 2, FIG. 4, and FIG. 6. Therefore, the structures in the embodiment that are the same as Embodiment 1 and Embodiment 2 are not separately illustrated to save space in the Description and the accompanying drawings.

[0039] Embodiment 5:

[0040] The embodiment is basically the same as Embodiment 1, Embodiment 2, Embodiment 3 and Embodiment 4, with the following differences:

[0041] The magnetic conductive component is a frame, with the first magnet and spring washer secured sequentially at the center of the frame, and a magnetic gap is established between the first magnet and the side wall of the frame. The second magnet is secured at the edge of the first magnet that is close to the magnetic gap, while the spring washer is located on the inner side of the second magnet.

[0042] The present utility model, by adding a horizontally magnetized annular magnet to the original magnets, changes the direction of the original magnetic field and effectively increases the density of the magnetic flux at the magnetic gap and the number of magnetic lines of force passing through the voice coil, thereby improving the sensitivity of the micro loudspeaker and enhancing the overall acoustic performance.

[0043] In the Description, the concerned naming of the first magnet and the second magnet is only for distinguishing technical features, not for representing the location relationship or assembly sequence between the first magnet and the second magnet.

[0044] The present utility model is not limited to the above detailed description of the embodiments. Any variations made by a person of ordinary skill in the art, based on the aforementioned ideas and without creative effort, shall be considered as the protection scope of the present utility model.

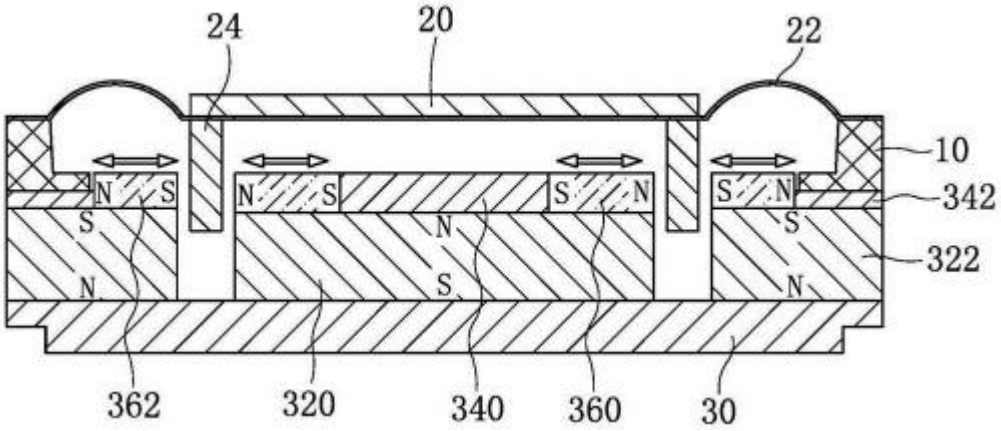


FIG. 1

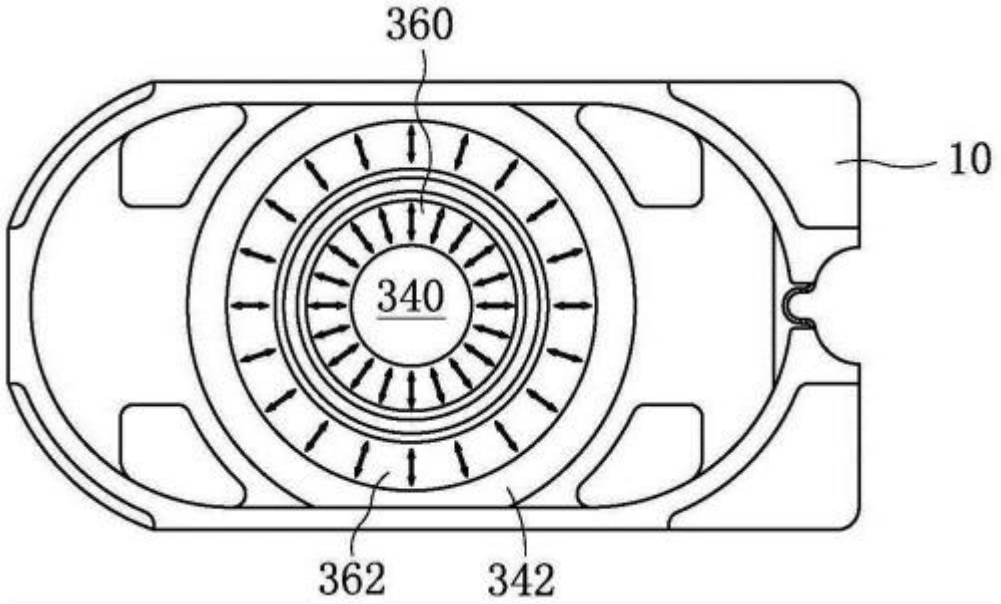


FIG. 2

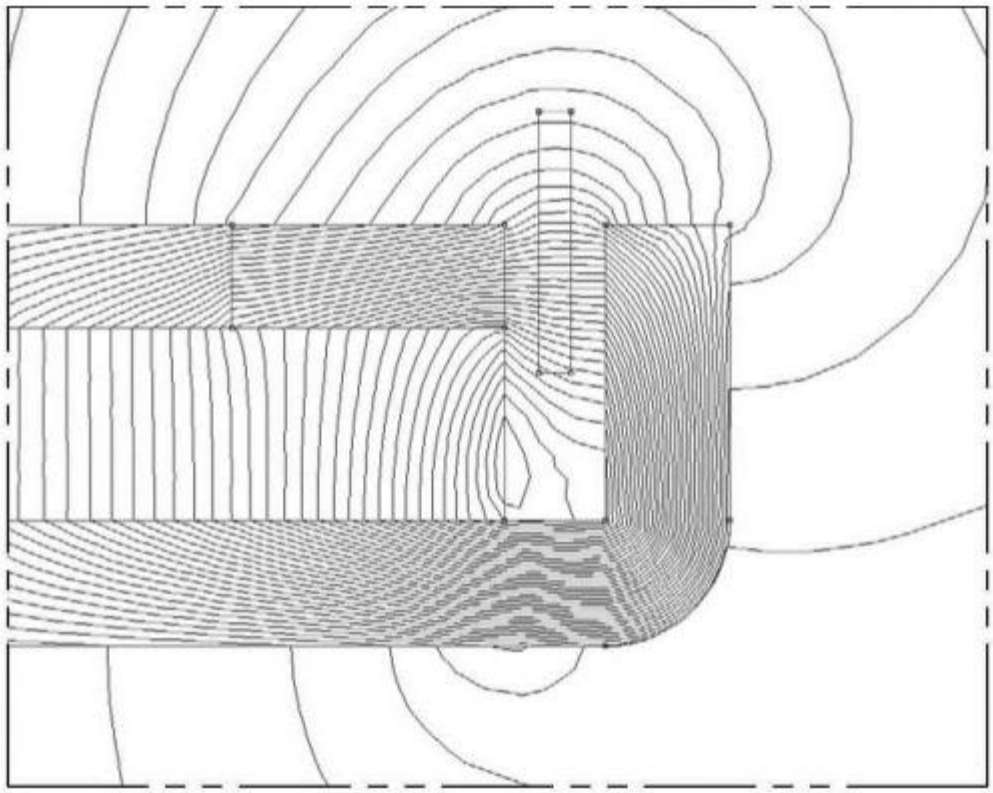


FIG. 3

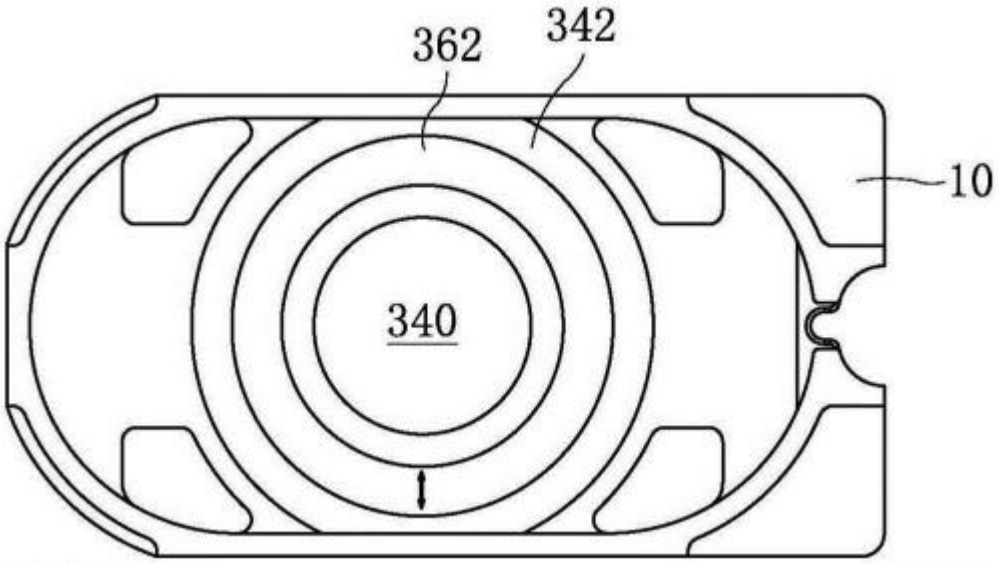


FIG. 4

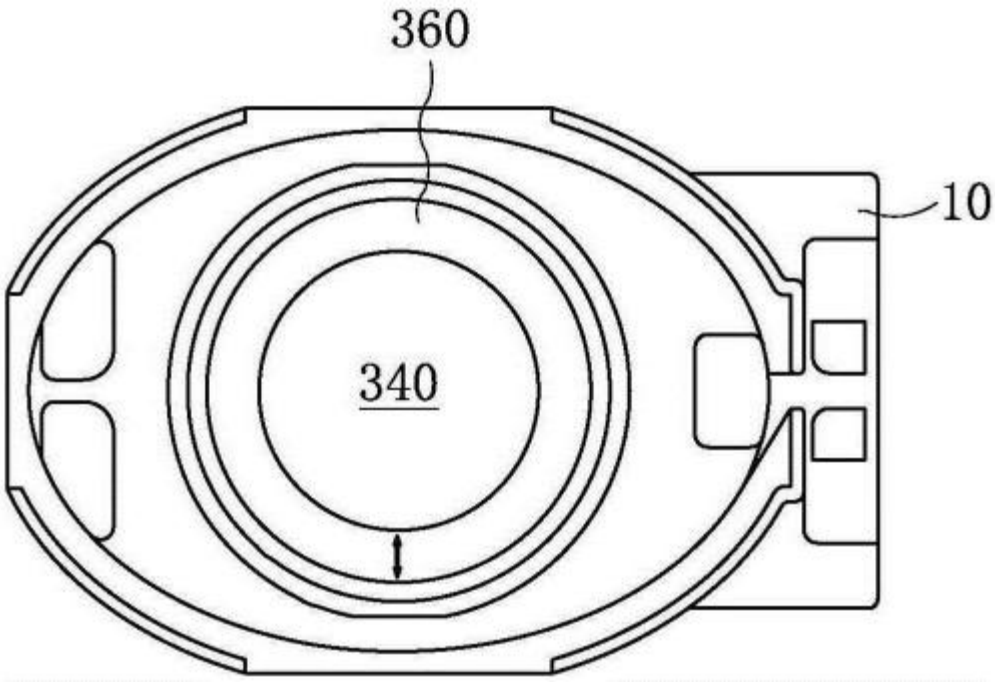


FIG. 5

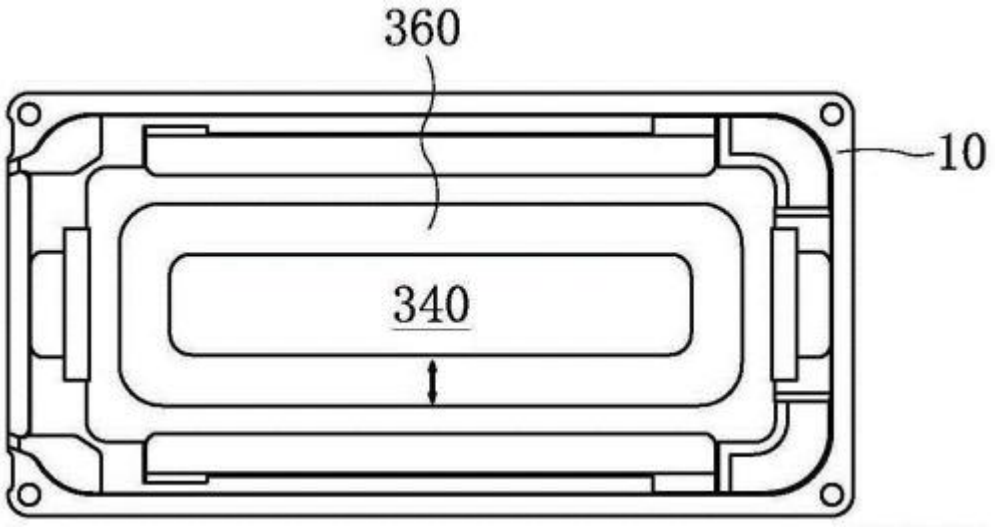


FIG. 6

TRANSLATION CERTIFICATION

Date: 2025/01/26

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