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(54) **ANTI-COUPLING SOUND STRUCTURE FOR REFRIGERATOR AND REFRIGERATOR**

(57) An anti-coupling sound structure (100) for a refrigerator and a refrigerator. Said anti-coupling sound structure (100) comprises: a mounting panel (1) for connecting to a refrigerator door body (4) or a refrigerator body (5), the mounting panel (1) being provided with several through holes (11); and a sound body (2) provided on one side of the back face of the mounting panel (1) and separated, by a gap (6), from the back face of the mounting plate (1), the gap (6) being provided therein with an enclosing portion (3). Said anti-coupling sound structure (100) separates the sound body (2) and the mounting panel (1) from each other, such that the refrigerator is less prone to electrostatic coupling in an electromagnetic compatibility experiment, helping to ensure experiment precision and avoiding the impact on sound quality due to the resonance of the sound body (2) in use with the mounting panel (1); moreover, the sound-converging effect of the enclosing portion (3) can improve the directivity of the sound generated by the sound body (2), achieving a better listening effect.

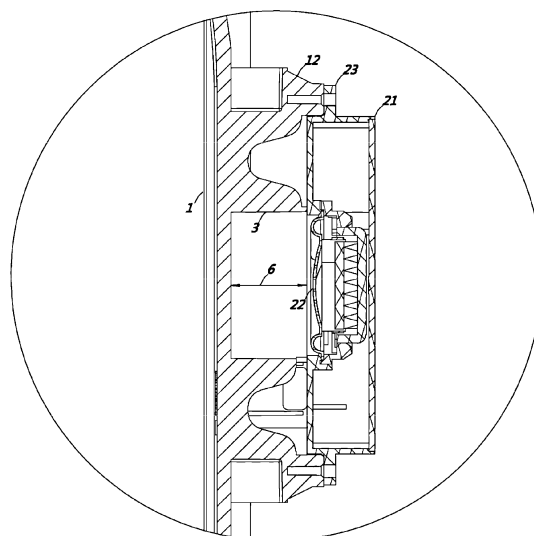


Fig. 6

Description

Technical Field

[0001] The present invention relates to refrigerator manufacturing technology, and in particular to an anti-coupling sound structure for a refrigerator and a corresponding refrigerator.

Background of the Invention

[0002] As a container that keeps food cold at a constant low temperature, the refrigerator has become one of the essential household appliances in modern homes. With the rapid development of informatization, users are increasingly demanding the intelligentization of refrigerators.

[0003] One of the most important functions of an intelligent refrigerator is that it can perform human-computer interaction. Playing the voice with a sound structure set in the refrigerator is an important means of human-computer interaction.

[0004] The sound structure of the existing refrigerator includes a mounting panel and a sound body, the sound body being closely attached to a back face of the mounting panel and being fixedly connected by a buckle.

[0005] An electromagnetic compatibility experiment (EMC experiment) is an experiment in which various electrical equipments (also including organisms in a broad sense) can coexist under limited space, time, and spectral resources without causing degradation. It includes two parts: an electromagnetic interference test and an electromagnetic sensitivity test. The electromagnetic interference test is to test the strength of a piece of equipment under test against surrounding electronic equipments by measuring the size of an electromagnetic wave signal generated by the equipment under test in normal working conditions and emitted outward. The electromagnetic sensitivity test is to measure the anti-interference ability of the equipment under test against electromagnetic disturbance.

[0006] When an electromagnetic compatibility experiment is carried out on the refrigerator, it is necessary to apply static electricity from the surface of the mounting panel to the sound structure. Since the sound body in the existing sound structure directly contacts the back face of the mounting panel, the sound body is so close to the surface of the mounting panel that electrostatic coupling is likely to occur, thereby affecting the experiment precision and being not conducive to product testing.

[0007] At the same time, the sound body directly contacts the mounting panel, and the sound body easily resonates with the mounting panel during use, affecting the sound quality.

[0008] In addition, since the sound structure of the existing refrigerator does not have a sound-converging structure, the sound emitted by the sound body is rela-

tively divergent, and it is difficult to obtain a good listening effect.

Summary of the Invention

[0009] An object of the present invention is to provide an anti-coupling sound structure for a refrigerator and a corresponding refrigerator, so as to overcome at least one defect in the prior art.

[0010] In one aspect, the present invention provides an anti-coupling sound structure for a refrigerator, comprising: a mounting panel for connecting to a refrigerator door body or a refrigerator body, the mounting panel being provided with several through holes; and a sound body being provided on one side of a back face of the mounting panel and the sound body being separated, by a gap, from the back face of the mounting panel.

[0011] Optionally, the anti-coupling sound structure further comprises a cylindrical enclosing portion with two open ends and provided between the sound body and the mounting panel to improve the directivity of the sound generated by the sound body.

[0012] Optionally, the through holes are provided at least in the area where the mounting panel is located in the enclosing portion.

[0013] Optionally, the enclosing portion extends from the back face of the mounting panel to come in contact with a front face of the sound body.

[0014] Optionally, the sound body comprises a connector plate and a loudspeaker, the loudspeaker being fixed to the connector plate, and the connector plate being detachably and fixedly connected to the mounting panel.

[0015] Optionally, the loudspeaker is aligned with an end opening of the enclosing portion.

[0016] Optionally, the inner diameter of the end opening on the side of the enclosing portion close to the loudspeaker is greater than or equal to the outer diameter of the loudspeaker.

[0017] Optionally, an outer edge of the connector plate is provided with a retaining ring, the back face of the mounting panel is provided with a raised column, the raised column is provided with a screw hole, and the connector plate is connected to the mounting panel with the cooperation of a bolt passing through the retaining ring and the screw hole.

[0018] Optionally, the gap is 7-10 millimetres.

[0019] Optionally, the mounting panel is embedded on the refrigerator door body or the refrigerator body, and the surface of a front face of the mounting panel is on the same plane as an outer surface of the refrigerator door body or the refrigerator body.

[0020] In another aspect, the present invention provides a refrigerator body, which comprises a door body, a refrigerator body and an anti-coupling sound structure according to the present invention, the mounting panel of the anti-coupling sound structure being connected to the refrigerator door body or the refrigerator body.

[0021] In the anti-coupling sound structure of the present invention, the sound body and the mounting panel are separated from each other, such that the refrigerator is less prone to electrostatic coupling in an electromagnetic compatibility experiment, helping to ensure experiment precision and also avoiding the impact on sound quality due to the resonance of the sound body in use with the mounting panel; moreover, the sound-converging effect of the enclosing portion can improve the directivity of the sound generated by the sound body, achieving a better listening effect.

[0022] According to the detailed description of particular embodiments of the present invention below in conjunction with the accompanying drawings, the above and other objects, advantages and features of the present invention will become more apparent to a person skilled in the art.

Brief Description of the Drawings

[0023] Some of particular embodiments of the present invention will be described below in detail in an exemplary but not limiting way with reference to the accompanying drawings. The same reference signs indicate the same or similar components or parts in the accompanying drawings. It is understood by a person skilled in the art that the accompanying drawings are not necessarily drawn to scale. In the accompanying drawings:

Fig. 1 is a structural schematic diagram of a refrigerator mounted with an anti-coupling sound structure for a refrigerator provided by the present invention;
 Fig. 2 is a structural schematic diagram of a front face of the anti-coupling sound structure for a refrigerator provided by the present invention;
 Fig. 3 is a structural schematic diagram of a back face of the anti-coupling sound structure for a refrigerator provided by the present invention;
 Fig. 4 is a structural schematic diagram of a side face of the anti-coupling sound structure for a refrigerator provided by the present invention;
 Fig. 5 is a sectional structural schematic diagram taken along line A-A of Fig. 3; and
 Fig. 6 is a partially enlarged schematic diagram at portion A of Fig. 5.

Detailed Description of the Invention

[0024] The present invention is described in detail below in conjunction with the particular embodiments shown in the accompanying drawings. However, these embodiments are not intended to limit the present invention, and the structures, methods, or functional changes made by those skilled in the art in accordance with the embodiments are included within the scope of the present invention.

[0025] It should be noted that the orientations described herein are all referenced to the state in which a

sound structure is normally installed in a refrigerator. For example, a front face of a mounting panel is the side surface of the mounting panel facing the exterior of the refrigerator, and a back face of the mounting panel is the side surface of the mounting panel facing the interior of the refrigerator.

[0026] With reference to Figs. 1-6, an anti-coupling sound structure 100 for a refrigerator according to some embodiments of the present invention can comprise: a mounting panel 1 for connecting to a refrigerator door body 4 or a refrigerator body 5, the mounting panel 1 being provided with several through holes 11; and a sound body 2 provided on one side of a back face of the mounting panel 1 and separated, by a gap 6, from the back face of the mounting panel 1.

[0027] The through holes 11 are used to increase the permeability between the sound body 2 and the external environment, facilitating the external transmission of sound. In some embodiments of the present invention, preferably holes (generally small holes) are provided through the front and back faces of the mounting panel 1.

[0028] The sound body 2 and the mounting panel 1 are separated from each other. Since the sound body 2 and the mounting panel 1 have a safe distance therebetween, and when an electromagnetic compatibility experiment is performed in the refrigerator and static electricity is applied to the front face of the mounting panel 1, the sound body 2 is less likely to suffer electrostatic coupling, which is beneficial to ensure the experiment precision of the electromagnetic compatibility experiment.

[0029] At the same time, since the sound body 2 is accompanied by vibration during use, providing close to the mounting panel 1 is easy to resonate with the mounting panel 1, thus affecting the sound quality; and the separation of the sound body 2 and the mounting panel 1 is beneficial to suppressing resonance generation, and the sound quality of the sound structure can be improved.

[0030] With reference to Fig. 1, in the present embodiment, the sound structure is provided on a side face of the refrigerator door body 4, and the height of the sound structure is substantially equal to the head position of an adult when in a standing state. Thus, the sound body 2 can be closer to a user's ear in most usage scenarios, which is beneficial to achieving a better listening effect.

[0031] In some further embodiments of the present invention, with reference to Figs. 5 and 6, the anti-coupling sound structure 100 for the refrigerator further comprises a cylindrical enclosing portion 3 with two open ends and provided between the sound body 2 and the mounting panel 1 to improve the directivity of the sound generated by the sound body 2.

[0032] The sound body 2 for a refrigerator is usually powered by a small built-in battery with low speaker power. In addition, sound waves emitted by the sound body 2 are scattered and spread around, and the direction of some of the sound waves is deviated from the user's orientation (the user's orientation refers to the height orientation where the user may be when the refrigerator is

normally used). For example, the sound waves transmitted upward must be reflected several times through the wall before they enter the human ear, rendering severe attenuation, and directly affecting the user's listening effect.

[0033] After the enclosing portion 3 is provided, the sound waves emitted by the sound body 2 are reflected and converged by an inner wall of the enclosing portion 3, and then transmitted outward through the through holes 11 in the mounting panel 1, so that the sound waves are concentrated in the user's orientation, which is beneficial to improving the user's listening effect.

[0034] With reference to Fig. 2, in some further embodiments of the present invention, the through holes 11 are arranged in an array in the mounting panel 1 and cover most of the area of the mounting panel 1. Due to the converging effect of the enclosing portion 3, most of the sound waves are concentrated in the range of the enclosing portion 3. In other embodiments of the present invention, the through holes 11 may also be provided only in the area within the enclosing portion 3 of the mounting panel 1.

[0035] In some further embodiments of the present invention, the enclosing portion 3 extends from the back face of the mounting panel 1 to come in contact with a front face of the sound body 2; the enclosing portion 3 extends from the back face of the mounting panel 1, i.e. forming an integral structure with the mounting panel 1, which can facilitate the injection moulding of the enclosing portion 3 and the mounting panel 1; and the enclosing portion 3 is in contact with the sound body 2, and the two are closely combined to form a sound-converging structure of a one-sided opening (the through holes 11 in the mounting panel 1), which can prevent the sound waves from leaking from a fitting slot of the enclosing portion 3 and the sound body 2. Of course, it is not excluded that the enclosing portion 3 and the mounting panel 1 may also use a separate structure in other embodiments of the present invention.

[0036] In some further embodiments of the present invention, the sound body 2 comprises a connector plate 21 and a loudspeaker 22, the loudspeaker 22 being fixed to the connector plate 21, and the connector plate 21 being detachably and fixedly connected to the mounting panel 1. In some further embodiments of the present invention, the loudspeaker 22 is aligned with an end opening of the enclosing portion 3. In some further embodiments of the present invention, the inner diameter of the end opening on the side of the enclosing portion 3 close to the loudspeaker 22 is equal to the outer diameter of the loudspeaker 22. In some other further embodiments of the present invention, the inner diameter of the end opening on the side of the enclosing portion 3 close to the loudspeaker 22 can also be greater than the outer diameter of the loudspeaker 22, as long as the size of the end opening of the enclosing portion 3 may cover the loudspeaker 22.

[0037] In some further embodiments of the present in-

vention, an outer edge of the connector plate 21 is provided with a retaining ring 23, the back face of the mounting panel 1 is provided with a raised column 12, the raised column 12 is provided with a screw hole, and the connector plate 21 is connected to the mounting panel 1 with the cooperation of a bolt passing through the retaining ring 23 and the screw hole. Compared with the existing buckle connection method, the above-mentioned connection method of the cooperation of the buckle, the bolt and the screw hole is more stable and reliable, and the sound body 2 is not displaced due to the vibration of same during broadcasting. The screw hole is provided in the raised column 12, and the sound body 2 can be supported by the raised column 12 to separate the sound body 2 from the mounting panel 1, naturally forming the gap 6.

[0038] Moreover, the distance of the gap 6 is too small to prevent electrostatic coupling. If the distance is too large, the overall thickness of the sound structure is increased, and more space for an insulation layer of the refrigerator is occupied during installation, which affects the thermal insulation performance of the refrigerator. The gap 6 is preferably 7-10 millimetres.

[0039] In order to make the appearance of the refrigerator more artistic, and also to facilitate installation and processing, the mounting panel 1 is embedded on the refrigerator door body 4 or the refrigerator body 5, and the surface of a front face of the mounting panel is on the same plane as an outer surface of the refrigerator door body 4 or the refrigerator body 5.

[0040] According to some embodiments of another aspect of the present invention, also provided is a refrigerator (shown in Fig. 1) comprising a door body 4, a refrigerator body 5 and an anti-coupling sound structure 100 according to any of the embodiments of the present invention. The mounting panel 1 of the anti-coupling sound structure 100 is connected to the refrigerator door body 4 or the refrigerator body 5. Preferably, as previously mentioned, the mounting panel 1 can be embedded on the refrigerator door body 4 or the refrigerator body 5, and the surface of a front face of the mounting panel is on the same plane as an outer surface of the refrigerator door body 4 or the refrigerator body 5.

[0041] In the present invention, the sound body and the mounting panel are separated from each other, such that the refrigerator is less prone to electrostatic coupling in an electromagnetic compatibility experiment, helping to ensure experiment precision and also avoiding the impact on sound quality due to the resonance of the sound body in use with the mounting panel; moreover, the sound-converging effect of the enclosing portion can improve the directivity of the sound generated by the sound body, achieving a better listening effect.

[0042] Up to this, a person skilled in the art should recognize that although a plurality of exemplary embodiments of the present invention have been shown and described in detail herein, numerous other variations or modifications meeting the principle of the present invention can be directly determined or derived according to

the contents disclosed in the present invention. Therefore, the scope of the present invention should be construed and considered as covering all of such other variations or modifications.

Claims

1. An anti-coupling sound structure for a refrigerator, comprising:

a mounting panel for connecting to a refrigerator door body or a refrigerator body, the mounting panel being provided with several through holes; and
a sound body provided on one side of a back face of the mounting panel and separated, by a gap, from the back face of the mounting panel.

2. The anti-coupling sound structure according to claim 1, further comprising:

a cylindrical enclosing portion with two open ends and provided between the sound body and the mounting panel to improve the directivity of a sound generated by the sound body.

3. The anti-coupling sound structure according to claim 2, wherein
the through holes are provided at least in the area where the mounting panel is located in the enclosing portion.

4. The anti-coupling sound structure according to claim 2, wherein
the enclosing portion extends from the back face of the mounting panel to come in contact with a front face of the sound body.

5. The anti-coupling sound structure according to claim 2, wherein
the sound body comprises a connector plate and a loudspeaker, the loudspeaker being fixed to the connector plate, and the connector plate being detachably and fixedly connected to the mounting panel.

6. The anti-coupling sound structure according to claim 5, wherein
the loudspeaker is aligned with an end opening of the enclosing portion.

7. The anti-coupling sound structure according to claim 5, wherein
the inner diameter of the end opening on the side of the enclosing portion close to the loudspeaker is greater than or equal to the outer diameter of the loudspeaker.

8. The anti-coupling sound structure according to claim

5, wherein

an outer edge of the connector plate is provided with a retaining ring, the back face of the mounting panel is provided with a raised column, the raised column is provided with a screw hole, and the connector plate is connected to the mounting panel with the cooperation of a bolt passing through the retaining ring and the screw hole.

9. The anti-coupling sound structure according to claim 1, wherein
the gap is 7-10 millimetres.

10. The anti-coupling sound structure according to claim 1, wherein
the mounting panel is embedded on the refrigerator door body or the refrigerator body, and the surface of a front face of the mounting panel is on the same plane as an outer surface of the refrigerator door body or the refrigerator body.

11. A refrigerator body, comprising a door body, a refrigerator body and an anti-coupling sound structure according to claim 1, the mounting panel of the anti-coupling sound structure being connected to the refrigerator door body or the refrigerator body.

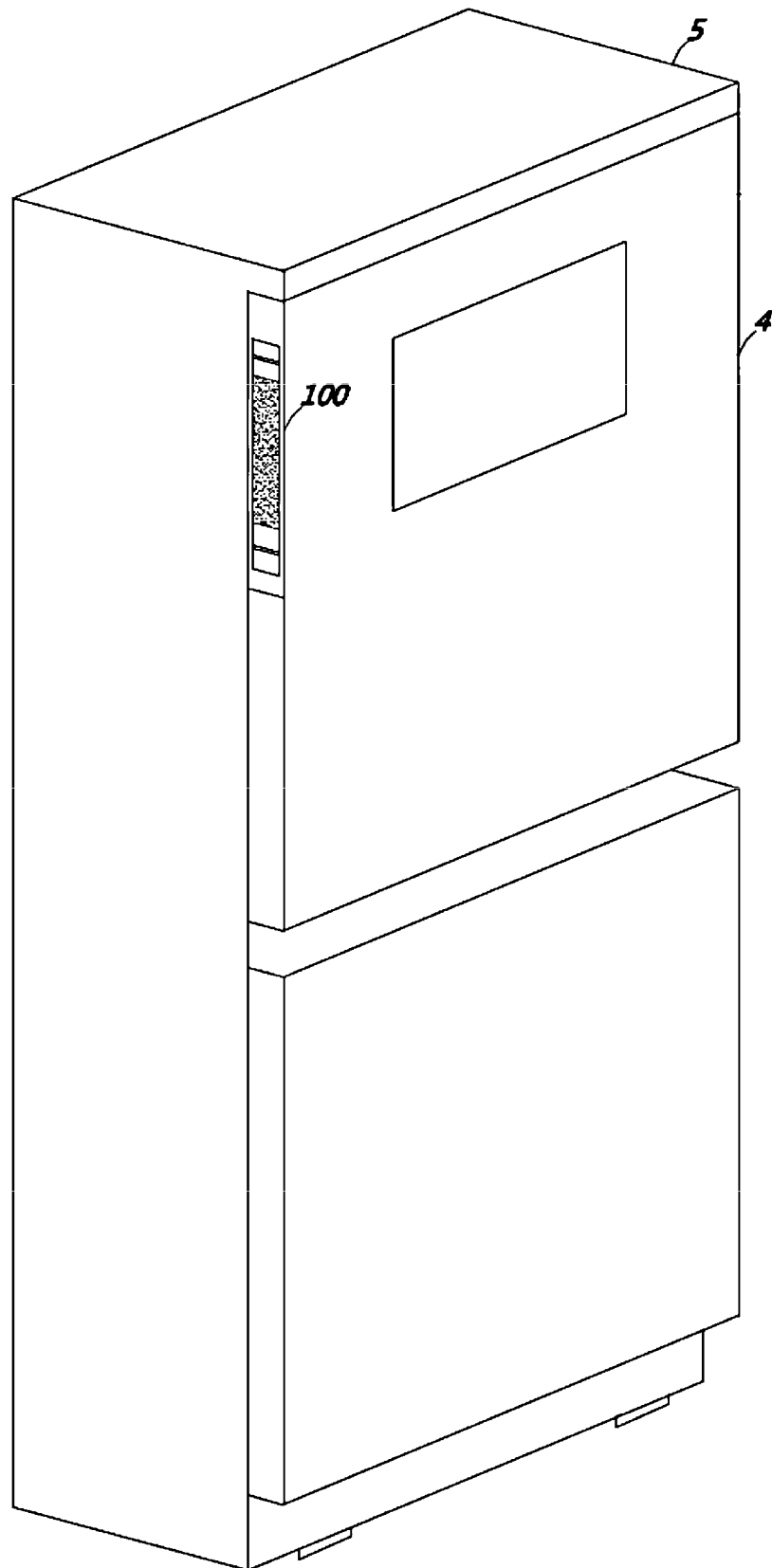


Fig. 1

100

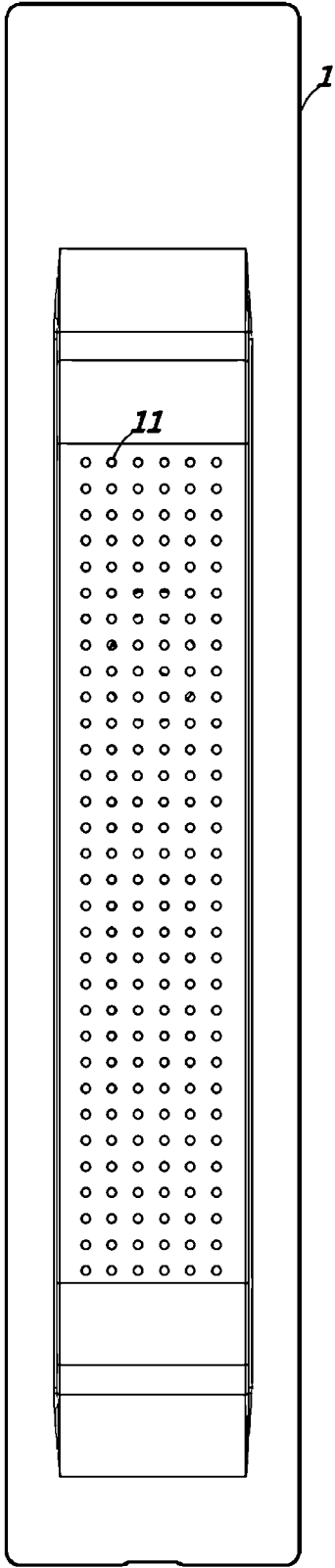


Fig. 2

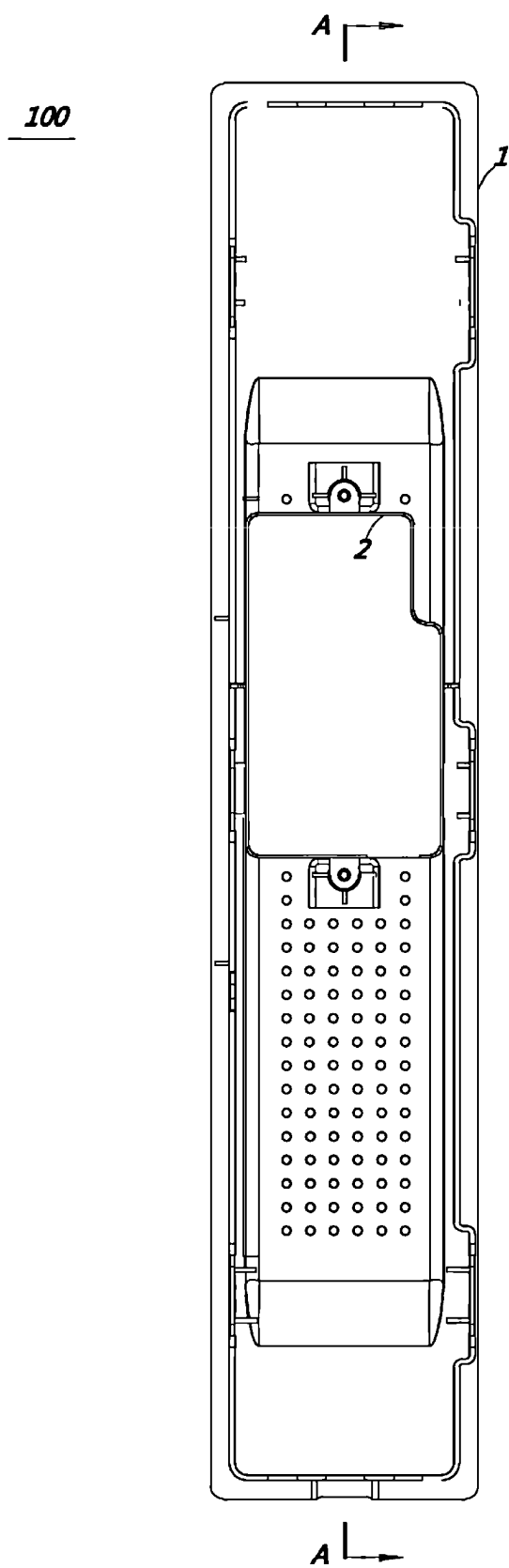


Fig. 3

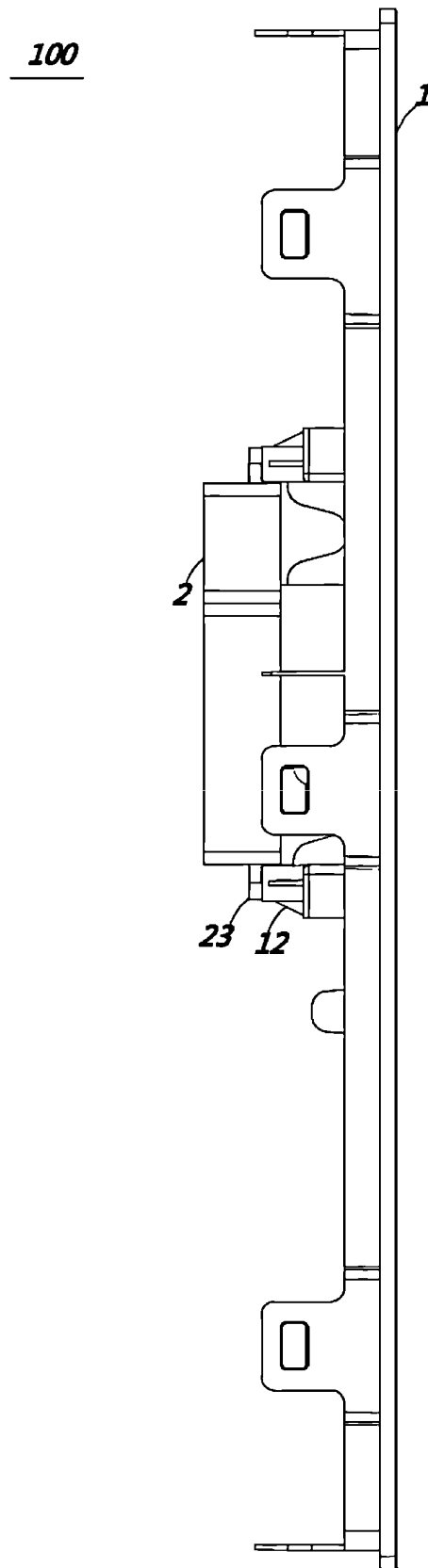


Fig. 4

100

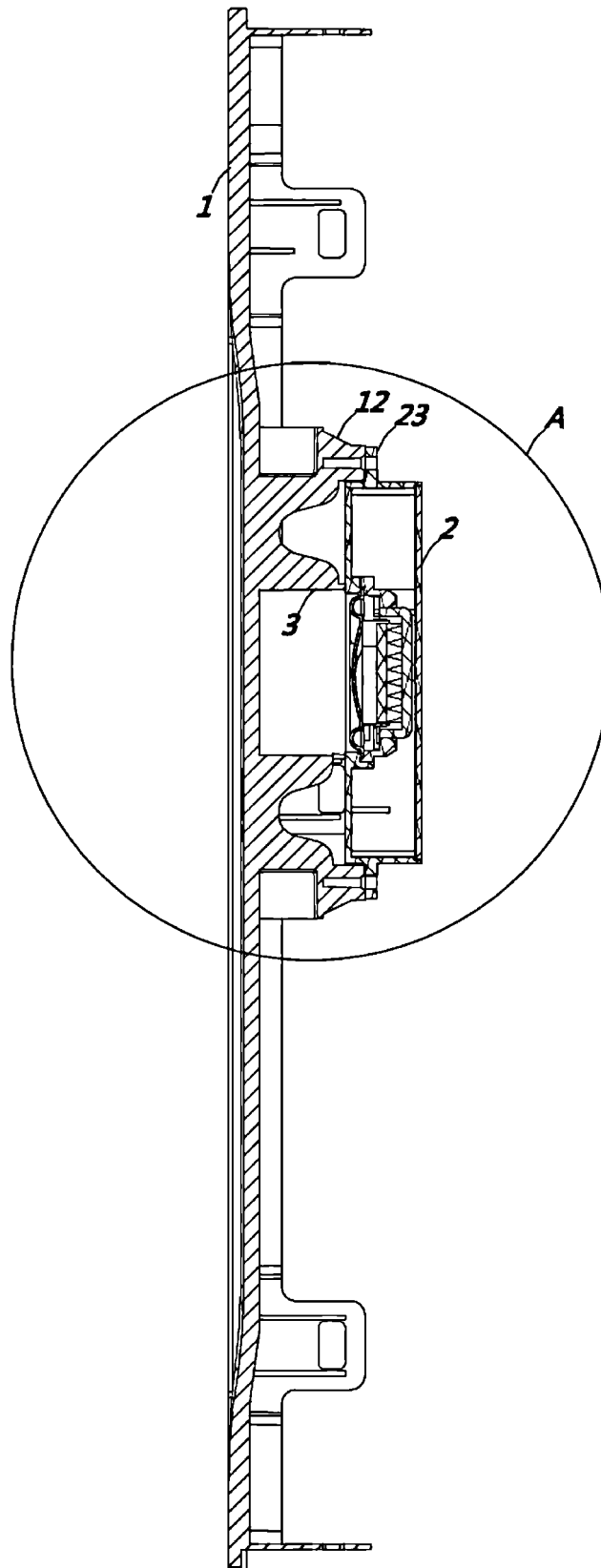


Fig. 5

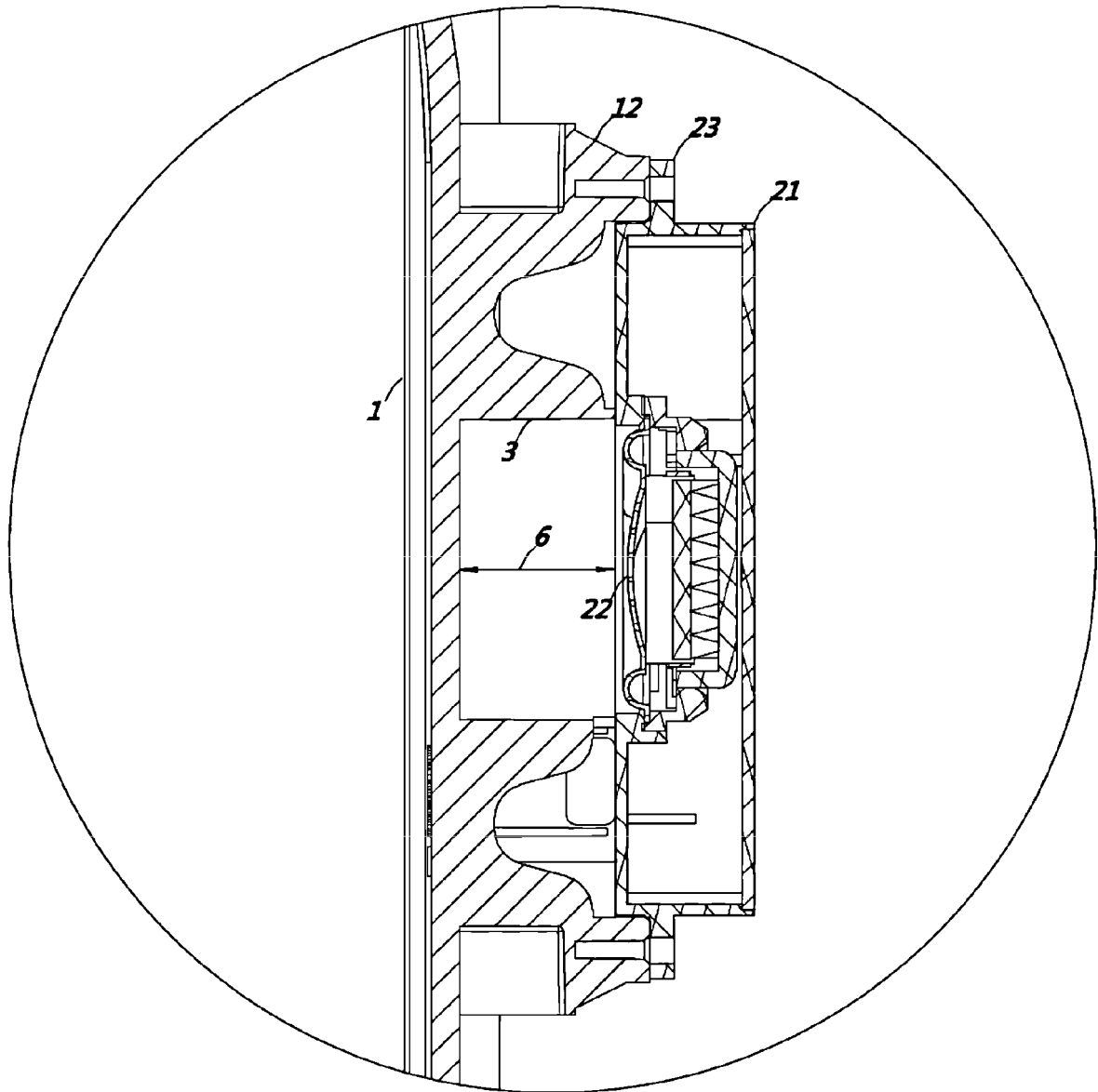


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/113924

A. CLASSIFICATION OF SUBJECT MATTER

F25D 23/00 (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)

F25D; FI; F25D 23/00 & 301R

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)

CNABS, CNTXT, CNKI, DWPI, SIPOABS: refrigerator, fridge, speaker, gap, clearance, interface, resonance, hole, opening, orifice, distance, coupling

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105910376 A (QINGDAO HAIER CO., LTD.) 31 August 2016 (31.08.2016) description, paragraphs [0022]-[0039], and figures 1-6	1-11
X	CN 101622884 A (WHIRLPOOL CO., LTD.) 06 January 2010 (06.01.2010) description, page 6, line 4 to page 16, line 14, and figures 1-7	1-11
A	KR 20070033131 A (LG ELECTRONICS INC.) 26 March 2007 (26.03.2007) the whole document	1-11
A	JP 2004085071 A (MATSUSHITA REFRIGERATION) 18 March 2004 (18.03.2004) the whole document	1-11
A	JP 2002031471 A (MATSUSHITA REFRIGERATION) 31 January 2002 (31.01.2002) the whole document	1-11

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT
 Information on patent family members

 International application No.
 PCT/CN2016/113924

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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