



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**24.08.2022 Bulletin 2022/34**

(51) International Patent Classification (IPC):  
**F25D 17/06** <sup>(2006.01)</sup> **F25D 17/08** <sup>(2006.01)</sup>

(21) Application number: **20806799.1**

(86) International application number:  
**PCT/CN2020/079990**

(22) Date of filing: **18.03.2020**

(87) International publication number:  
**WO 2020/228412 (19.11.2020 Gazette 2020/47)**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **10.05.2019 CN 201910389731**

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(54) **MODULAR UNIVERSAL AIR SUPPLY DEVICE FOR REFRIGERATOR, REFRIGERATOR, AND METHOD FOR MANUFACTURING REFRIGERATOR**

(57) Disclosed are a modular universal air supply device for a refrigerator, the refrigerator, and a method for manufacturing the refrigerator. The modular universal air supply device comprises: an air duct main body (20); two optional widening modules (30) arranged on two lateral sides of the air duct main body (20); and a first optional air duct covering plate (40) and/or a second optional air duct covering plate (50) each comprising a front cover part (41) and two connection parts (42) arranged on two lateral sides of the front cover part (41); the front cover parts (41) are arranged on a front side of the air duct main body (20), and each connection part (42) is configured to be mounted on a refrigerator body; and the second optional air duct covering plate (50) further comprises two widening cover parts (51), and each widening cover part (51) is connected to one lateral side of a front cover part (41) and is arranged on a front side of one optional widening module (30). The universality of the refrigerator body and air duct foam can be improved, the molding cost is reduced, waste in terms of administration caused by too many air ducts and refrigerator bodies is reduced, air ducts with different apparent widths can be installed in the same refrigerator body, and cross-platform air duct module universality and refrigerator body universality are achieved.

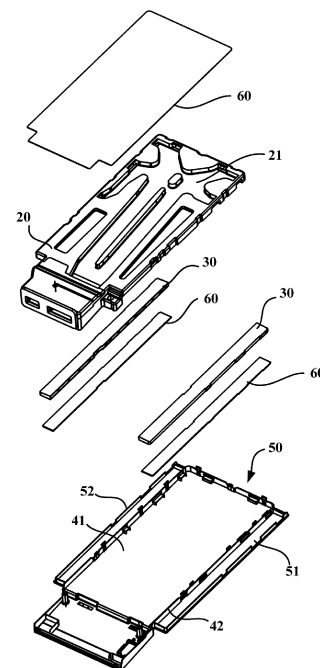


Fig. 1

## Description

### FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of refrigeration equipment, and more particularly relates to a modular universal air supply device for a refrigerator, a refrigerator, and a method for manufacturing a refrigerator.

### BACKGROUND OF THE INVENTION

[0002] With the development of society and economy and the improvement of people's living standards, refrigerators have also become indispensable household appliances in people's daily lives. Existing refrigerating compartments of refrigerators have diversified appearances and different width requirements on air ducts. During research and development of some refrigerators, it is often only necessary to modify the appearance of the air duct and the appearance of interior trimmings. However, the air duct needs to transmit air to an air outlet, so when the air duct is widened, foam of a heat insulation layer inside needs to be widened. If the heat insulation layer is not widened, cold air will directly pass through a plastic cover plate, and may cause condensation. Therefore, an inner liner cooperating with the heat insulation layer to achieve a fixation effect also needs to be widened and modified, resulting in new mold opening for the air duct and new mold opening for the corresponding inner liner of a cabinet, which causes great cost input of molds. And management waste is caused by too many air ducts and cabinets. In addition, management confusion easily occurs.

### BRIEF DESCRIPTION OF THE INVENTION

[0003] In view of the above problems, the present invention is proposed so as to provide a modular universal air supply device for a refrigerator, a refrigerator and a method for manufacturing a refrigerator to solve or at least partially solve the above problems. The universality of a cabinet and air duct foam can be improved; the cost input of molds is reduced; the management waste caused by too many air ducts and cabinets is reduced; the air ducts with different appearance widths can be installed in the same cabinet, and cross-platform air duct module universality and cabinet universality are achieved.

[0004] Therefore, in one aspect, the present invention proposes a modular universal air supply device for a refrigerator, including:

an air duct main body, provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement; each of the vertical end surfaces being provided with at least one air supply outlet;

two optional widening modules, disposed at two transverse sides of the air duct main body, wherein each of the optional widening air duct modules is provided with at least one connection air duct, and each of the connection air ducts communicates with one of the air supply outlets on the corresponding vertical end surface; and

a first optional air duct cover plate and/or a second optional air duct cover plate, the first optional air duct cover plate and the second optional air duct cover plate both including a front cover portion and two connection portions respectively disposed at two transverse sides of the front cover portion, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is configured to be installed on a cabinet of the refrigerator; and

the second optional air duct cover plate further includes two widening cover portions, wherein each of the widening cover portions is connected to one transverse side of the front cover portion, and is disposed at a front side of one of the optional widening modules; and each of the widening cover portions is integrally formed with the front cover portion, or each of the widening cover portions is installed on the front cover portion through a connection structure.

[0005] Optionally, a thermal insulation material layer is disposed between the air duct main body and the front cover portion; and

a thermal insulation material layer is disposed between the optional widening module and the corresponding widening cover portion.

[0006] Optionally, each of the connection portions includes a vertical side plate connected to the front cover portion, and a plurality of first buckles connected to a back side edge of the vertical side plate, so as to fit with a plurality of first clamping grooves formed in the cabinet; and

at least one first ventilation hole is formed in each of the vertical side plates, and each of the first ventilation holes is formed in a way of corresponding to one of the air supply outlets.

[0007] Optionally, both of the first optional air duct cover plate and the second optional air duct cover plate further include:

a connection plate connected to an upper side edge of the front cover portion, and a plurality of second buckles connected to a back side edge of the connection plate, so as to fit with a plurality of second clamping grooves formed in the cabinet.

[0008] Optionally, the second optional air duct cover plate further includes:

two enclosures, wherein each of the enclosures is disposed at a back surface of one of the widening cover portions, and defines an accommodation cavity for accommodating the corresponding optional

widening module together with the connection portion or the air duct main body; and  
at least one second ventilation hole is formed in each of the enclosures, and each of the second ventilation holes is disposed in a way of corresponding to an outlet of one of the connection air ducts of the corresponding optional widening module.

**[0009]** Optionally, bulges of the plurality of first buckles of each of the connection portions are located at an outer side of the corresponding vertical side plate; at least one third buckle is further disposed on each of the connection portions, and a bulge of the third buckle is located at an inner side of the corresponding vertical side plate; and a bulge of each of the second buckles is located at the upper side of the connection plate; at least one fourth buckle is also disposed on the connection plate; and a bulge of the fourth buckle is located at a lower side of the connection plate.

**[0010]** Optionally, the cabinet is an inner liner, and the thermal insulation material layer is PE foam.

**[0011]** In another aspect, the present invention further provides a refrigerator, wherein the refrigerator includes an inner liner and a modular universal air supply device, and the modular universal air supply device includes:

an air duct main body, disposed at a back portion of the inner liner and provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement, wherein each of the vertical end surfaces is provided with at least one air supply outlet; and  
a first optional air duct cover plate, including a front cover portion and two connection portions respectively disposed at two transverse sides of the front cover portion, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is installed on the inner liner.

**[0012]** In yet another aspect, the present invention further provides another refrigerator, wherein the refrigerator includes an inner liner and a modular universal air supply device, and the modular universal air supply device includes:

an air duct main body, disposed at a back portion of the inner liner and provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement, wherein each of the vertical end surfaces is provided with at least one air supply outlet;  
two optional widening modules, disposed at two transverse sides of the air duct main body, wherein at least one connection air duct is disposed on each of the optional widening air duct modules, and each of the connection air ducts communicates with one of the air supply outlets on the corresponding vertical

end surface; and

a second optional air duct cover plate, including a front cover portion, two connection portions respectively disposed at two transverse sides of the front cover portion, and two widening cover portions, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is installed on the inner liner; each of the widening cover portions is connected to one transverse side of the front cover portion, and is disposed at a front side of one of the optional widening modules; and each of the widening cover portions is integrally formed with the front cover portion, or each of the widening cover portions is installed on the front cover portion through a connection structure.

**[0013]** Optionally, the modular universal air supply device is any one of the above modular universal air supply devices.

**[0014]** In yet another aspect, the present invention further provides a method for manufacturing a refrigerator by using any one of the above modular universal air supply devices, wherein  
when manufacturing a refrigerator including an inner liner, an air duct main body and a first optional air duct cover plate, the manufacturing method includes:

manufacturing an inner liner for the refrigerator by a first mold;  
manufacturing an air duct main body by a second mold;  
manufacturing a first optional air duct cover plate including a front cover portion and connection portions; and  
assembling the inner liner, the air duct main body and the first optional air duct cover plate; and  
when manufacturing a refrigerator including an inner liner, an air duct main body, two optional widening modules and a second optional air duct cover plate, the manufacturing method includes:

manufacturing the inner liner by the first mold;  
manufacturing the air duct main body by the second mold;  
manufacturing the optional widening modules by a third mold;  
manufacturing the first optional air duct cover plate including a front cover portion and connection portions, manufacturing widening cover portions, installing the widening cover portions onto the first optional air duct cover plate to manufacture a second optional air duct cover plate; or manufacturing a second optional air duct cover plate including a front cover portion, connection portions and widening cover portions; and  
assembling the inner liner, the air duct main body, two of the optional widening modules and the second optional air duct cover plate.

**[0015]** In the modular universal air supply device and the refrigerator of the present invention, since the air duct main body, the optional widening modules, the first optional air duct cover plate and the second optional air duct cover plate are provided, that is, only appearance components and universal left and right ventilation pipes (i.e., widening modules) are newly added, while the cabinet and the foam assembly inside both can be universal to an existing cabinet, the cost of molds caused by new addition of components is reduced. At the same time, the cabinets of all models can be planned in a unified manner to realize the universality of components of cabinets of different platforms. That is, the present invention realizes the modular design and study on an air duct assembly, and the mold cost and the management cost are reduced.

**[0016]** Further, through the present invention, during widening of the air duct, the air duct foam and air duct PE foam are universal; the inner liner is also universal; air guide pipes are added to left and right sides to guide air to a place where it is required; and the PE foam and the ventilation pipes cooperate to prevent condensation on the air duct cover plates. The modular unified standardization of the air duct of the refrigerator can be realized; universality on refrigerators with different air supply widths is realized; and the modular universal air supply device can be applicable to all refrigerators with surrounding air outlet.

**[0017]** According to the following detailed descriptions of specific embodiments of the present invention in conjunction with the drawings, those skilled in the art will more clearly understand the above and other objectives, advantages and features of the present invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]** Some specific embodiments of the present invention are described in detail below with reference to the drawings by way of example and not limitation. The same reference numerals in the drawings indicate the same or similar components or parts. Those skilled in the art should understand that these drawings are not necessarily drawn in scale. In the drawings:

Figure 1 is a schematic structure diagram of a modular universal air supply device according to an embodiment of the present invention.

Figure 2 is a schematic structure diagram of a modular universal air supply device according to an embodiment of the present invention.

Figure 3 is a schematic structure diagram of a refrigerator according to an embodiment of the present invention.

Figure 4 is a schematic diagram of airflow flowing inside the refrigerator shown in Figure 3.

Figure 5 is a schematic sectional view along an A-A plane in Figure 3.

Figure 6 is a schematic sectional view along a B-B plane in Figure 3.

Figure 7 is a schematic structure diagram of a refrigerator according to an embodiment of the present invention.

Figure 8 is a schematic diagram of airflow flowing inside the refrigerator shown in Figure 7.

Figure 9 is a schematic sectional view along a C-C plane in Figure 7.

Figure 10 is a schematic sectional view along a D-D plane in Figure 7.

Figure 11 is a schematic enlargement view of a local cross section in Figure 10.

Figure 12 is a schematic structure diagram of an inner liner of the refrigerator shown in Figure 3 and Figure 7.

## DETAILED DESCRIPTION

**[0019]** Figure 1 is a schematic structure diagram of a modular universal air supply device according to an embodiment of the present invention. Figure 2 is a schematic structure diagram of a modular universal air supply device according to an embodiment of the present invention. As shown in Figure 1 and Figure 2, and referring to Figure 3 to Figure 12, the embodiment of the present invention provides a modular universal air supply device for a refrigerator. The modular universal air supply device may include an air duct main body 20, two optional widening modules 30, a first optional air duct cover plate 40 and/or a second optional air duct cover plate 50.

**[0020]** The air duct main body 20 may be provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement. Each of the vertical end surfaces is provided with at least one air supply outlet. A lower end surface of the air duct main body 20 may be provided with an air inlet 22. An air duct may be provided with at least one communication groove 21/communication passage communicating with the air inlet 22 and at least one air supply outlet. That is, the air duct main body 20 is mainly used to guide an airflow to flow, and is made of a thermal isolation material/heat insulation material.

**[0021]** The two optional widening modules 30 may be disposed at two transverse sides of the air duct main body 20. At least one connection air duct is disposed on each of the optional widening air duct modules, and each of the connection air ducts communicates with one air supply outlet on the corresponding vertical end surface. The optional widening modules 30 may also be called ventilation pipes, and are configured to widen the air duct main body 20 in a width direction (i.e., transverse direction) of the air duct main body 20 to further convey the airflow. The optional widening modules 30 are made of a thermal isolation material/heat insulation material.

**[0022]** The first optional air duct cover plate 40 and the second optional air duct cover plate 50 both include a front cover portion 41 and two connection portions 42 respectively disposed at two transverse sides of the front cover portion 41. The front cover portion 41 is disposed

at a front side of the air duct main body 20. Each of the connection portions 42 is configured to be installed on a cabinet of the refrigerator, for example, installed at an inner liner 90 of the cabinet. Additionally, the second optional air duct cover plate 50 further includes two widening cover portions 51. Each of the widening cover portions 51 is connected to one transverse side of the front cover portion 41, and is disposed at a front side of one optional widening module 30. Each of the widening cover portions 51 is integrally formed with the front cover portion 41, or each of the widening cover portions 51 is installed on the front cover portion 41 or one connection portion 42 through a connection structure. When each of the widening cover portions 51 is installed on the front cover portion 41 or one connection portion 42 through a connection structure, the condition can also be understood as that each of the widening cover portions 51 is installed at one corresponding side of the first optional air duct cover plate 40 through a connection structure.

**[0023]** When the modular universal air supply device according to the embodiment of the present invention is used, and when a refrigerator including an inner liner 90, an air duct main body 20 and a first optional air duct cover plate 40 is manufactured, the inner liner 90, the air duct main body 20 and the first optional air duct cover plate 40 are selected to be assembled so as to form the refrigerator with a narrow air duct. When a refrigerator including an inner liner 90, an air duct main body 20, two optional widening modules 30 and a second optional air duct cover plate 50 is manufactured, the inner liner 90, the air duct main body 20, the two optional widening modules 30 and the second optional air duct cover plate 50 are selected to be assembled so as to form the refrigerator with a wide air duct cover plate. When the wide and narrow air ducts of the refrigerator are converted, the unified inner liner 90 and air duct main body 20 can be used, and even the unified first optional air duct cover plate 40 can be used to further reduce the molds, so that the cost input of the molds is reduced; the management waste caused by too many air ducts, cabinets and the like is reduced; the air ducts with different appearance widths can be installed in the same cabinet, and cross-platform air duct module universality and cabinet universality are achieved.

**[0024]** In some embodiments of the present invention, a thermal insulation material layer 60 is disposed between the air duct main body 20 and the front cover portion 41. A thermal insulation material layer 60 is disposed between the optional widening modules 30 and the corresponding widening cover portions 51. The thermal insulation material layer 60 is preferably PE foam, and a thickness may be in a range of 2 mm to 4 mm, preferably 3 mm. The arrangement of the thermal insulation material layer 60 may prevent condensation from forming on a front surface of the air duct cover plate. The second optional air duct cover plate 50 further includes two enclosures 52. Each of the enclosure portions 52 is disposed at a back surface of one widening cover portion 51, and

defines an accommodation cavity for accommodating the corresponding optional widening module 30 together with the connection portion 42 or the air duct main body 20. At least one second ventilation hole is formed in each enclosure 52, and each of the second ventilation holes is disposed in a way of corresponding to an outlet of one connection air duct of the corresponding optional widening module 30.

**[0025]** In some embodiments of the present invention, each of the connection portions 42 includes a vertical side plate connected to the front cover portion 41, and a plurality of first buckles 55 connected to a back side edge of the vertical side plate, so as to fit with a plurality of first clamping grooves 91 formed in the cabinet. At least one first ventilation hole is formed in each of the vertical side plates, and each of the first ventilation holes is formed in a way of corresponding to one air supply outlet. Both of the first optional air duct cover plate 40 and the second optional air duct cover plate 50 further include a connection plate connected to an upper side edge of the front cover portion 41, and a plurality of second buckles 56 connected to a back side edge of the connection plate, so as to fit with a plurality of second clamping grooves 92 formed in the cabinet.

**[0026]** Bulges of the plurality of first buckles 55 of each of the connection portions 42 are located at an outer side of the corresponding vertical side plate. At least one third buckle 57 is further disposed on each of the connection portions 42, and a bulge of the third buckle 57 is located at an inner side of the corresponding vertical side plate. A bulge of each of the second buckles 56 is located at the upper side of the connection plate; at least one fourth buckle 58 is also disposed on the connection plate; and a bulge of the fourth buckle 58 is located at a lower side of the connection plate. The third buckle 57 and the fourth buckle 58 are preferably used to fix the air duct main body 20, and can also be used to be fixed to the inner liner 90. In some embodiments of the present invention, the buckles may also be called clamping hooks, and the clamping grooves are called clamping hook fixing grooves.

**[0027]** Figure 3 is a schematic structure diagram of a refrigerator according to an embodiment of the present invention. As shown in Figure 3, and referring to Figure 4 to Figure 6, arrows in the figures show flowing directions of airflows. The embodiment of the present invention further provides a refrigerator, including an inner liner 90 and a modular universal air supply device. Additionally, the modular universal air supply device includes an air duct main body 20 and a first optional air duct cover plate 40. The air duct main body 20 is disposed at a back portion of the inner liner 90. Additionally, the air duct main body 20 is provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement. Each of the vertical end surfaces is provided with at least one air supply outlet, whose main effect is to guide air to a region requiring refrigeration. The first optional air duct cover plate 40

includes a front cover portion 41 and two connection portions 42 respectively disposed at two transverse sides of the front cover portion 41. The front cover portion 41 is disposed at a front side of the air duct main body 20, and each of the connection portions 42 is installed on the inner liner 90. Preferably, the refrigerator uses partial components of the modular universal air supply device in any one of the above embodiments so as to form the refrigerator with the narrow air duct. A width of the narrow air duct can be 400 mm. That is, the modular universal air supply device according to the present embodiment includes partial or all corresponding components of the modular universal air supply device according to any one of the above embodiments.

**[0028]** In some further embodiments of the present invention, if a refrigerator with a wide air duct needs to be manufactured, on the basis of the refrigerator with the narrow air duct of the embodiment, two optional widening air duct modules are added, and two widening cover portions 51 are added; or two optional widening air duct modules are added, and the first optional air duct cover plate 40 is changed into the second optional air duct cover plate 50.

**[0029]** Figure 7 is a schematic structure diagram of a refrigerator according to an embodiment of the present invention. As shown in Figure 7, and referring to Figure 8 to Figure 10, arrows in the figures show flowing directions of airflows. The embodiment of the present invention further provides a refrigerator, including an inner liner 90 and a modular universal air supply device. Additionally, the modular universal air supply device includes an air duct main body 20, two optional widening modules 30 and a second optional air duct cover plate 50.

**[0030]** The air duct main body 20 is disposed at a back portion of the inner liner 90. Additionally, the air duct main body 20 is provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement. Each of the vertical end surfaces is provided with at least one air supply outlet. The two optional widening modules 30 are disposed at two transverse sides of the air duct main body 20. At least one connection air duct is provided on each of the optional widening air duct modules; each of the connection air ducts communicates with one air supply outlet on the corresponding vertical end surface whose main effect is to guide air to a region requiring refrigeration. The second optional air duct cover plate 50 includes a front cover portion 41, two connection portions 42 respectively disposed at two transverse sides of the front cover portion 41, and two widening cover portions 51. The front cover portion 41 is disposed at a front side of the air duct main body 20, and each of the connection portions 42 is installed on the inner liner 90. Each widening cover portion 51 is connected to one transverse side of the front cover portion 41, and is disposed at a front side of one optional widening module 30. Additionally, each of the widening cover portions 51 is integrally formed with the front cover portion 41, or each of the widening cover portions 51 is

installed on the front cover portion 41 or one connection portion 42 through a connection structure. Preferably, the refrigerator uses partial components of the modular universal air supply device in any one of the above embodiments so as to form the refrigerator with the wide air duct. A width of the wide air duct can be 500 mm. That is, the modular universal air supply device according to the present embodiment includes partial or all corresponding components of the modular universal air supply device according to any one of the above embodiments.

**[0031]** In some further embodiments of the present invention, if a refrigerator with a narrow air duct needs to be manufactured, on the basis of the refrigerator with the wide air duct of the embodiment, two optional widening air duct modules are removed, and two widening cover portions 51 are removed; or the two optional widening air duct modules are removed, and the second optional air duct cover plate 50 is changed into the first optional air duct cover plate 40.

**[0032]** The embodiment of the present invention further provides a method for manufacturing a refrigerator. Specifically, when manufacturing a refrigerator including an inner liner 90, an air duct main body 20 and a first optional air duct cover plate 40, the manufacturing method of the refrigerator includes: the inner liner 90 for the refrigerator is manufactured by a first mold; the air duct main body 20 is manufactured by a second mold; the first optional air duct cover plate 40 including a front cover portion 41 and connection portions 42 is manufactured; and the inner liner 90, the air duct main body 20 and the first optional air duct cover plate 40 are assembled.

**[0033]** When manufacturing a refrigerator including an inner liner 90, an air duct main body 20, two optional widening modules 30 and a second optional air duct cover plate 50, the manufacturing method of the refrigerator includes: the inner liner 90 is manufactured by the first mold; the air duct main body 20 is manufactured by the second mold; the optional widening modules 30 are manufactured by a third mold; the first optional air duct cover plate 40 including a front cover portion 41 and connection portions 42 is manufactured; widening cover portions 51 are manufactured; and the widening cover portions 51 are installed onto the first optional air duct cover plate 40 to manufacture the second optional air duct cover plate 50; or the second optional air duct cover plate 50 including a front cover portion 41, connection portions 42 and widening cover portions 51 is manufactured; and the inner liner 90, the air duct main body 20, the two optional widening modules 30 and the second optional air duct cover plate 50 are assembled.

**[0034]** Hereto, those skilled in the art should realize that although multiple exemplary embodiments of the present invention have been shown and described in detail herein, without departing from the spirit and scope of the present invention, many other variations or modifications that conform to the principles of the present invention can still be directly determined or deduced from the contents disclosed in the present invention. Therefore,

the scope of the present invention should be understood and deemed to cover all such other variations or modifications.

## Claims

1. A modular universal air supply device for a refrigerator, comprising:

an air duct main body, provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement, each of the vertical end surfaces being provided with at least one air supply outlet; two optional widening modules, disposed at two transverse sides of the air duct main body, wherein each of the optional widening air duct modules is provided with at least one connection air duct, and each of the connection air ducts communicates with one of the air supply outlets on the corresponding vertical end surface; and a first optional air duct cover plate and/or a second optional air duct cover plate, the first optional air duct cover plate and the second optional air duct cover plate both comprising a front cover portion and two connection portions respectively disposed at two transverse sides of the front cover portion, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is configured to be installed on a cabinet of the refrigerator; and the second optional air duct cover plate further comprises two widening cover portions, wherein each of the widening cover portions is connected to one transverse side of the front cover portion, and is disposed at a front side of one of the optional widening modules; and each of the widening cover portions is integrally formed with the front cover portion, or each of the widening cover portions is installed on the front cover portion or one of the connection portions through a connection structure.

2. The modular universal air supply device according to claim 1, wherein

a thermal insulation material layer is disposed between the air duct main body and the front cover portion; and a thermal insulation material layer is disposed between the optional widening module and the corresponding widening cover portion.

3. The modular universal air supply device according to claim 1, wherein

each of the connection portions comprises a vertical side plate connected to the front cover portion, and a plurality of first buckles connected to a back side edge of the vertical side plate, so as to fit with a plurality of first clamping grooves formed in the cabinet; and at least one first ventilation hole is formed in each of the vertical side plates, and each of the first ventilation holes is formed in a way of corresponding to one of the air supply outlets.

4. The modular universal air supply device according to claim 3, wherein both of the first optional air duct cover plate and the second optional air duct cover plate further comprise:

a connection plate connected to an upper side edge of the front cover portion, and a plurality of second buckles connected to a back side edge of the connection plate, so as to fit with a plurality of second clamping grooves formed in the cabinet.

5. The modular universal air supply device according to claim 1, wherein the second optional air duct cover plate further comprises:

two enclosures, wherein each of the enclosures is disposed at a back surface of one of the widening cover portions, and defines an accommodation cavity for accommodating the corresponding optional widening module together with the connection portion or the air duct main body; and at least one second ventilation hole is formed in each of the enclosures, and each of the second ventilation holes is disposed in a way of corresponding to an outlet of one of the connection air ducts of the corresponding optional widening module.

6. The modular universal air supply device according to claim 2, wherein the cabinet is an inner liner, and the thermal insulation material layer is PE foam.

7. A refrigerator, wherein the refrigerator comprises an inner liner and a modular universal air supply device, and the modular universal air supply device comprises:

an air duct main body, disposed at a back portion of the inner liner and provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement, wherein each of the vertical end surfaces is provided with at least one air supply outlet; and a first optional air duct cover plate, comprising a front cover portion and two connection portions respectively disposed at two transverse sides of

the front cover portion, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is installed on the inner liner.

8. A refrigerator, wherein the refrigerator comprises an inner liner and a modular universal air supply device, and the modular universal air supply device comprises:

an air duct main body, disposed at a back portion of the inner liner and provided with a front surface and a back surface in opposite arrangement, and two vertical end surfaces in opposite arrangement, wherein each of the vertical end surfaces is provided with at least one air supply outlet;

two optional widening modules, disposed at two transverse sides of the air duct main body, wherein at least one connection air duct is disposed on each of the optional widening air duct modules, and each of the connection air ducts communicates with one of the air supply outlets on the corresponding vertical end surface; and a second optional air duct cover plate, comprising a front cover portion, two connection portions respectively disposed at two transverse sides of the front cover portion, and two widening cover portions, wherein the front cover portion is disposed at a front side of the air duct main body, and each of the connection portions is installed on the inner liner; each of the widening cover portions is connected to one transverse side of the front cover portion, and is disposed at a front side of one of the optional widening modules; and each of the widening cover portions is integrally formed with the front cover portion, or each of the widening cover portions is installed on the front cover portion or one of the connection portions through a connection structure.

9. The refrigerator according to claim 7 or 8, wherein the modular universal air supply device is the modular universal air supply device according to any one of claims 1 to 6.

10. A method for manufacturing a refrigerator, wherein when manufacturing a refrigerator comprising an inner liner, an air duct main body and a first optional air duct cover plate, the manufacturing method comprises:

manufacturing an inner liner for the refrigerator by a first mold;  
manufacturing an air duct main body by a second mold;  
manufacturing a first optional air duct cover plate comprising a front cover portion and connection

portions; and

assembling the inner liner, the air duct main body and the first optional air duct cover plate; and

when manufacturing a refrigerator comprising an inner liner, an air duct main body, two optional widening modules and a second optional air duct cover plate, the manufacturing method comprises:

manufacturing the inner liner by the first mold;  
manufacturing the air duct main body by the second mold;  
manufacturing optional widening modules by a third mold;  
manufacturing the first optional air duct cover plate comprising a front cover portion and connection portions, manufacturing widening cover portions, and installing the widening cover portions onto the first optional air duct cover plate to manufacture a second optional air duct cover plate; or manufacturing a second optional air duct cover plate comprising a front cover portion, connection portions and widening cover portions; and assembling the inner liner, the air duct main body, two of the optional widening modules and the second optional air duct cover plate.



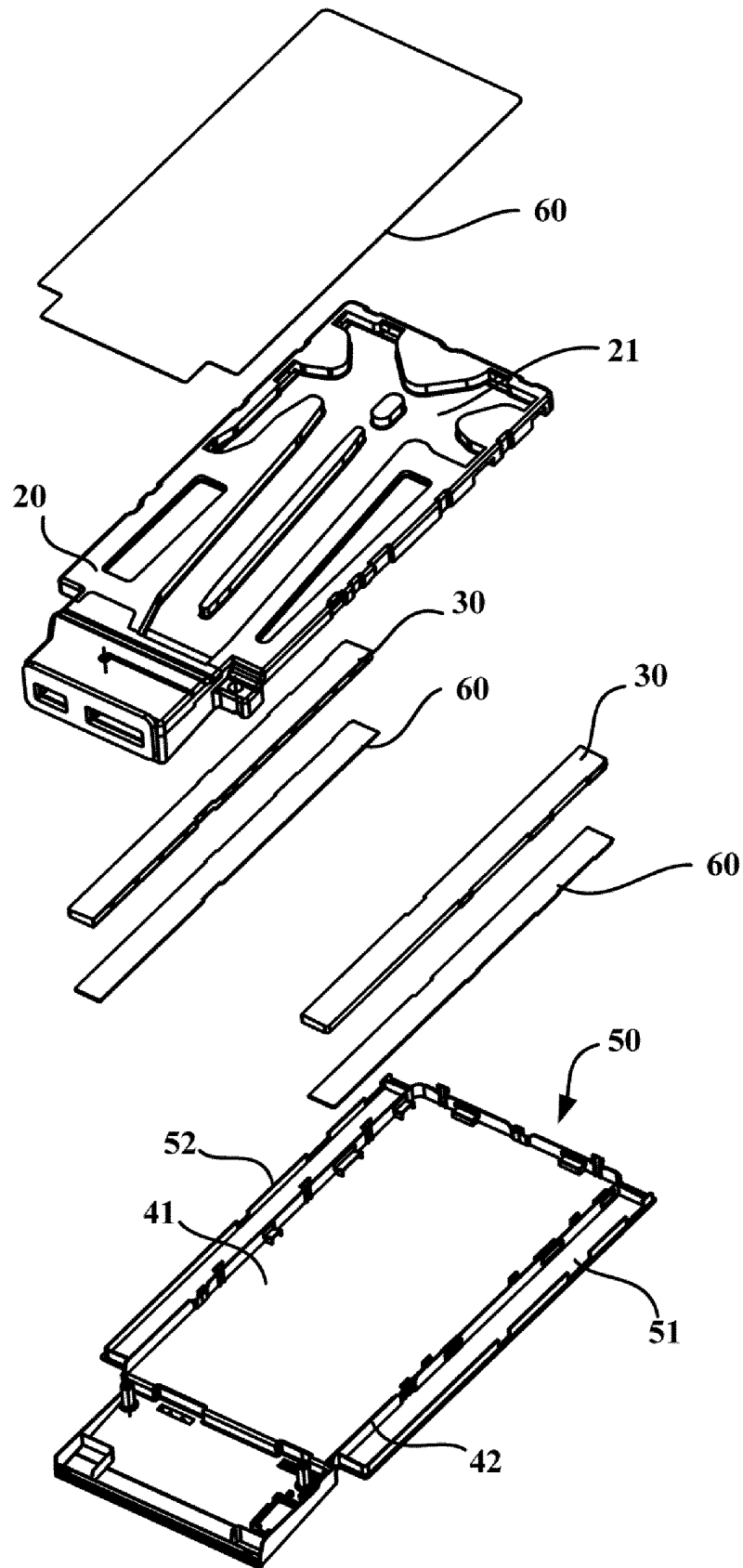


Fig. 1

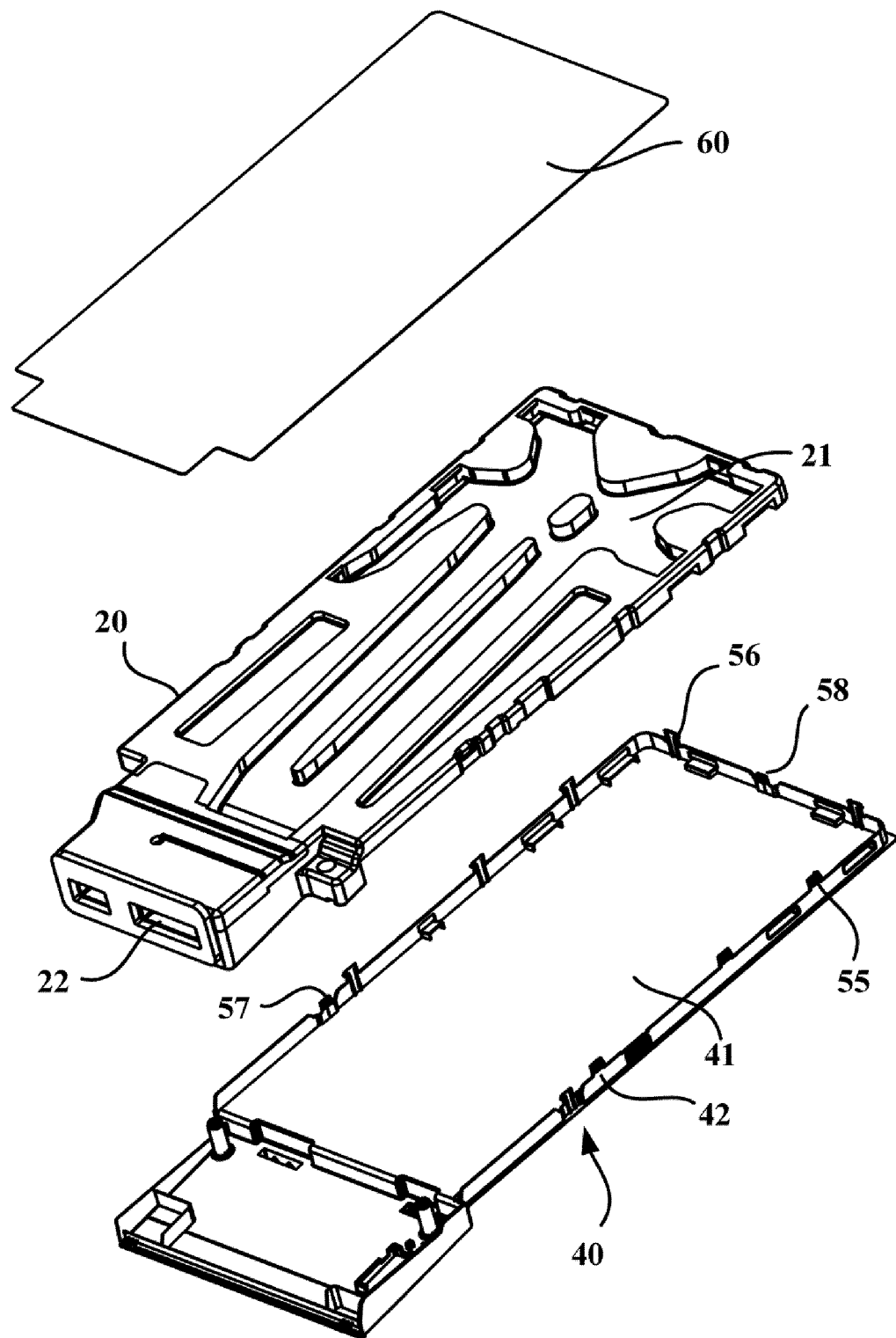


Fig. 2

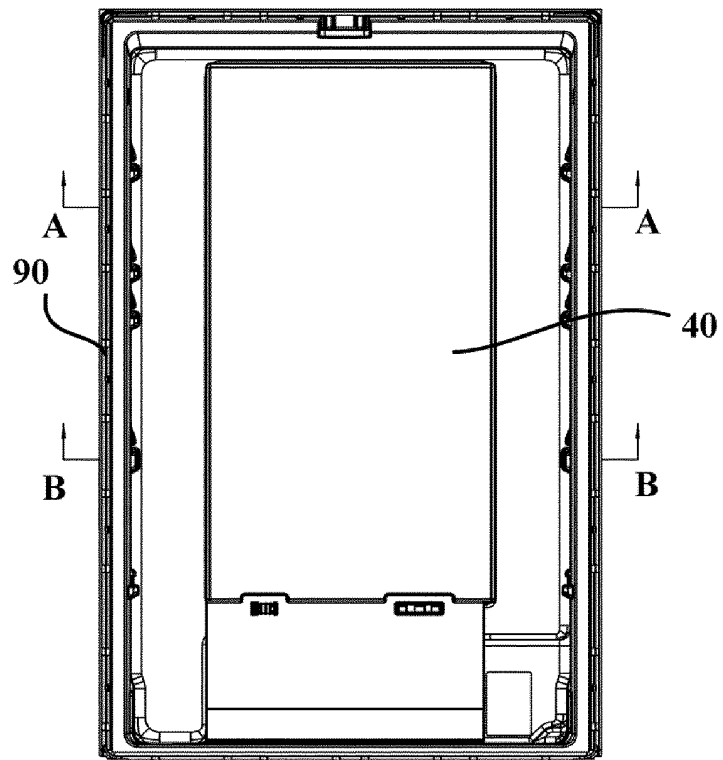


Fig. 3

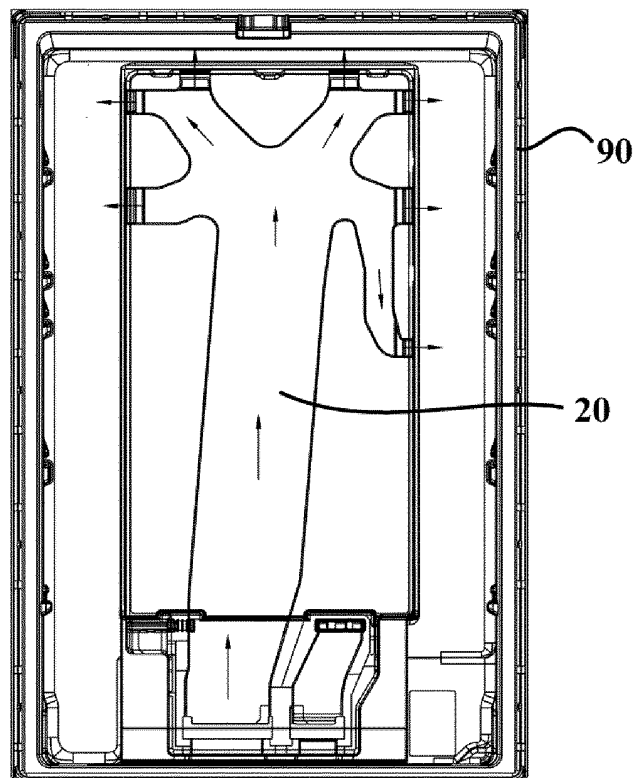


Fig. 4

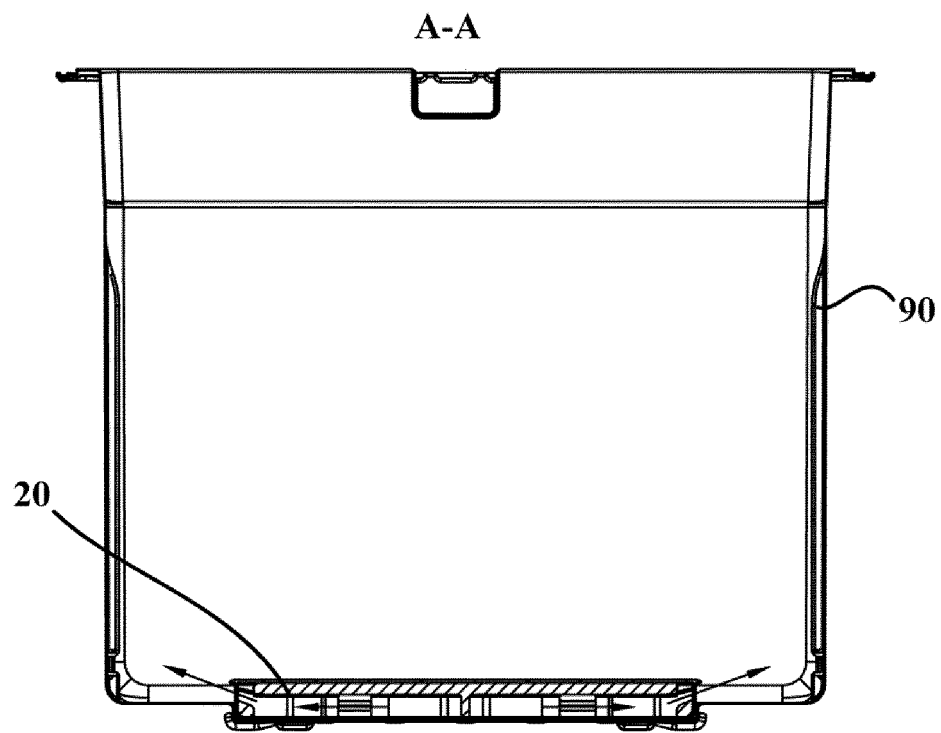


Fig. 5

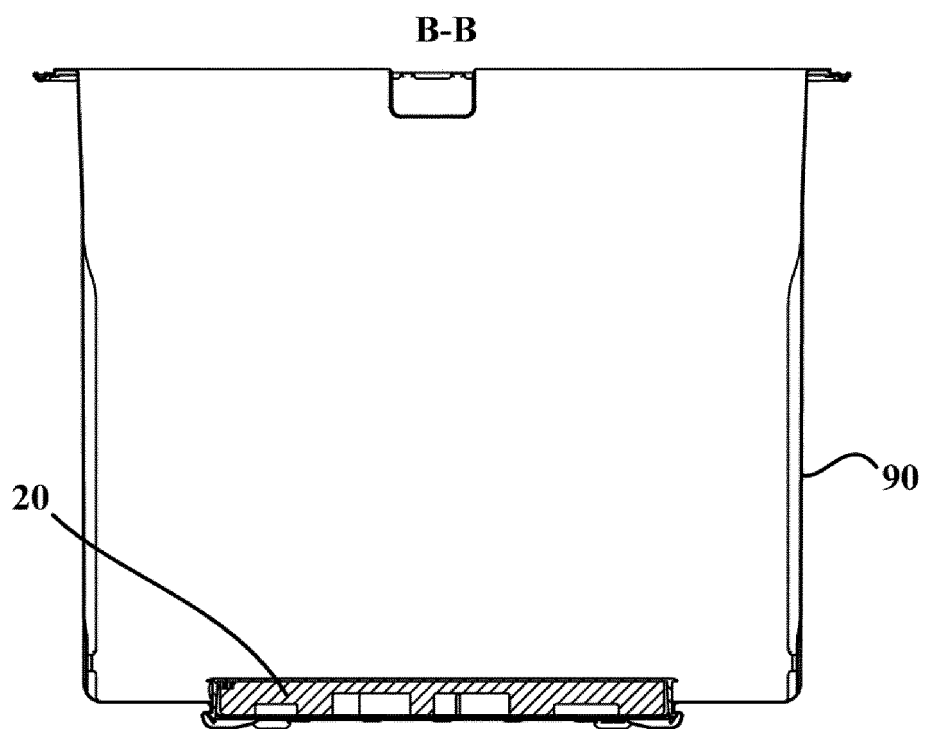


Fig. 6

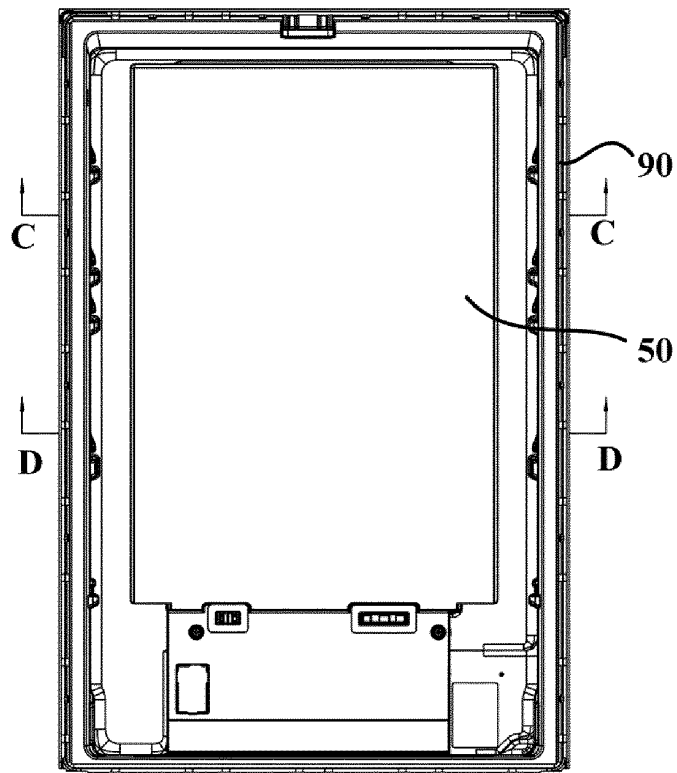


Fig. 7

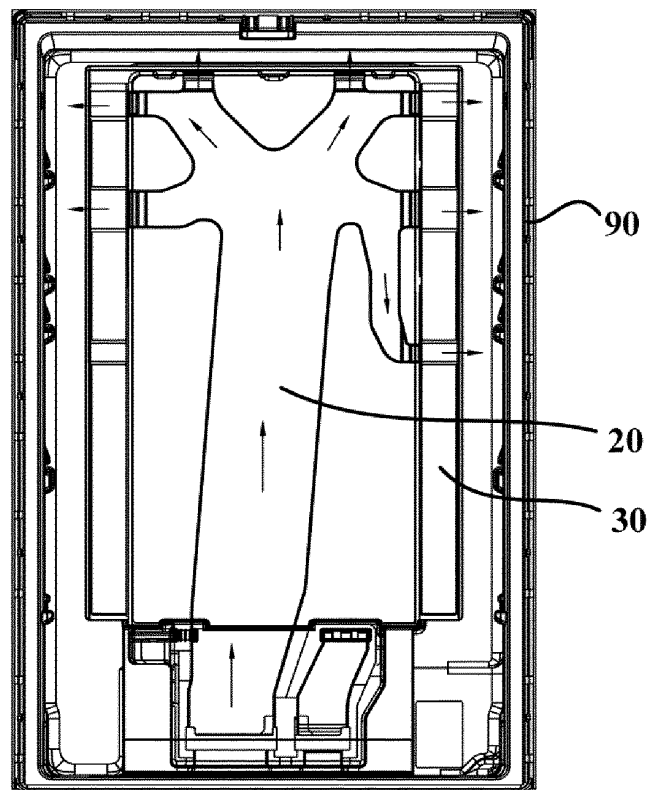


Fig. 8

C-C

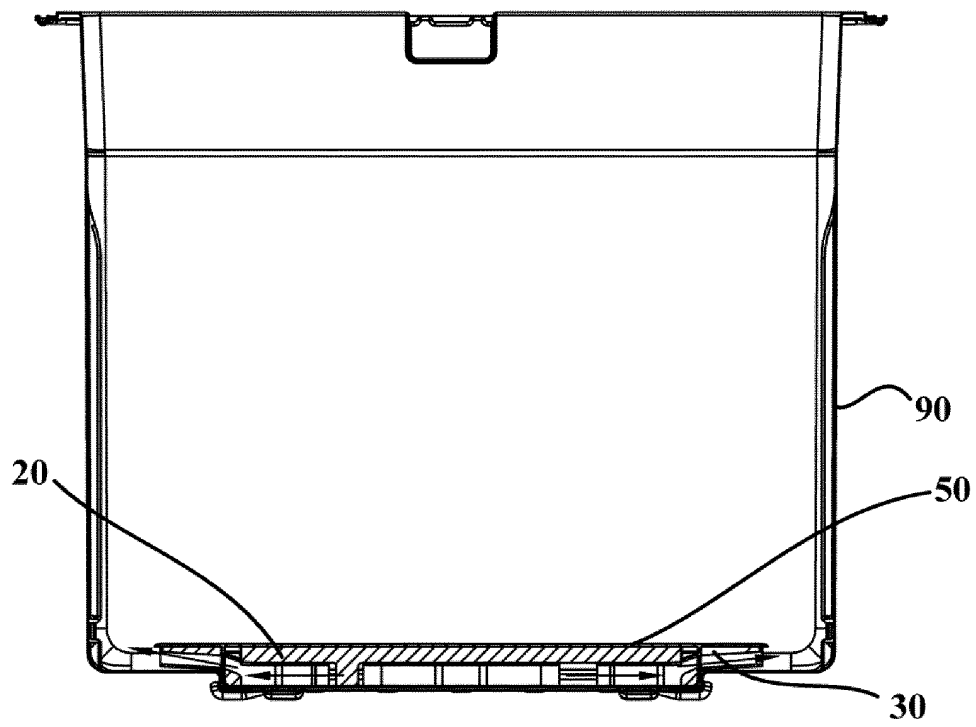


Fig. 9

D-D

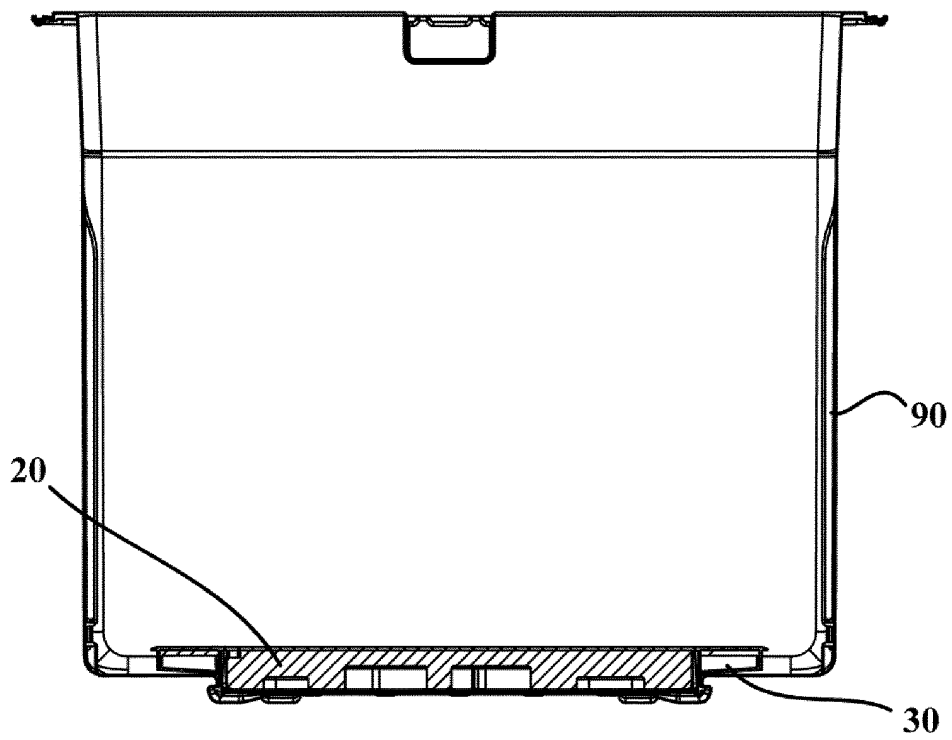


Fig. 10

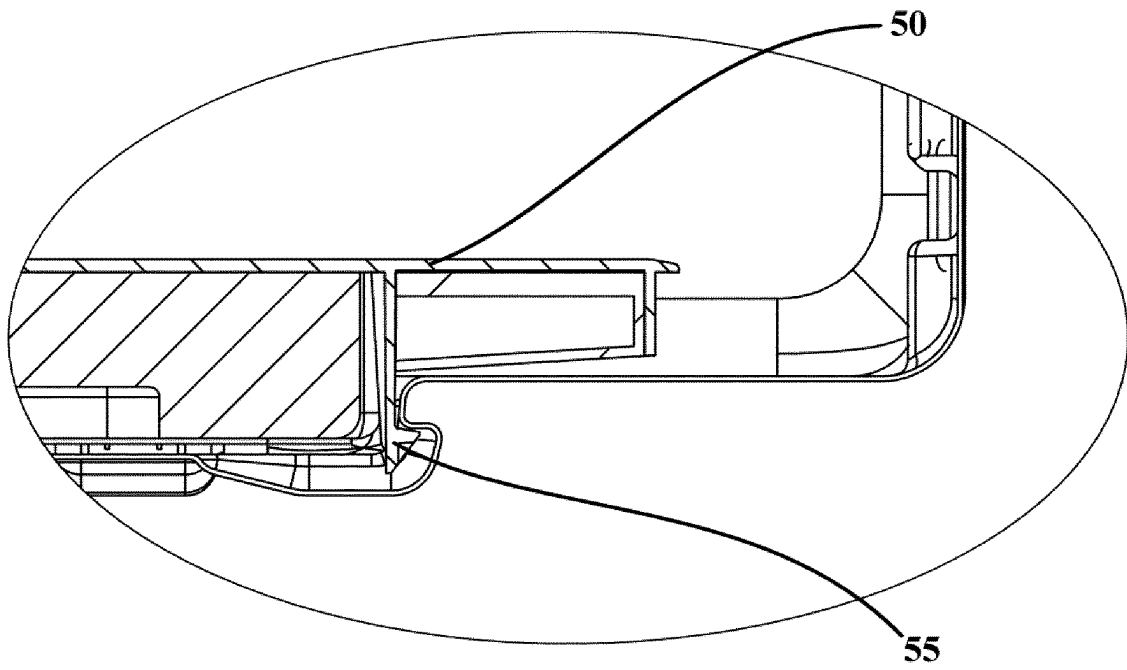


Fig. 11

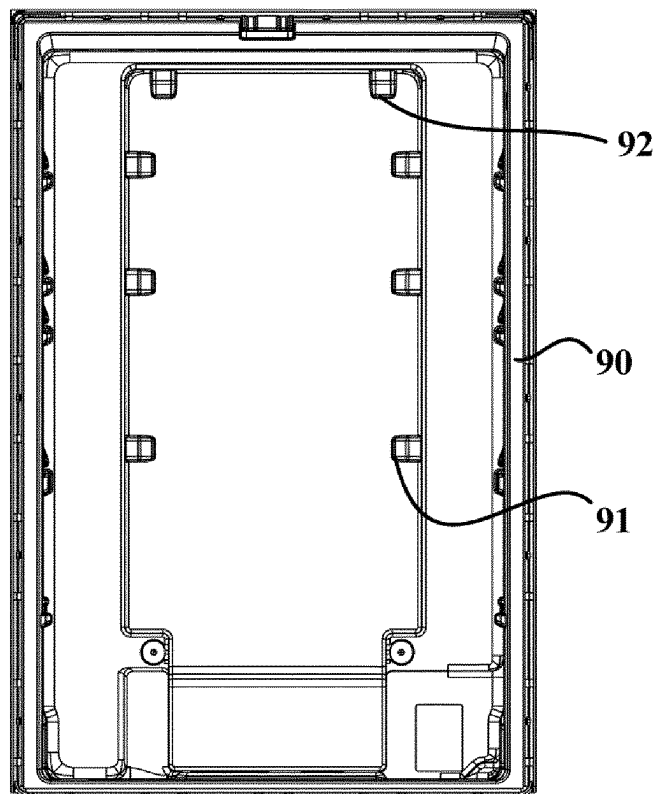


Fig. 12

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/079990

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> F25D 17/06(2006.01)i; F25D 17/08(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																								
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) F25D17 F25D11 F25D31 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: 风道, 风路, 通道, 模具, 模块, 结构, 构造, 宽度, 加宽, 拓宽, 变宽, 调节, 调整, 改变, 变化, duct, mould, modular, structure, construction, width, widening, adjust+, chang+, alter+, convert+																								
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																								
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>PX</td> <td>CN 110057155 A (QINDAO HAIER REFRIGERATOR CO., LTD. et al.) 26 July 2019 (2019-07-26) claims 1-10</td> <td>1-10</td> </tr> <tr> <td>X</td> <td>CN 107726708 A (HEFEI HUALING CO., LTD. et al.) 23 February 2018 (2018-02-23) description, paragraphs [0032]-[0057], and figures 1-6</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 108286859 A (GUANGDONG GALANZ GROUP CO., LTD. et al.) 17 July 2018 (2018-07-17) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 109708383 A (CHANGHONG MEILING CO., LTD.) 03 May 2019 (2019-05-03) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 207778935 U (HEFEI HUALING CO., LTD. et al.) 28 August 2018 (2018-08-28) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>US 2018172336 A1 (SAMSUNG ELECTRONICS CO., LTD.) 21 June 2018 (2018-06-21) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>KR 20090101524 A (LG ELECTRONICS INC.) 29 September 2009 (2009-09-29) entire document</td> <td>1-10</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	PX	CN 110057155 A (QINDAO HAIER REFRIGERATOR CO., LTD. et al.) 26 July 2019 (2019-07-26) claims 1-10	1-10	X	CN 107726708 A (HEFEI HUALING CO., LTD. et al.) 23 February 2018 (2018-02-23) description, paragraphs [0032]-[0057], and figures 1-6	1-10	A	CN 108286859 A (GUANGDONG GALANZ GROUP CO., LTD. et al.) 17 July 2018 (2018-07-17) entire document	1-10	A	CN 109708383 A (CHANGHONG MEILING CO., LTD.) 03 May 2019 (2019-05-03) entire document	1-10	A	CN 207778935 U (HEFEI HUALING CO., LTD. et al.) 28 August 2018 (2018-08-28) entire document	1-10	A	US 2018172336 A1 (SAMSUNG ELECTRONICS CO., LTD.) 21 June 2018 (2018-06-21) entire document	1-10	A	KR 20090101524 A (LG ELECTRONICS INC.) 29 September 2009 (2009-09-29) entire document	1-10
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Date of the actual completion of the international search <b>03 April 2020</b>	Date of mailing of the international search report <b>23 April 2020</b>																							
Name and mailing address of the ISA/CN <b>China National Intellectual Property Administration (ISA/CN)  No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088  China</b> Facsimile No. (86-10)62019451	Authorized officer  Telephone No.																							

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/079990

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2004069143 A (HOSHIZAKI ELECTRIC CO., LTD.) 04 March 2004 (2004-03-04) entire document	1-10

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.

PCT/CN2020/079990

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 110057155 A	26 July 2019	None	
CN 107726708 A	23 February 2018	None	
CN 108286859 A	17 July 2018	None	
CN 109708383 A	03 May 2019	None	
CN 207778935 U	28 August 2018	None	
US 2018172336 A1	21 June 2018	CN 109716046 A	03 May 2019
		WO 2018110913 A1	21 June 2018
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		EP 3497387 A4	18 September 2019
KR 20090101524 A	29 September 2009	None	
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