(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 252 216 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.12.2017 Bulletin 2017/49

(51) Int Cl.:
D06F 58/20 *(2006.01)* *D06F 25/00* *(2006.01)*

(21) Application number: **16205510.7**

(22) Date of filing: **20.12.2016**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **31.05.2016 CN 201610375616**
31.05.2016 CN 201620513985 U

(71) Applicant: **Wuxi Little Swan Co., Ltd.**
New District
Wuxi
Jiangsu 214028 (CN)

(72) Inventors:
- **MIAO, Yulai**
  Jiangsu 214028 (CN)
- **LU, Song**
  Jiangsu 214028 (CN)
- **QIAN, Wei**
  Jiangsu 214028 (CN)

(74) Representative: **Papa, Elisabetta et al**
Società Italiana Brevetti S.p.A
Piazza di Pietra, 39
00186 Roma (IT)

(54) CLOTHES DRYER OR WASHER-DRYER

(57) A clothes dryer or washer-dryer which includes: a cabinet (100); an inner drum (200) rotatably disposed in the cabinet (100) and having an air inlet and an air outlet; and a heat pump module (300) disposed to an upper end of the cabinet (100) and including a casing (1) connected with the cabinet (100) and defining a heat exchange chamber (10A) and at least one mounting chamber (103B) therein, the heat exchange chamber (10A) having a heat exchange inlet and a heat exchange outlet; a condenser (2) disposed in the heat exchange chamber (10A); a compressor (3) disposed to the casing (1); an evaporator (4) disposed to the casing (1); a throttling device disposed to the casing (1) and sequentially connected with the condenser (2), the compressor (3) and the evaporator (4) to form a heat pump (300) circuit; and a fan assembly (6) disposed to the casing (1) and having an inlet and an outlet, the inlet communicating with the heat exchange outlet, and the outlet communicating with the air inlet, wherein at least one of the compressor (3), the evaporator (4), the throttling device and the fan assembly (6) is disposed in the corresponding at least one mounting chamber (103B). The clothes dryer or washer-dryer with the heat pump module (300) integrally mounted to the cabinet (100) is reasonable in component layout and stable in component installation.

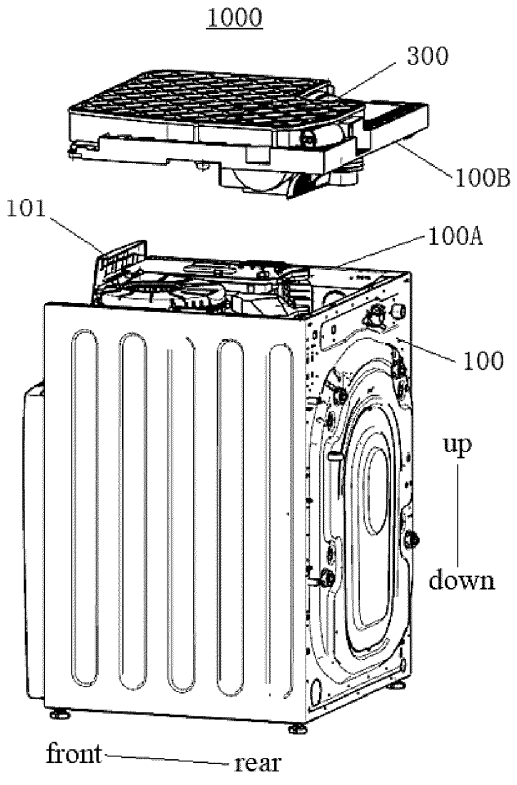

Fig. 1

EP 3 252 216 A1

Description

FIELD

[0001] The present disclosure relates to a technical field of a washing machine, and particularly to a clothes dryer or washer-dryer.

BACKGROUND

[0002] In the related art, a clothes dryer or washer-dryer has a separated type heat pump drying system, that is a compressor and both of an evaporator and a condenser are arranged at an upper portion and a lower portion of a cabinet respectively and connected through pipes. The clothes dryer or washer-dryer having the above arrangement is complex in structure, hard to assemble and disassemble, and is disadvantageous to production and maintenance. Moreover, a layout and installation of components such as a compressor, an evaporator, a throttling device and a fan assembly need to be improved.

SUMMARY

[0003] The present disclosure seeks to solve at least one of the problems existing in the related art to at least some extent. Therefore, the present disclosure provides a clothes dryer or washer-dryer having an integral heat pump module disposed to a cabinet, and reasonable layout and stable installation of components such as a compressor, an evaporator, a throttling device and a fan assembly can be accomplished.

[0004] The clothes dryer or washer-dryer according to embodiments of the present disclosure includes: a cabinet; an inner drum rotatably disposed in the cabinet and having an air inlet and an air outlet; and a heat pump module disposed to an upper end of the cabinet and including: a casing connected with the cabinet and defining a heat exchange chamber and at least one mounting chamber therein, the heat exchange chamber having a heat exchange inlet and a heat exchange outlet; a condenser disposed in the heat exchange chamber, a compressor disposed to the casing; an evaporator disposed to the casing; a throttling device disposed to the casing and sequentially connected with the condenser, the compressor and the evaporator to form a heat pump circuit; and a fan assembly disposed to the casing and having an inlet and an outlet, the inlet communicating with the heat exchange outlet, and the outlet communicating with the air inlet, in which at least one of the compressor, the evaporator, the throttling device and the fan assembly is disposed in the corresponding at least one mounting chamber.

[0005] In the clothes dryer or washer-dryer according to the embodiments of the present disclosure, the condenser, the compressor, the evaporator, the throttling device and the fan assembly and the like are disposed to the casing, the casing is connected with the cabinet, and at least one of the compressor, the evaporator, the throttling device and the fan assembly is disposed in the corresponding at least one mounting chamber, thereby integrally mounting the heat pump module to the cabinet, and accomplishing reasonable layout and stable installation of the components such as the compressor, the evaporator, the throttling device and the fan assembly, so the clothes dryer or washer-dryer is simple and compact in structure, convenient to assemble and disassemble, and low in the costs of production and maintenance.

[0006] In addition, the clothes dryer or washer-dryer according to embodiments of the present disclosure further may have the following additional features:

According to some embodiments, the fan assembly is disposed on a lower surface of the casing.

[0007] Optionally, the at least one mounting chamber includes a compressor mounting chamber, an evaporator mounting chamber and a throttling device mounting chamber, and the compressor, the evaporator and the throttling device are respectively and correspondingly mounted in the compressor mounting chamber, the evaporator mounting chamber and the throttling device mounting chamber.

[0008] Further, the casing is provided with a first two-component chamber and a second two-component chamber, and the first two-component chamber is provided with a separating plate therein to separate the first two-component chamber into the heat exchange chamber and the evaporator mounting chamber.

[0009] Optionally, the compressor mounting chamber communicates with the throttling device mounting chamber to form the second two-component chamber.

[0010] Optionally, the first two-component chamber is located in front of the second two-component chamber.

[0011] According to some embodiments, the heat pump module further includes a filter, the filter is disposed to the casing and has a filtering inlet and a filtering outlet, the filtering inlet communicates with the air outlet, and the filtering outlet communicates with the heat exchange inlet.

[0012] Optionally, the at least one mounting chamber further includes a filter mounting chamber, and the filter is disposed in the filter mounting chamber.

[0013] According to some embodiments, the casing includes: a base disposed on the cabinet; and a cover body detachably covering on the base and cooperating with the base to define the heat exchange chamber and the at least one mounting chamber.

[0014] Optionally, the clothes dryer or washer-dryer further includes an outer cover, and the outer cover detachably covers on the casing.

[0015] Additional aspects and advantages of embodiments of present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of

the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is an exploded view of a clothes dryer or washer-dryer according to an embodiment of the present disclosure at an angle;
Fig. 2 is an exploded view of the clothes dryer or washer-dryer according to the embodiment of the present disclosure at another angle;
Fig. 3 is a perspective view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure at an angle;
Fig. 4 is a perspective view of the heat pump module of the clothes dryer or washer-dryer according to the embodiment of the present disclosure at another angle;
Fig. 5 is a partial exploded view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 6 is an exploded view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 7 is a top view of a partial structure of a heat pump module of clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 8 is a partial enlarged top view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 9 is a schematic assembling view of a condenser of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 10 is a sectional view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 11 is a sectional view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 12 is an exploded view of a casing of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 13 is a partial enlarged view of a casing of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 14 is a partial schematic view of a compressor of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;
Fig. 15 is a partial enlarged schematic view of a heat pump module of a clothes dryer or washer-dryer according to an embodiment of the present disclosure;

[0017] Reference numerals:

1000 clothes dryer or washer-dryer
100 cabinet; 200 inner drum; 300 heat pump module; 101 control panel; 100A annular upper end face; 100B supporting fitting face;
1 casing; 11 base; 12 cover body;
10a heat exchange chamber; 101b compressor mounting chamber; 102b evaporator mounting chamber; 103b throttling device mounting chamber; 104b filter mounting chamber;
110 mounting plate pair; 1101 mounting plate; 1102 connecting plate; 111 column with threaded hole; 112 slot; 113 inserting tongue; 13 edge plate; 131 vertical plate segment; 132 horizontal plate segment;
2 condenser; 3 compressor; 4 evaporator; 5 throttling device; 6 fan assembly;
7 filter; 8 damping device.

DETAILED DESCRIPTION

[0018] Embodiments of the present disclosure will be described in detail and examples of the embodiments will be illustrated in the drawings. The embodiments described herein with reference to drawings are explanatory, which are used to illustrate the present disclosure, but shall not be construed to limit the present disclosure.

[0019] In the following, a clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure will be described with reference to Fig. 1 to Fig. 15. As to an up-down direction, an up-down direction of the clothes dryer or washer-dryer 1000 in normal use shall prevail.

[0020] As shown in Fig. 1 to Fig. 15, the clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure may include a cabinet 100, an inner drum 200 and a heat pump module 300. As shown in Fig. 1 and Fig. 2, the cabinet 100 may be configured to be substantially rectangular in shape. The inner drum 200 is rotatably disposed in the cabinet 100 and may have an air inlet and an air outlet. Clothes to be washed and dried can be put into the inner drum 200, and the clothes can be washed and dried in the inner drum 200. Hot air can enters through the air inlet, and flows out through the air outlet after drying the clothes.

[0021] As shown in Fig. 1 and Fig. 2, the heat pump module 300 may be disposed to an upper end of the cabinet 100. Referring to Fig. 3 to Fig. 7, the heat pump module may include a casing 1, a condenser 2, a compressor 3, an evaporator 4, a throttling device 5 and a fan assembly 6. That is the compressor 3 is arranged together with the condenser 2, the evaporator 4 and the throttling device 5, thus improving modularity and integration level, providing a simple and compact structure and reduced costs of production and maintenance, and facilitating assembling and disassembling.

[0022] Specifically, the casing 1 may be connected with the cabinet 100 and define a heat exchange chamber 10a and at least one mounting chamber, the condenser 2 may be disposed in the heat exchange chamber 10a,

the heat exchange chamber 10a has a heat exchange inlet and a heat exchange outlet, the heat exchange outlet communicates with the air inlet, and air after heat exchange in the heat exchange chamber 10a may flow out through the heat exchange outlet and enter the inner drum through the air inlet. The compressor 3, the evaporator 4 and the throttling device 5 may be disposed to the casing 1, and the throttling device 5 is sequentially connected with the condenser 2, the compressor 3 and the evaporator 4 to form a heat pump circuit. A refrigerant may flow in the heat pump circuit and exchange heat with air in the heat exchange chamber 10a, such that the heat pump circuit can provide heat energy for drying the clothes in the inner drum.

[0023] At least one of the compressor 3, the evaporator 4, the throttling device 5 and a fan assembly 6 is disposed in a corresponding mounting chamber. For example, in an embodiment shown in Fig. 12, the casing 1 is provided with three mounting chambers, the compressor 3, the evaporator 4 and the throttling device 5 are correspondingly disposed in the three mounting chambers, thus arranging and positioning the compressor 3, the evaporator 4 and the throttling device 5, accomplishing reasonable layouts of components and improving stability. The condenser 2, the compressor 3, the evaporator 4 and the throttling device 5 are connected together through connecting pipes.

[0024] Of course, a structure of the present disclosure is not limited thereby. The number of the mounting chambers is not limited to the above description, i.e. there may be one, two and four mounting chambers and so on, which should be understood by those skilled in the art and will not described in detail herein.

[0025] When the clothes dryer or washer-dryer 1000 works, first the clothes to be washed is washed in the inner drum 200, then the heat pump module 300 starts working, and the fan assembly 6 transports hot air generated after heat exchange into the inner drum 200 to dry the washed clothes. Specifically, the compressor 3 starts working to compress the refrigerant, a high-pressure refrigerant compressed by the compressor 3 is discharged from the compressor 3, flows into the condenser 2 through the connecting pipes and emits heat in the condenser 2 to raise a temperature of the air in the heat exchange chamber 10a, and the high-temperature high-pressure refrigerant is converted into a medium-temperature high-pressure refrigerant at the same time. High-temperature air in the heat exchange chamber 10a can flow out through the heat exchange outlet and flow into the inner drum 200 through the air inlet to dry the clothes in the inner drum 200.

[0026] Then the refrigerant flows out of the condenser 2 and flows into the throttling device 5 to be throttled and depressurized, the medium-temperature high-pressure refrigerant is throttled and depressurized to become a low-temperature low-pressure refrigerant which flows to the evaporator 4, and absorbs heat in the evaporator 4 to be vaporized. Finally, the refrigerant flows back to the compressor 3 to accomplish a circulation so as to dry the clothes.

[0027] In a drying process, the fan assembly 6 may accelerate flowing of the high-temperature air, such that the high-temperature air flowing out through the heat exchange outlet may quickly flow into the inner drum 200 through the air inlet, thus raising a drying speed.

[0028] In the clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure, the condenser 2, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 are disposed to the casing 1, the casing 1 is connected with the cabinet 100, and at least one of the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 is disposed in a corresponding mounting chamber, thereby integrally mounting the heat pump module 300 to the cabinet 100, and accomplishing reasonable layout and stable installation of the components such as the compressor, the evaporator, the throttling device and the fan assembly, so the clothes dryer or washer-dryer 1000 is simple and compact in structure, convenient to assemble and disassemble, low in the costs of production and maintenance, and good in drying effect.

[0029] According to some embodiments of the present disclosure, as shown in Fig. 1 and Fig. 2, an upper end face of the cabinet 100 may be configured as an annular upper end face 100A, a lower surface of the casing 1 is provided with a supporting fitting surface 100B which can be supported on the annular upper end face 100A, thus mounting the casing 1 to the upper end of the cabinet 100, providing a simple structure and reliable positioning, and improving an appearance of the clothes dryer or washer-dryer 1000 to some extent.

[0030] In some embodiments, the supporting fitting face 100B may be provided with a supporting groove recessed upwards, and at least a portion of the annular supporting face is inserted in the supporting groove, to position the annular upper end face 10 and the supporting fitting face 100B, thus preventing malposition during assembling.

[0031] In some embodiments, the casing 1 is detachably connected with the cabinet 100, thus provide convenient assembling, disassembling and maintenance.

[0032] Optionally, the casing 1 is fixedly connected with the cabinet 100 through a threaded fastener. Specifically, the casing 1 is provided with a first mounting hole, the cabinet 100 may be provided with a second mounting hole for fitting with the threaded fastener, and the threaded fastener may pass through the first mounting hole and be fitted in the second mounting hole to fixedly connect the casing 1 and the cabinet 100, thus providing reliable positioning and connection, a high assembling efficiency with low mounting difficulty and a reduced cost, and facilitating processing and manufacturing.

[0033] According to some embodiment of the present disclosure, as shown in Fig. 1 and Fig. 2, an upper end of a front surface of the cabinet 100 may be provided with

a control panel 101, the control panel 101 may have a control region for controlling the clothes dryer or washer-dryer 1000 to operate, and a user can control the clothes dryer or washer-dryer 1000 to operate through the control region to wash and dry the clothes. The control panel 101 may extend upwards beyond the upper end face of the cabinet 100 and abut against the casing 1, thus preventing the casing from being exposed, and further improving the appearance of the clothes dryer or washer-dryer 1000.

[0034] Optionally, the clothes dryer or washer-dryer 1000 may include an outer cover (not shown in figures), the outer cover may be detachably disposed to the casing 1 to protect the casing 1 and other components, and the outer cover may make the appearance of the clothes dryer or washer-dryer 1000 better.

[0035] In the following, a specific structure of the heat pump module 300 is described with reference to drawings.

[0036] Referring to Fig. 1 to Fig. 15, the heat pump 300 may include the casing 1, the condenser 2, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6, in which the condenser 2, the compressor 3, the evaporator 4 and the throttling device 5 are sequentially connected to form the heat pump circuit.

[0037] According to some embodiments, the heat pump module 300 may further include a filter 7. As shown in Fig. 6, the filter 7 may be disposed to the casing 1 and have a filtering inlet and a filtering outlet. The filtering inlet communicates with the air outlet, the air in the inner drum 200 flows out through the air outlet and enters the filter 7 through the filtering inlet, and the filer 7 filters flocks and the like impurities in the air. The filtering outlet may communicate with the heat exchange inlet, and clear air after filtering may flow into the heat exchange chamber 10a through the heat exchange inlet after passing the filtering outlet, exchange heat with the condenser 2 and absorb heat of the condenser 2 to carry out a drying circulation. Therefore, the filter 7 can filter the air entering the heat exchange chamber 10a, thus improve cleanliness of the air in the inner drum 200, preventing the flocks and the like impurities from entering the heat exchange chamber 10a, and improving heat exchanging performance of the condenser 2 to some extent.

[0038] In order to reduce vibration, the heat pump module 300 may further include a damping device 8. As shown in Fig. 5 to Fig. 7, the damping device 8 may be disposed on the compressor 3. The damping device can be used for buffering to reduce vibration generated by the compressor 3 when the compressor compresses the refrigerant, thus not only ensuring that the heat pump module 300 can normally work, but also reducing noise.

[0039] As shown in Fig. 6, Fig. 10 and Fig. 11, the fan assembly 6 may be disposed on the lower surface of the casing 1 to accelerate circulation of the air in the inner drum 200. An internal space of the casing 1 can be saved through disposing the fan assembly 6 on the lower surface of the casing 1, which can facilitate layout and mounting of the condenser 2, the evaporator 4 and the throttling device 5, such that the internal space of the casing 1 can be reasonably utilized, the heat pump module 300 can have a simple and compact structure, and components can have a reasonable layout.

[0040] In the following, the casing 1 of the heat pump module 300 in the clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure is described with reference to the drawings.

[0041] According to some embodiments of the present disclosure, as shown in Fig. 2 to Fig. 15, the casing 1 may define the heat exchange chamber 10a therein, and the condenser 2 is disposed in the heat exchange chamber 10a. The casing 1 may define at least one mounting chamber, and at least one of the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 is disposed in a corresponding mounting chamber.

[0042] In some embodiments, as shown in Fig. 2 to Fig. 15, the casing 1 may include a base 11 and a cover body 12. The base 11 may be disposed on the cabinet 100, and the condenser 2, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 may be disposed to the base 11, and at least one of the condenser 2, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 is supported on the base 11 to improve stability of positioning the components to some extent. The cover body 12 detachably covers on the base 11, and the cover 12 may shield at least one of the compressor 3, the evaporator 4, and the throttling device 5 to protect the components. For example, in an example shown in Fig. 5, the condenser 2, the compressor 3, the evaporator 4 and the throttling device 5 are supported on the base 11 and shielded by the cover body 12, thus improving stability and safety, protecting the components by the cover body 12, preventing the components from being exposed, and improving the appearance.

[0043] Specifically, the cover body 12 may cooperate with the base 11 to define the heat exchange chamber 10a and the at least one mounting chamber, the condenser 2 may be mounted in the heat exchange chamber 10a, and at least one of the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 may be disposed in the corresponding at least one mounting chamber to improve stability during mounting.

[0044] As shown in Fig. 6, Fig. 10 and Fig. 11, the fan assembly 6 may be disposed to the casing 1, the fan assembly 6 may have an inlet and an outlet, the inlet may communicate with the heat exchange outlet, and the outlet may communicate with the air inlet. An outlet end of the fan assembly 6 may stretch downwards out of the base 11, and the fan assembly 6 may be connected with the inner drum 200 through an air intake pipe, so after the condenser 2 emits heat, the heat can be transmitted to air around the condenser 2, the fan assembly 6 may blow the air flowing out through the heat exchange outlet into the inner drum 200 to dry the clothes, which can accelerate circulation of the air and raise a drying effi-

ciency.

[0045] In some embodiments, as shown in Fig. 5 to Fig. 7, the at least one mounting chamber may include a compressor mounting chamber 101b, an evaporator mounting chamber 102b and a throttling device mounting chamber 103b. The compressor 3, the evaporator 4 and the throttling device 5 may be respectively mounted in the compressor mounting chamber 101b, the evaporator mounting chamber 102b and the throttling device mounting chamber 103b, so the compressor 3, the evaporator 4 and the throttling device 5 can be mounted in respective mounting chambers, which provides a reasonable layout of the components, reduces mounting difficulty and simplifies mounting steps.

[0046] Optionally, as shown in Fig. 12, the casing 1 may be provided with a first two-component chamber and a second two-component chamber therein, in which the first two-component chamber may be provided with a separating plate therein to separate the first two-component chamber into the heat exchange chamber 10a and the evaporator mounting chamber 102b. That is, the first two-component chamber is separated into the heat exchange chamber 10a and the evaporator mounting chamber 102b through the separating plate, such that a heat exchanger and the evaporator 4 may be disposed in the first two-component chamber and spaced apart from each other.

[0047] Further, as shown in Fig. 7 and Fig. 12, the compressor mounting chamber 101b may communicate with the throttling device mounting chamber 103b to form the second two-component chamber, and the compressor 3 and the throttling device 5 may be disposed in the second two-component chamber. The second two-component chamber can position the compressor 3 and the throttling device 5 to improve stability and reliability of the compressor 3 and the throttling device 5, and to reduce the number of mounting chambers, which means that the mounting chambers are larger in size and convenient to manufacture.

[0048] As shown in Fig. 5 to Fig. 7 and Fig. 12, the first two-component chamber may be located in front of the second two-component chamber, that is the evaporator 4 and the condenser 2 may be mounted at positions close to the control panel 101, and the compressor 3 and the throttling device 5 may be disposed at a rear side of the casing 1, thus further optimizing the layout of the components, reducing vibration and raising a heat exchange efficiency.

[0049] According to some embodiments of the present disclosure, as shown in Fig. 12, the at least one mounting chamber may further include a filter mounting chamber 104b, and the filter 7 may be disposed in the filter mounting chamber 104b, thus facilitating mounting the filter 7 and positioning the filter 7.

[0050] In a selectable embodiment, the base 11 may be connected with a cover plate through threaded fasteners, thus detachably mounting the base 11 and the cover plate, and providing a simple structure and convenient dismounting and mounting. Optionally, as shown in Fig. 6 and Fig. 15, the heat exchanger or the evaporator mounting chamber 102b may be provided with a plurality of columns 111 with threaded holes, and the threaded fasteners may pass through the cover plate and be fitted in the threaded holes of the columns 111 to connect the cover plate with the base 11.

[0051] In the following, a manner of positioning the condenser 2 and the evaporator 4 to the casing 1 in the clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure is described with reference to Fig. 5 to Fig. 15.

[0052] According to some embodiments of the present disclosure, at least one of the heat exchange chamber 10a and the evaporator mounting chamber 102b may be provided with a slot 112, and at least one of the evaporator 4 and the condenser 2 may be provided with an inserting tongue 113 for inserting into the corresponding slot 112. The inserting tongue 113 is fitted in the slot 112 to position the condenser 2 and the evaporator 4 into the heat exchange chamber 10a or the evaporator mounting chamber 102b. On the one hand, the condenser 2 and the evaporator 4 can be positioned to prevent malposition caused by waggle during transportation; one the other hand, vibration generated during usage of the condenser 2 and the evaporator 4 can be reduced, thus improving stability and reducing noise.

[0053] According to some embodiments of the present disclosure, referring to Fig. 1 to Fig. 15, the condenser 2 and/or the evaporator 4 may have a fin structure to improve the heat exchange efficiency. Two ends of the condenser 2 and/or the evaporator 4 may be individually provided with the inserting tongue 113, and two ends of the heat exchange chamber 10a and/or the evaporator mounting chamber 102b may be individually provided with the slot 112, to achieve further positioning and improve the stability and the reliability. That is at least one of the condenser 2 and the evaporator 4 may have the fin structure to improve the heat exchange efficiency, two ends of at least one of the condenser 2 and the evaporator 4 may be individually provided with the inserting tongue 113, the heat exchange chamber 10a and the evaporator mounting chamber 102b are provided with the slot 112 therein, and the inserting tongue 113 is inserted in the slot 102b to position at least one of the condenser 2 and the evaporator 4, thus firmly mounting and providing the stability and the reliability.

[0054] Optionally, the heat exchanger and/or the evaporator 4 may be rectangular in shape, and two nonadjacent corners of the condenser 2 and/or those of the evaporator 4 may be individually provided with the inserting tongue 113, to position the condenser 2 or the evaporator 4 in the heat exchange chamber 10a or the evaporator mounting chamber 102b through cooperation between two slots 112 and two inserting tongues 113.

[0055] Preferably, as shown in Fig. 7 to Fig. 9, the condenser 2 and/or the evaporator 4 may be rectangular in shape, and four corners of the condenser 2 and/or those

of the evaporator 4 may be individually provided with the inserting tongue 113. That is four corners of at least one of the condenser 2 and the evaporator 4 may be individually provided with the inserting tongues 113, the heat exchange chamber 10a or the evaporator mounting chamber 102b are correspondingly provided with four slots 112, and the four inserting tongues 113 are fitted in the corresponding four slots 112, thus further improving the stability and the reliability of the condenser 2 and the evaporator 4, preventing malposition and reducing the vibration and the noise.

[0056] In some embodiments, the condenser 2 and/or the evaporator 4 may be rectangular in shape, and two ends of the condenser 2 and/or those of the evaporator 4 may be individually provided with an edge plate 13. The edge plate 13 may include a vertical plate segment 131 having at least one end extending outwards beyond the condenser 2 and/or the evaporator 4 to form the inserting tongue 113, which is simple in structure and convenient to process.

[0057] For example, as shown in Fig. 5 to Fig. 9, the condenser 2 is rectangular in shape, the two ends of the condenser 2 are individually provided with the edge plate 13 including the vertical plate segment 131, and two ends of the vertical plate segment extend outwards beyond the condenser 2 to form the inserting tongue 113. Therefore, the four corners of the condenser 2 may be provided with four inserting tongues 113, and the four inserting tongues 113 are respectively inserted into corresponding four slots 112 to position the condenser 2. Similarly, the evaporator 4 is rectangular in shape, and the two ends of the evaporator 4 are individually provided with the edge plate 13 including the vertical plate segment 131, two ends of the vertical plate segment extend outwards beyond the evaporator 4 to form the inserting tongue 113, and the inserting tongue 113 is fitted in the slot 112 in the evaporator mounting chamber 102b to position the evaporator 4. After the inserting tongues 113 are aligned with the slots 112, the condenser 2 and the evaporator 4 can be pushed downwards to be mounted, which is low in mounting difficulty and high in efficiency.

[0058] Optionally, each inserting tongue 113 has a length of 3 mm to 8 mm, that is the length of each inserting tongue 113 may be chosen in a range from 3 mm to 8 mm, thus positioning and mounting the condenser 2 and the evaporator 4, avoiding interference, saving mounting spaces of the heat exchange chamber 10a and the evaporator mounting chamber 102b, and making the layout of the components more reasonable.

[0059] According to some embodiments of the present disclosure, as shown in Fig. 15, the heat exchange chamber 10a and the evaporator mounting chamber 102b may be individually provided with a mounting plate pair 110. The mounting plate pair 110 includes two mounting plates 1101 which extend along a vertical direction and disposed in parallel, and the slot 112 may be defined by the two mounting plates 1101 of the mounting plate pair 110. That is the slot 112 may be formed between the two mounting plates 1101 disposed in parallel, which can simplify a structure of the slot 112, facilitate processing and assembling and provide a low cost.

[0060] Optionally, at least one column 111 with the threaded hole may be connected with the mounting plate pair 110, to improve strength of the column 111 with the threaded hole and the mounting plate pair 110 and the reliability thereof. For example, in an embodiment shown in Fig. 15, the two mounting plates 1101 are connected with the column 111 with the threaded hole through a connecting plate 1102, and the connecting plate 1102 separates the mounting plate pair 110 into two slots 112. On the one hand, the connecting plate 1102 can improve strength and stability of the slots; one the other hand, the connecting plate 1102 and the mounting plate pair 110 can improve the strength of the column 111 with the threaded hole, thus preventing the column 111 with the threaded hole from deforming and further improving reliability of connection between the cover body 12 and the base 11.

[0061] Further, as shown in Fig. 13 and Fig. 14, each edge plate 13 may include an upper horizontal plate and/or a lower horizontal plate, an upper horizontal plate segment 132 may be connected to an upper end of the vertical plate segment 131, and a lower horizontal plate segment 132 may be connected with a lower end of the vertical plate segment 131. Moreover, as shown in Fig. 13, a level of an upper end face of the upper horizontal plate segment 132 may be higher than that of an upper end face of at least one of the heat exchanger and the evaporator 4, and a level of a lower end face of the lower horizontal plate segment 132 may be lower than that of a lower end face of the heat exchanger or the evaporator 4. Therefore, the lower horizontal plate segment 132 can abut against the base 11, and the upper horizontal plate segment 132 can separate the condenser 2 and the evaporator 4 from the cover body 12, which can reduce the vibration and the noise, facilitate heat exchange, and further improve heat exchanging performance of the condenser 2 and the evaporator 4.

[0062] To sum up, in the clothes dryer or washer-dryer 1000 according to the embodiments of the present disclosure, the condenser 2, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 and the like are mounted in the casing 1, and the casing 1 is connected with the cabinet 100, such that the heat pump module 300 can be integrally mounted to the cabinet 100; moreover, the compressor 3, the evaporator 4, the throttling device 5 and the fan assembly 6 are disposed in corresponding mounting chambers, which provides the reasonable layout and stable mounting of the components; and at the same time, the condenser 2 and the evaporator 4 can be reliably positioned in the heat exchange chamber 10a and the evaporator mounting chamber 102b through fitting of the inserting tongues 113 and the slots 112. The clothes dryer or washer-dryer 1000 is simple and compact in structure, high in integration level, convenient to assemble and disassemble, and low

in costs of production and maintenance.

[0063] Other configurations and operation of the clothes dryer or washer-dryer 100 according to embodiments of the present disclosure are known for those skilled in the art, which will not be described in detail herein.

[0064] In the specification, it is to be understood that terms such as "central," "longitudinal," "transverse," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," "counterclockwise," "axial," "radial," and "circumferential" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present disclosure be constructed or operated in a particular orientation.

[0065] In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may include one or more of this feature. In the description of the present disclosure, "a plurality of" means at least two, e.g. two or three and etc., unless specified otherwise.

[0066] In the present disclosure, unless specified or limited otherwise, the terms "mounted," "connected," "coupled," "fixed" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical, or electrical connections, or communicate with each other; may also be direct connections or indirect connections via intervening structures; may also be inner communications or interaction of two elements, which can be understood by those skilled in the art according to specific situations.

[0067] In the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of" a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of" a second feature may include an embodiment in which the first feature is right or obliquely "below," "under," or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

[0068] Reference throughout this specification to "an embodiment," "some embodiments," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples. Those skilled in the art can integrate and combine different embodiments or examples and the features in different embodiments or examples in the specification, in the condition without mutual contradiction.

[0069] Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that the above embodiments cannot be construed to limit the present disclosure, and changes, alternatives, and modifications can be made in the embodiments without departing from spirit, principles and scope of the present disclosure.

Claims

1. A clothes dryer or washer-dryer (1000) comprising:

a cabinet (100);
an inner drum (200) rotatably disposed in the cabinet (100) and having an air inlet and an air outlet; and
a heat pump module (300) disposed to an upper end of the cabinet (100) and comprising:

a casing (1) connected with the cabinet (100) and defining a heat exchange chamber (10a) and at least one mounting chamber therein, the heat exchange chamber (10a) having a heat
exchange inlet and a heat exchange outlet;
a condenser (2) disposed in the heat exchange chamber (10a),
a compressor (3) disposed to the casing (1);
an evaporator (4) disposed to the casing (1);
a throttling device (5) disposed to the casing (1) and sequentially connected with the condenser (2), the compressor (3) and the evaporator (4) to form a heat pump circuit; and
a fan assembly (6) disposed to the casing (1) and having an inlet and an outlet, the inlet communicating with the heat exchange outlet, and the outlet may communicating with the air inlet, wherein at least one of the compressor (3), the evaporator (4), the throttling device (5) and the fan assembly (6) is disposed in the corresponding at least one mounting chamber.

2. The clothes dryer or washer-dryer (1000) according to claim 1, wherein the fan assembly (6) is disposed on a lower surface of the casing (1).

3. The clothes dryer or washer-dryer (1000) according to claim 2, wherein the at least one mounting chamber comprises a compressor mounting chamber (101b), an evaporator mounting chamber (102b) and a throttling device mounting chamber (103b), and the compressor (3), the evaporator (4) and the throttling device (5) are respectively and correspondingly mounted in the compressor mounting chamber (101b), the evaporator mounting chamber (102b) and the throttling device mounting chamber (103b).

4. The clothes dryer or washer-dryer (1000) according to claim 3, wherein the casing (1) is provided with a first two-component chamber and a second two-component chamber, and the first two-component chamber is provided with a separating plate therein to separate the first two-component chamber into the heat exchange chamber (10a) and the evaporator mounting chamber (102b).

5. The clothes dryer or washer-dryer (1000) according to claim 4, wherein the compressor mounting chamber (101b) communicates with the throttling device mounting chamber (103b) to form the second two-component chamber.

6. The clothes dryer or washer-dryer (1000) according to claim 5, wherein the first two-component chamber is located in front of the second two-component chamber.

7. The clothes dryer or washer-dryer (1000) according to claim 1, wherein the heat pump module (300) further comprises a filter (7), the filter (7) is disposed to the casing (1) and has a filtering inlet and a filtering outlet, the filtering inlet communicates with the air outlet, and the filtering outlet communicates with the heat exchange inlet.

8. The clothes dryer or washer-dryer (1000) according to claim 7, wherein the at least one mounting chamber further comprises a filter mounting chamber (104b), and the filter (7) is disposed in the filter mounting chamber (104b).

9. The clothes dryer or washer-dryer (1000) according to any one of claims 1 to 8, wherein the casing (1) comprises:

a base (11) disposed on the cabinet (100); and a cover body (12) detachably covering on the base (11) and cooperating with the base (11) to define the heat exchange chamber (10a) and the at least one mounting chamber.

10. The clothes dryer or washer-dryer (1000) according to claim 9, further comprising an outer cover, wherein the outer cover detachably covers on the casing (1).

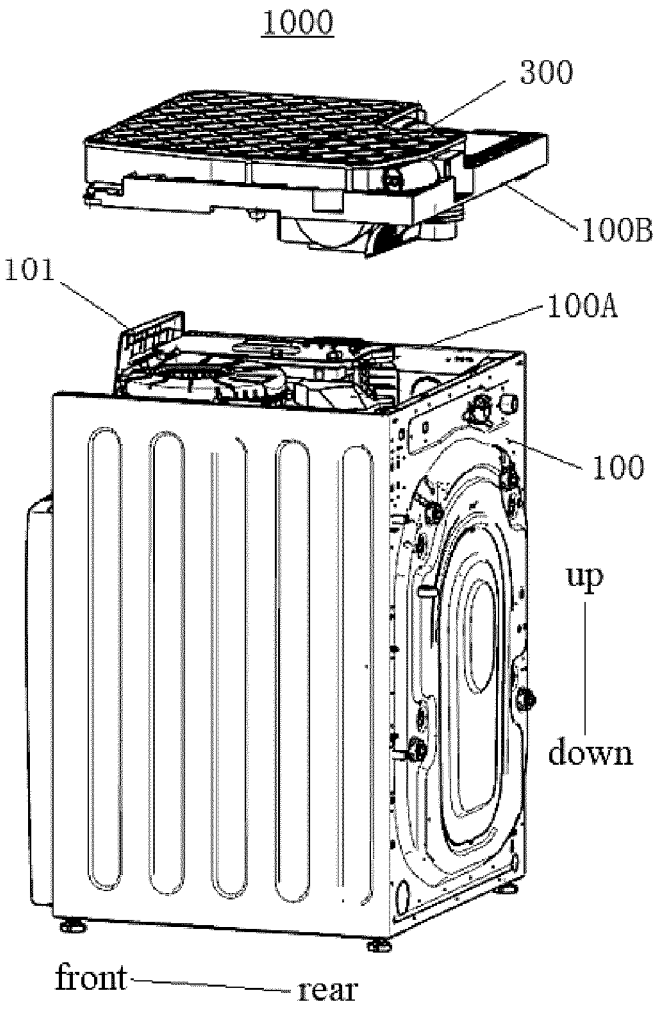

Fig. 1

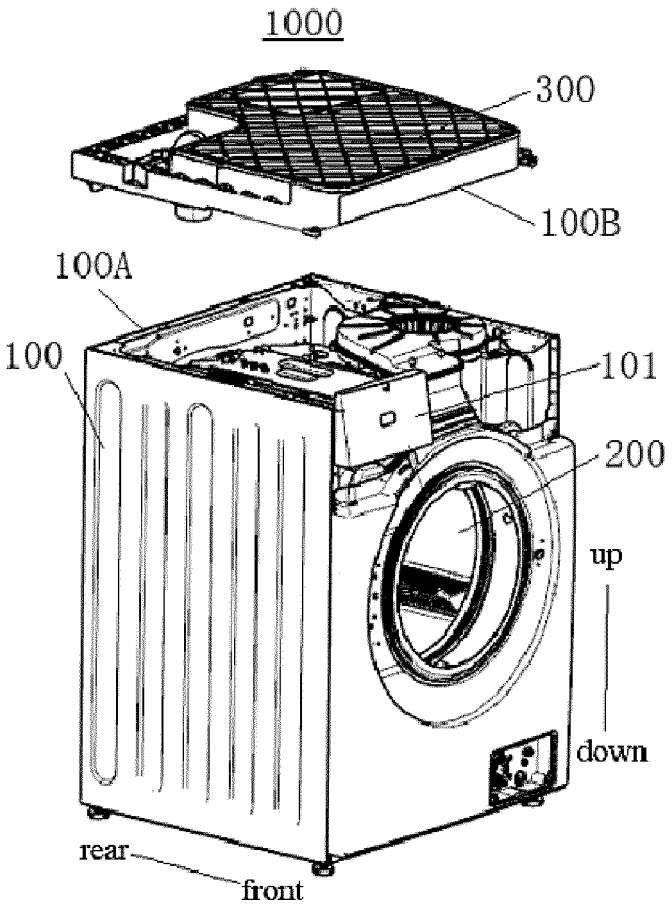

Fig. 2

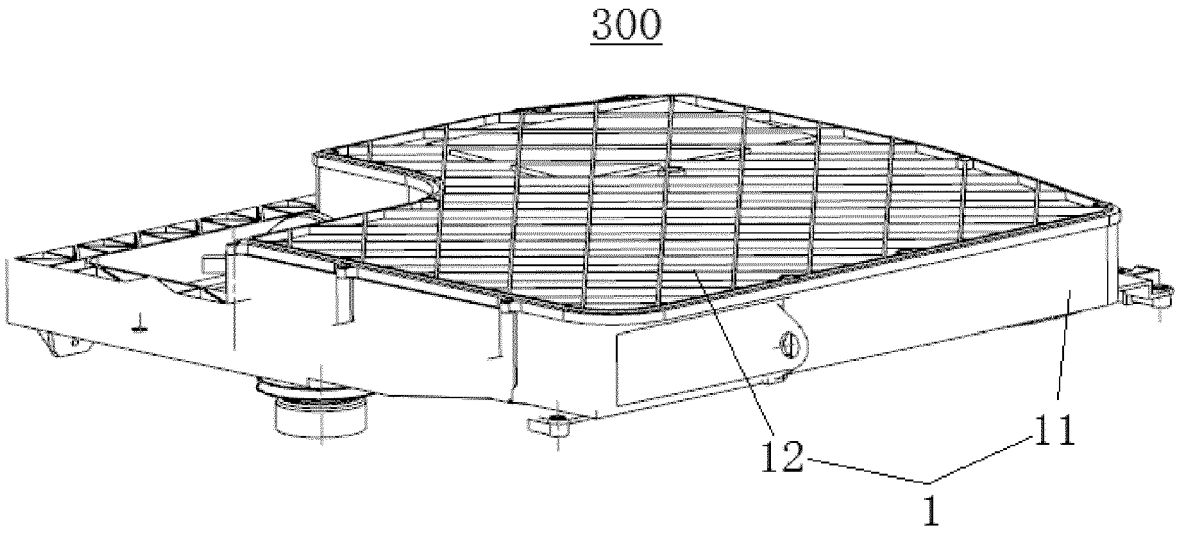

Fig. 3

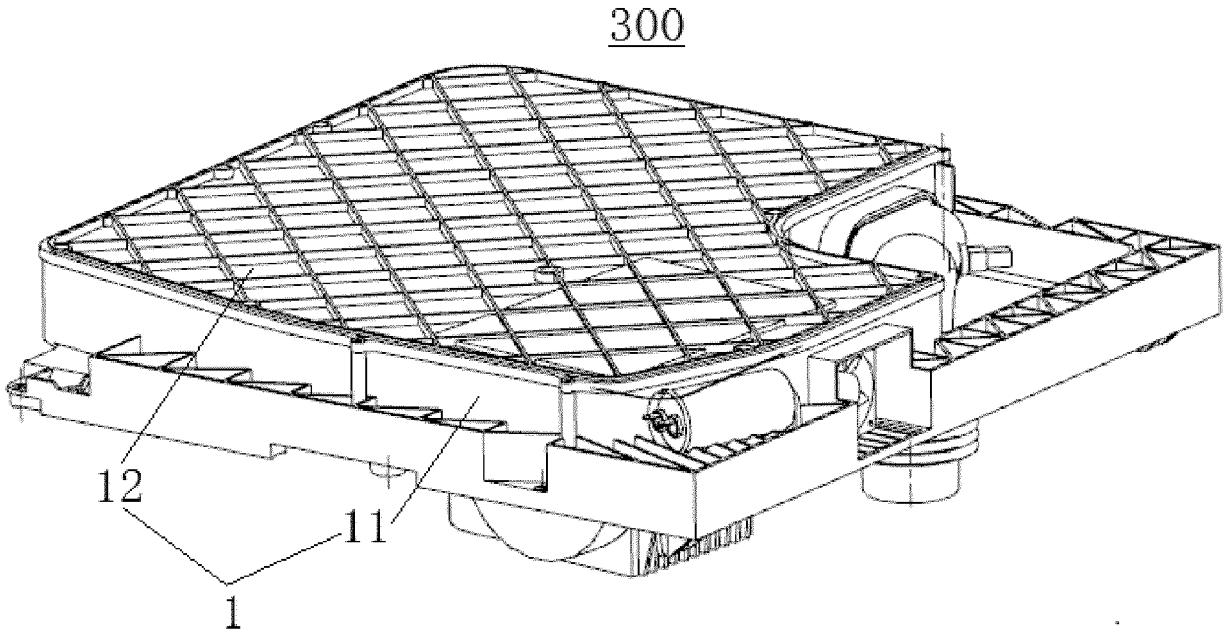

Fig. 4

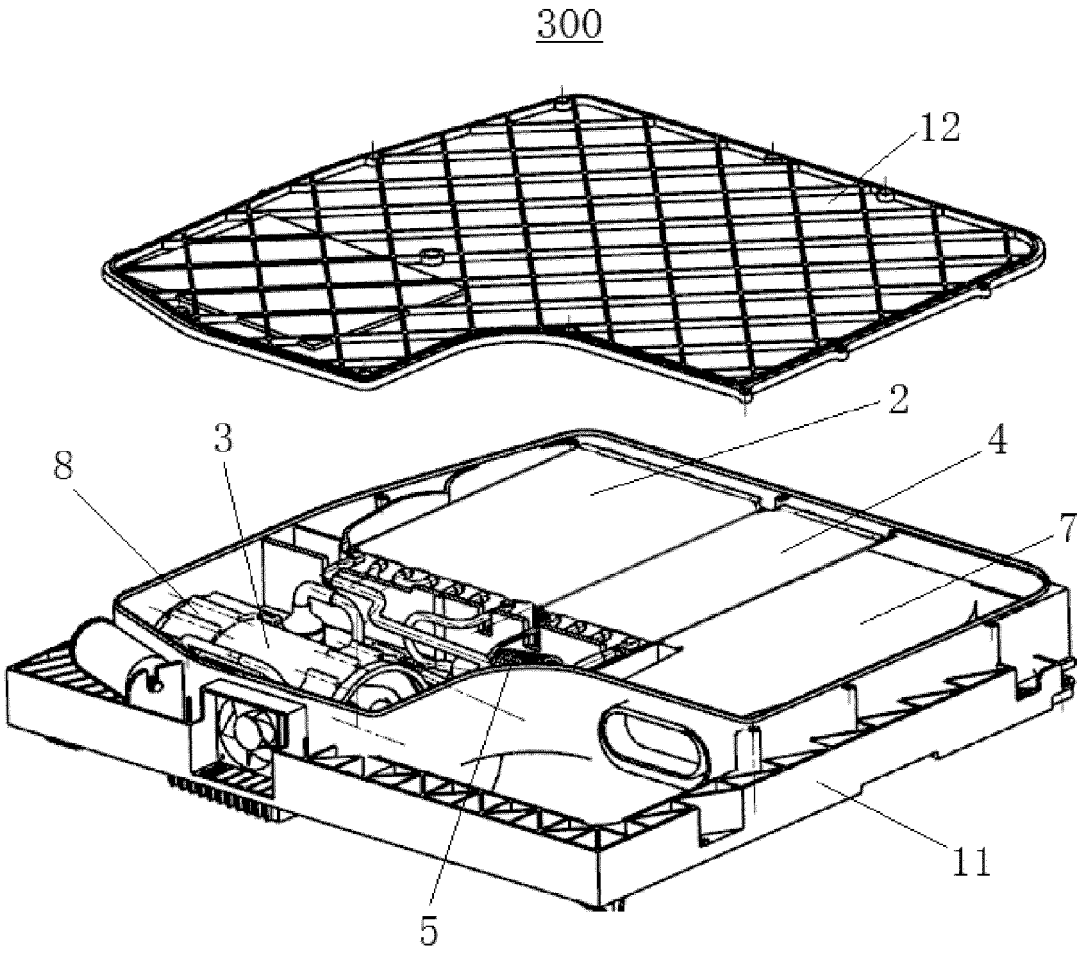

Fig. 5

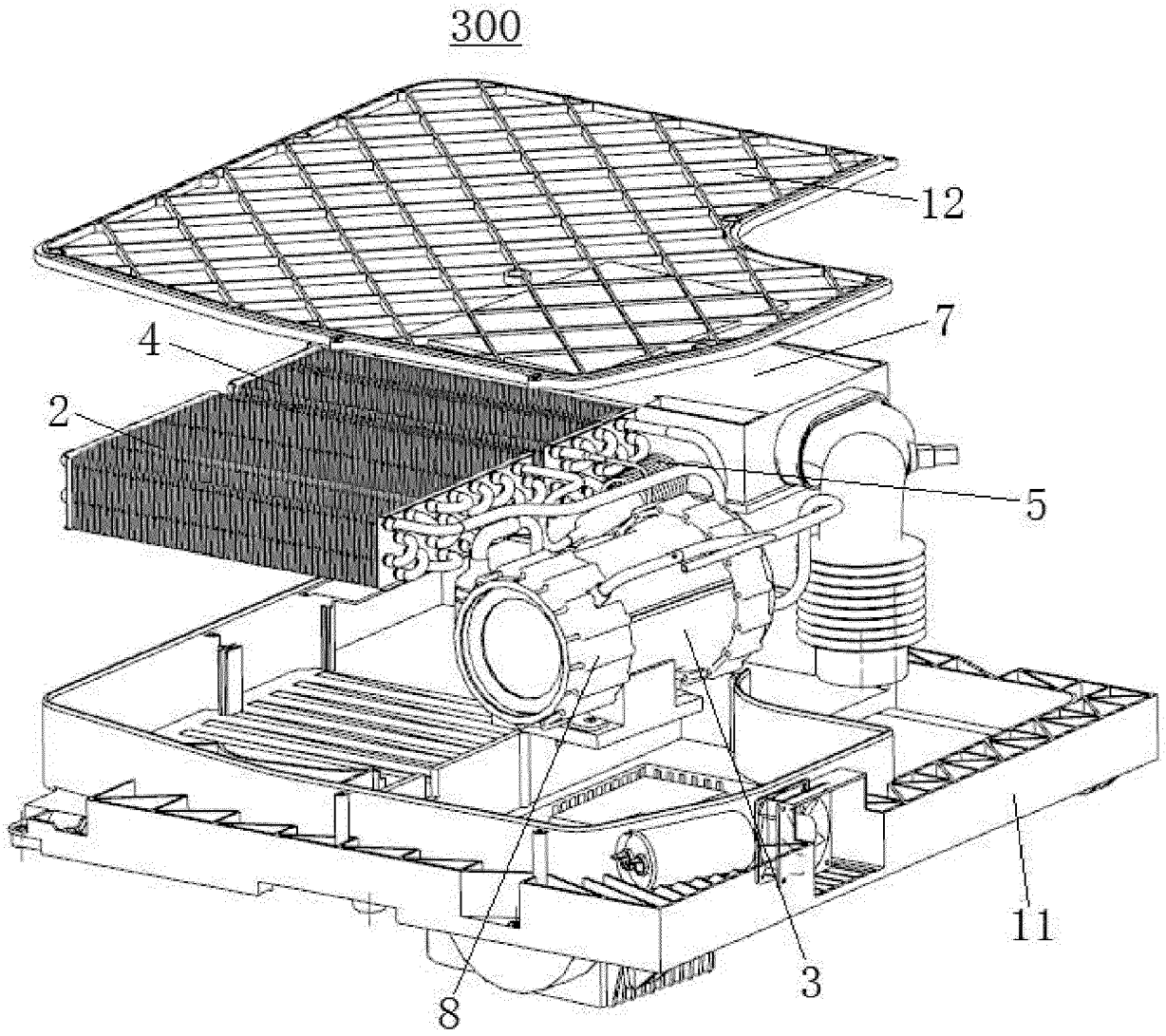

Fig. 6

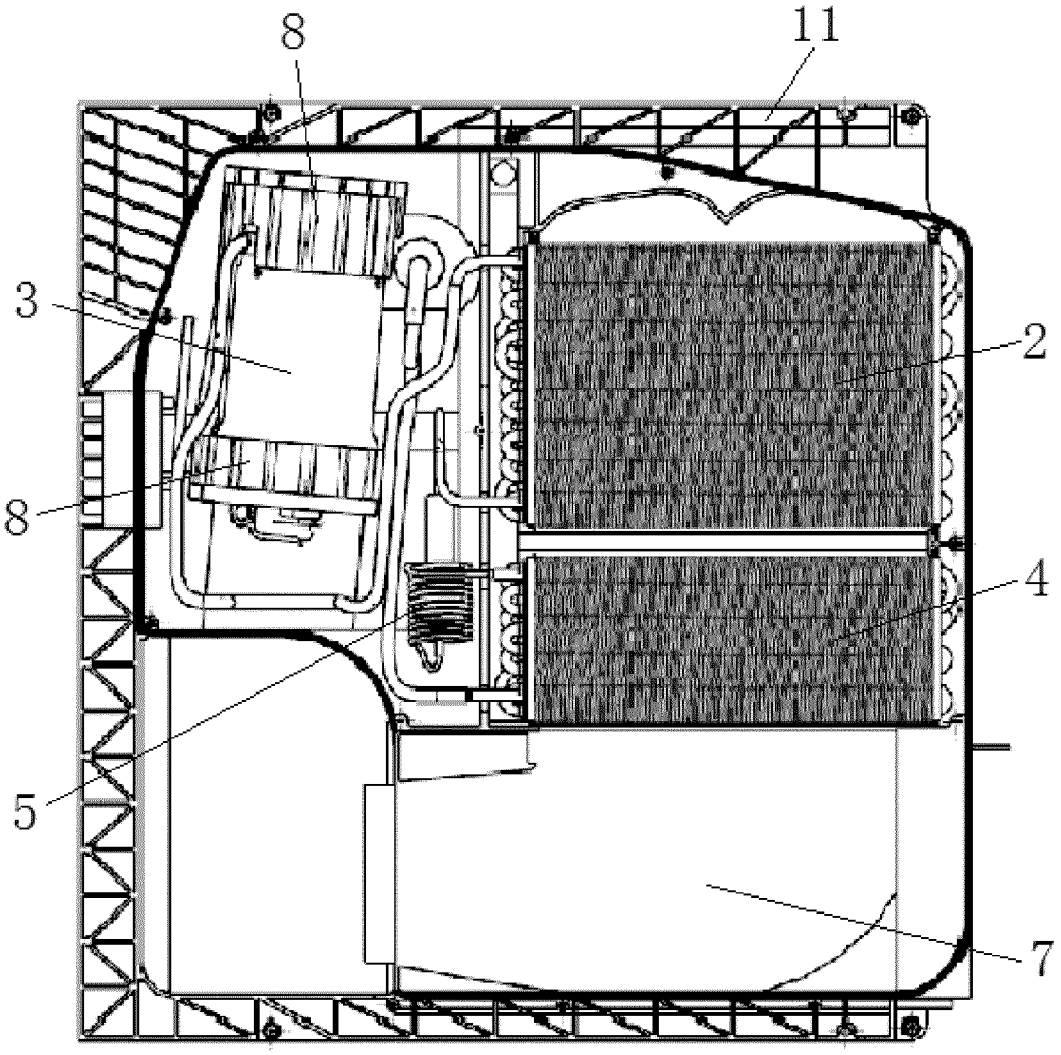

Fig. 7

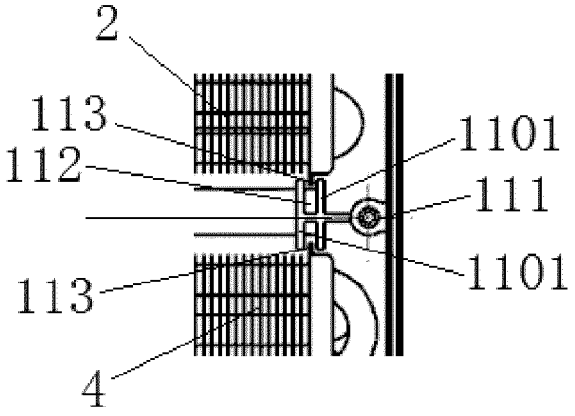

Fig. 8

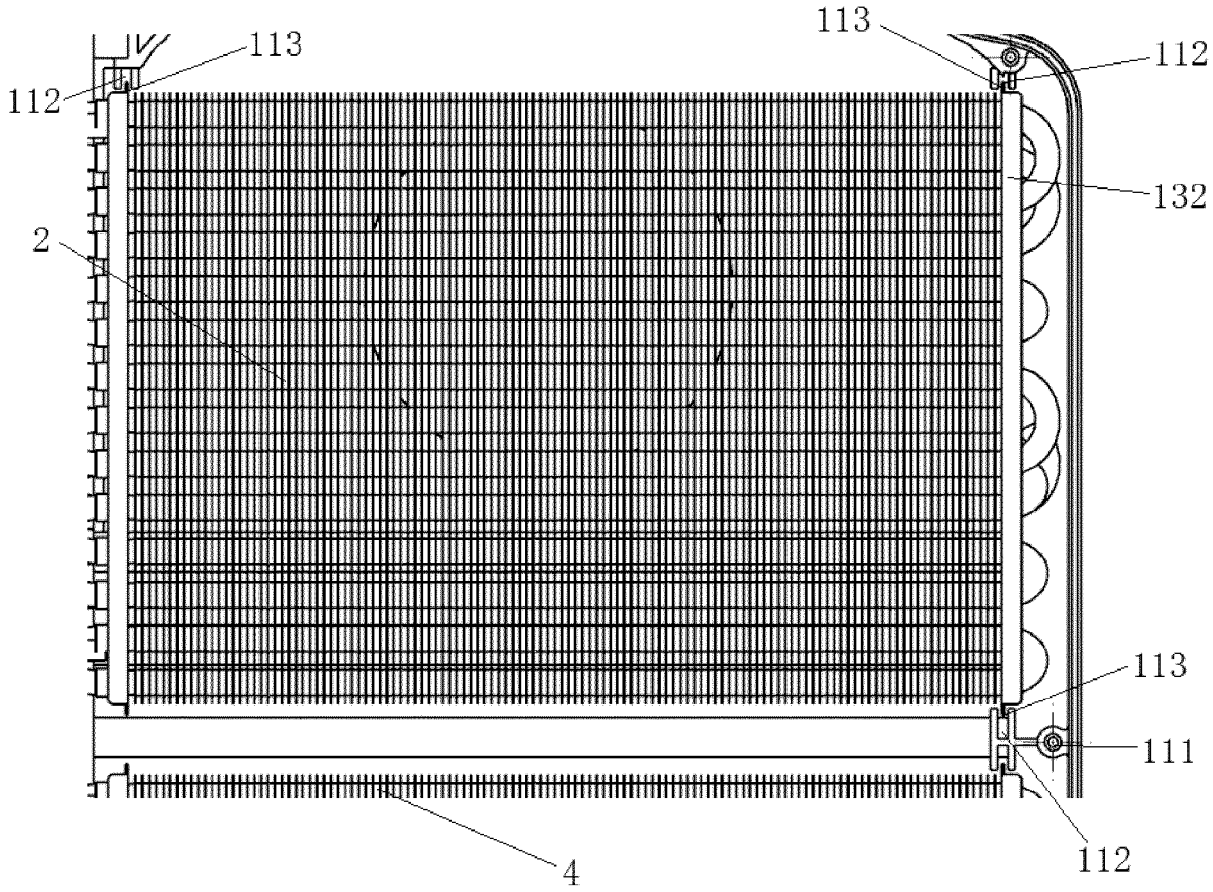

Fig. 9

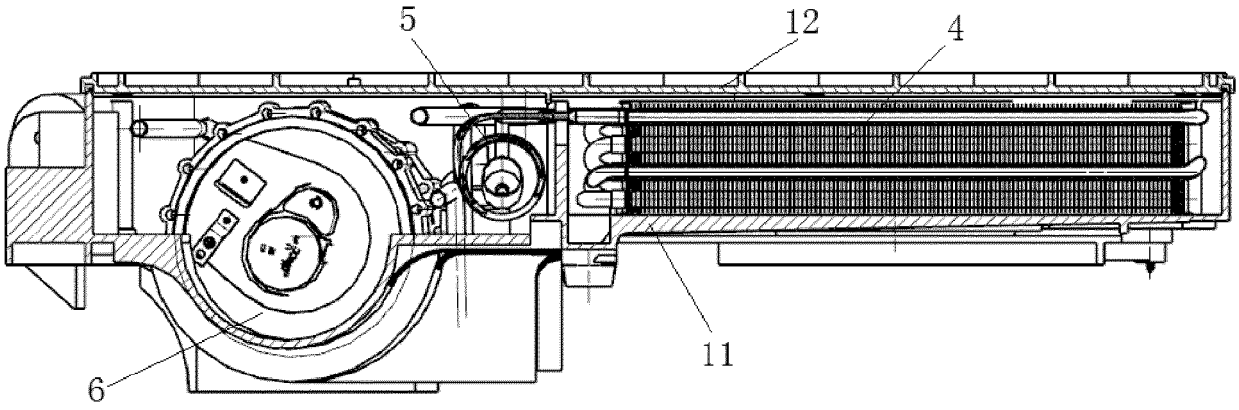

Fig. 10

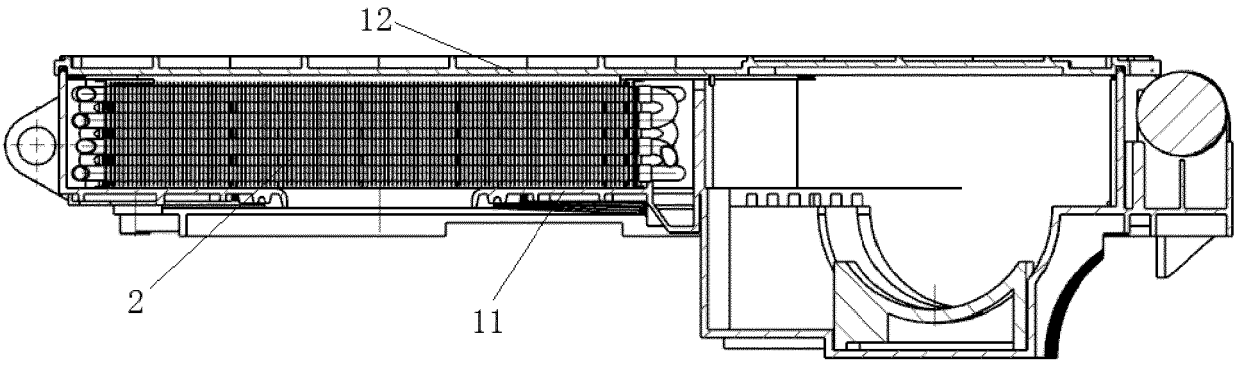

Fig. 11

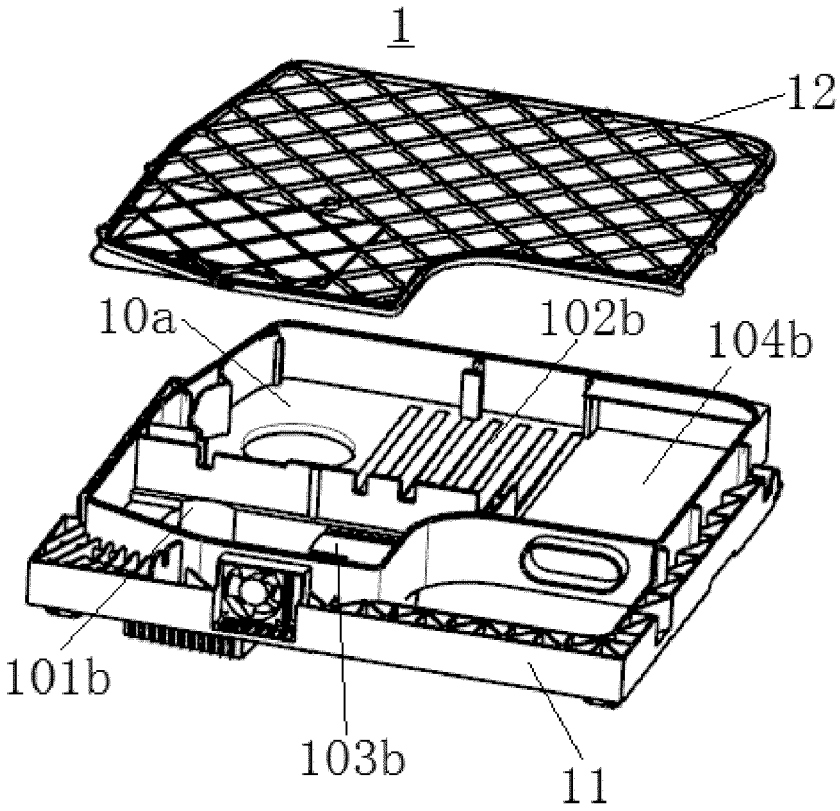

Fig. 12

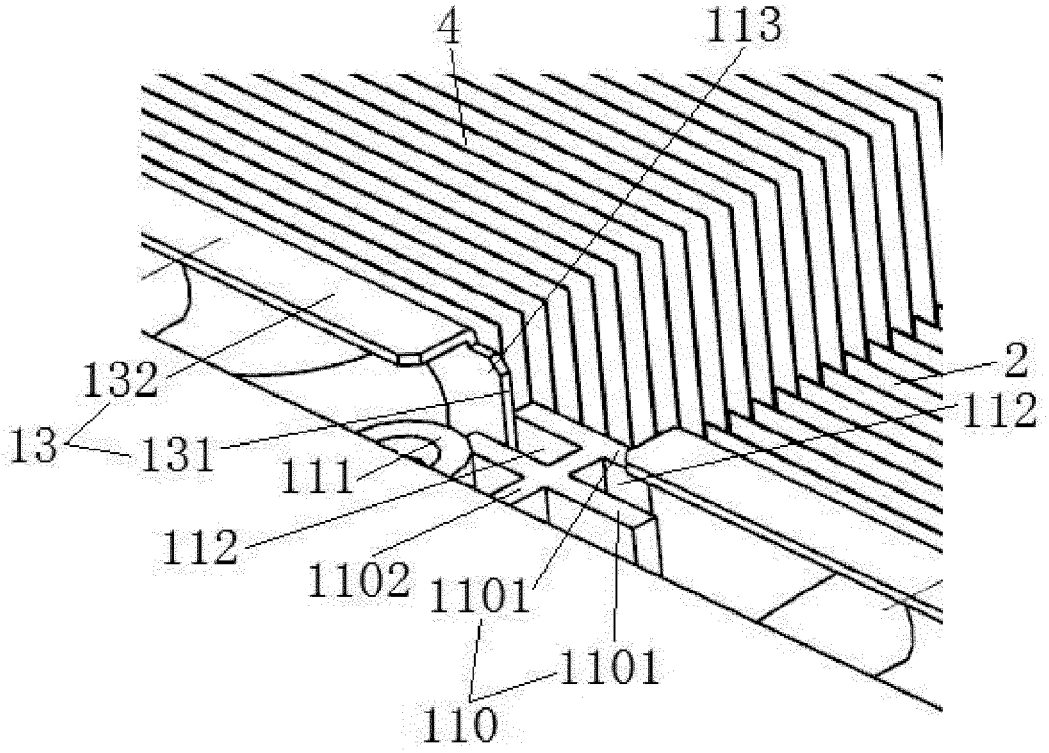

Fig. 13

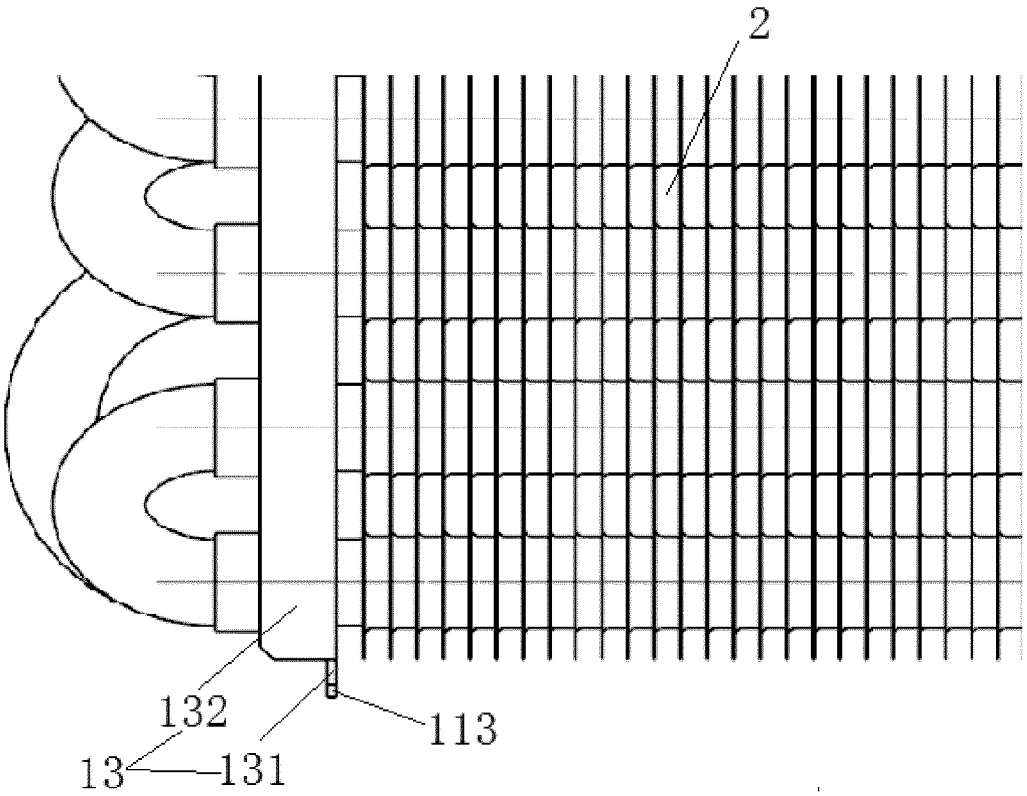

Fig. 14

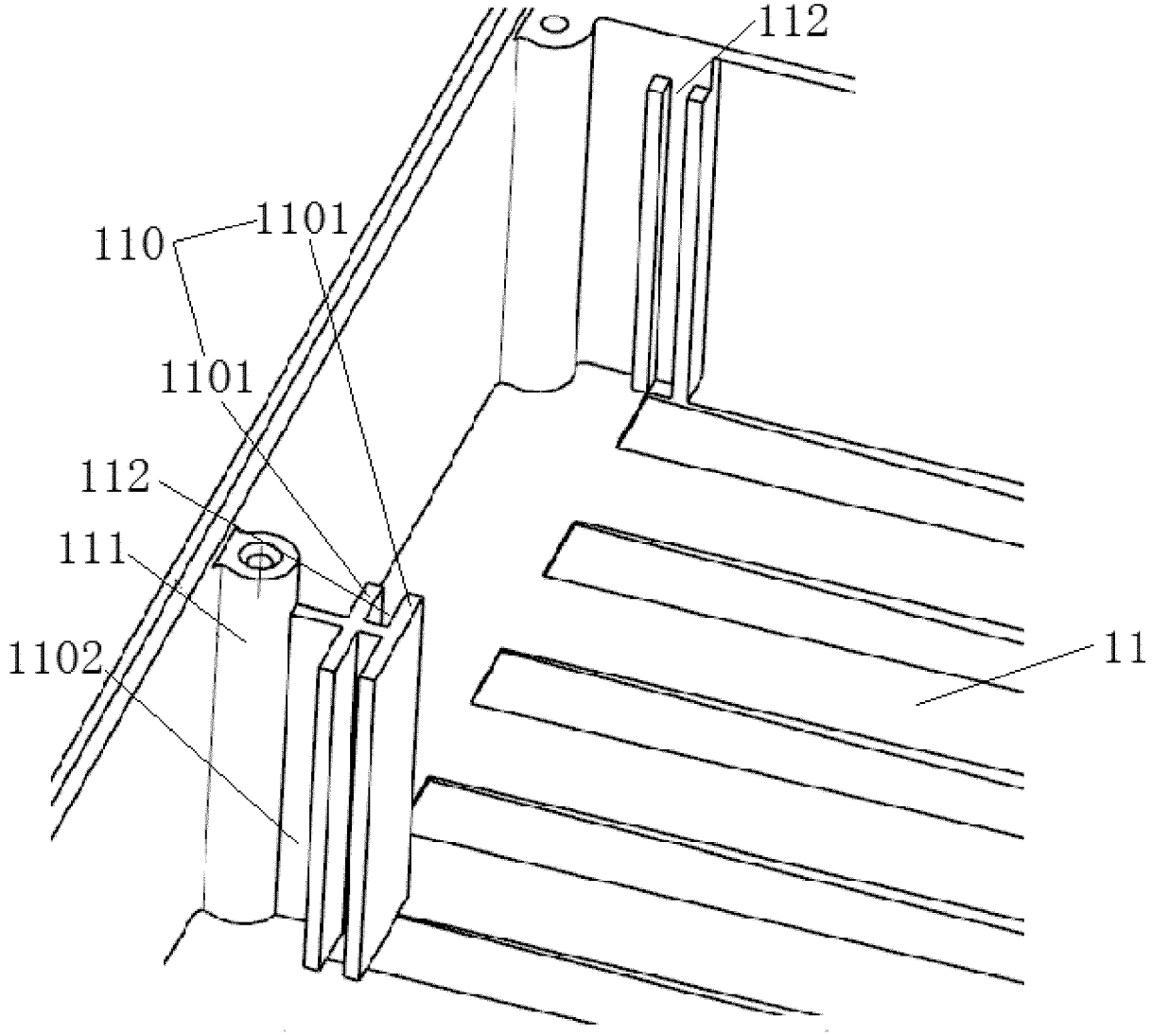

Fig. 15

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 20 5510

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 843 119 A1 (ELECTROLUX APPLIANCES AB [SE]) 4 March 2015 (2015-03-04) * paragraph [0032] - paragraph [0035] * * paragraph [0046] - paragraph [0057] * * figures 1-5F * -----	1-10	INV. D06F58/20 ADD. D06F25/00
X	EP 2 385 163 A1 (ELECTROLUX HOME PROD CORP [BE]) 9 November 2011 (2011-11-09) * paragraph [0013] - paragraph [0018] * * paragraph [0007] - paragraph [0010] * * paragraph [0027] - paragraph [0028] * * paragraph [0034] - paragraph [0057] * * figures 2-9 * -----	1-10	
X	EP 2 270 274 A1 (ELECTROLUX HOME PROD CORP [BE]) 5 January 2011 (2011-01-05) * paragraph [0025] - paragraph [0030] * * paragraph [0050] - paragraph [0052] * * paragraph [0056] - paragraph [0059] * * figures 1-27 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC) D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 February 2017	Bermejo, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 20 5510

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2843119 A1	04-03-2015	AU 2014314258 A1	10-03-2016
		CN 105492681 A	13-04-2016
		EP 2843119 A1	04-03-2015
		WO 2015028500 A1	05-03-2015
EP 2385163 A1	09-11-2011	BR PI1102068 A2	30-10-2012
		EP 2385163 A1	09-11-2011
		US 2011265523 A1	03-11-2011
EP 2270274 A1	05-01-2011	BR PI1014301 A2	05-04-2016
		CN 102686792 A	19-09-2012
		CN 104762797 A	08-07-2015
		EP 2270274 A1	05-01-2011
		EP 2660381 A1	06-11-2013
		EP 2660382 A1	06-11-2013
		EP 2660383 A1	06-11-2013
		EP 3109358 A1	28-12-2016
		RU 2012102983 A	10-08-2013
		RU 2014134882 A	20-03-2016
		RU 2014134884 A	20-03-2016
		RU 2014134887 A	20-03-2016
		US 2012159800 A1	28-06-2012
		US 2016083893 A1	24-03-2016
		WO 2011000760 A1	06-01-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82