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

(11) **EP 4 407 238 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.07.2024 Bulletin 2024/31

(21) Application number: **23153946.1**

(22) Date of filing: **30.01.2023**

(51) International Patent Classification (IPC):
F24D 3/08 *(2006.01)* ***F24D 11/02*** *(2006.01)*
F24D 17/02 *(2006.01)* ***F24H 4/04*** *(2006.01)*
F24H 9/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24H 4/04; F24D 3/08; F24D 11/02; F24D 17/02; F24H 9/02

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(71) Applicant: **BDR Thermea Group B.V.**
7332 BD Apeldoorn (NL)

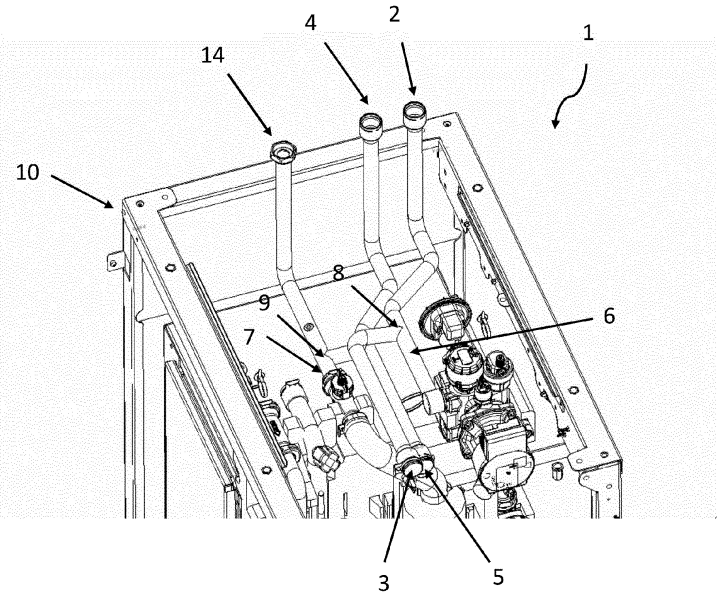
(72) Inventors:
- **WENDLING, Thomas**
  7332 BD Apeldoorn (NL)
- **BICHLER, Arnaud**
  7332 BD Apeldoorn (NL)
- **ANTOINE, Florian**
  7332 BD Apeldoorn (NL)

(74) Representative: **Dennemeyer & Associates S.A.**
Postfach 70 04 25
81304 München (DE)

(54) HEAT PUMP UNIT, ASSEMBLY OF A HEAT PUMP UNIT AND A TANK AND A METHOD OF INSTALLING A HEAT PUMP UNIT AND A TANK

(57) The invention relates to heat pump unit (1) comprising a liquid circuit. The heat pump unit (1) being configured to heat up liquid flowing through the liquid circuit, wherein the liquid circuit comprises connectors for fluidly connecting the liquid circuit to a tank (20), wherein the liquid circuit comprises
- at least two inlet connectors (2, 3) configured to receive liquid from the tank (20), and
- at least two outlet connectors (4, 5) configured to discharge liquid to the tank (20).

Fig. 1



EP 4 407 238 A1

Description

[0001] The invention relates to a heat pump unit. In addition, the invention relates to an assembly of a heat pump unit and a tank and a method of installing a heat pump unit and a tank.

[0002] Heat pump units use refrigerants to transport heat from a source medium (typically air or water) to a destination medium (typically air or water).

[0003] In a first heat exchanger (evaporator) heat is transferred from the source medium to the refrigerant. The refrigerant is circulated through a refrigerant circuit comprising a network of piping and components, including at least a first heat exchanger, a compressor, an expansion valve and a second heat exchanger (condenser). In the second heat exchanger, heat is transferred from the refrigerant to the destination medium.

[0004] One of the ways of characterising heat pump units is related to the source medium that is used. The main types are air source heat pump units and water source heat pump units. Heat pump units that use ground water as source medium are called ground source heat pump (GSHP) systems.

[0005] Heat pump units may be connected to a tank for storing hot liquid, e.g. water. This tank can be a domestic hot water tank.

[0006] The tank and the heat pump unit can be installed on top of each other or next to each other. Depending on the installation location and installation constraints, a choice is made where to install the tank relative to the heat pump unit. The heat pump market is evolving and it is now possible to install tanks in a wider range of locations. This is particularly the case for ground source heat pump units, which are installed indoors, usually in technical rooms. These rooms are usually limited in size and the compactness of the system becomes an important issue for the popularization of heat pump technology.

[0007] The heat pump unit usually has connections for connecting a hot liquid circuit of the heat pump unit to the tank. Water can flow from the tank to the heat pump unit to be heated up by a heat exchanger in the heat pump unit. The warmed water flows back to the tank.

[0008] The connections are provided to facilitate heating and storage of the liquid inside the tank. Typically, the connections are provided by single conduits or pipes that may be connected to the heat pump unit and the tank. These connections may also be on the back or at the top of the heat pump unit. However, these connections are not always easily accessible by an installer, for instance when there is little room at the installation location and/or the tank is obstructing access to the connections. The installer may be forced to make the connection blindly, i.e. without having a view on the connections. As a result installation errors can occur. A poor connection can lead to leaks in the liquid circuit or to premature fatigue of the elements.

[0009] The object of the invention is therefore to provide a heat pump unit that can be connected to a separate tank in an easy and reliable manner.

[0010] The object is solved by a heat pump unit comprising a liquid circuit, the heat pump unit being configured to heat up liquid flowing through the liquid circuit, wherein the liquid circuit comprises connectors for fluidly connecting the liquid circuit to a tank, wherein the liquid circuit comprises

- at least two inlet connectors configured to receive liquid from the tank, and
- at least two outlet connectors configured to discharge liquid to the tank.

[0011] Alternatively stated: the at least two inlet connectors are configured to receive liquid to be heated by the heat pump unit and the at least two outlet connectors are configured to discharge water heated by the heat pump unit.

[0012] There is provided a heat pump unit that can be connected to a tank via at least two connectors for the inlet as well as at least two connectors for the outlet. In an assembled state that connectors not used are closed, for instance by a plug. The connectors may be provided with quick-couplings, or are configured to work with quick-couplings, to connect the connectors to connection conduits.

[0013] The liquid may be water. The tank may be a water tank, comprising a reservoir. The tank may be configured to receive water from the heat pump unit directly in the tank reservoir. Alternatively, the tank comprises a tank heat exchanger positioned inside the tank reservoir, the tank heat exchanger being configured to receive water from the heat pump unit. The tank heat exchanger may heat up water present in the reservoir, surrounding the tank heat exchanger.

[0014] Such a heat pump unit has the advantage that different options are provided for connecting the heat pump unit to a tank. By providing a plurality of connectors an installer can choose which of the inlet connectors and which of the outlet connectors are best accessible and most convenient to use, depending on for instance the available space around the heat pump unit and tank and the relative position of the tank and the heat pump unit.

[0015] An installer may select the connectors that are best accessible. As a result, the risk of poor assembly and product damage are reduced. Also, visual inspection during installation as well as after installation and during maintenance is facilitated.

[0016] The inlet and outlet connectors may be closed, i.e. with a plug or a cap. The connectors selected to be connected to the tank can be opened, e.g. by removing the plug or the cap. The non-selected inlet and outlet connectors may remain closed.

[0017] According to an embodiment the heat pump unit comprises a heat pump housing and wherein

- at least one inlet connector and at least one outlet connector are provided in an inner space of the heat

pump housing, and

- at least one inlet connector and at least one outlet connector are provided on an outside of the heat pump housing.

[0018] This embodiment is advantageous, for instance when the tank is positioned relative to the heat pump unit such that the connectors provided on the outside of the heat pump housing are not or not easily accessible. In that case, the installer may select the connectors provided in the inner space of the heat pump housing. If the tank is positioned relative to the heat pump unit such that the connectors provided on the outside of the heat pump housing are accessible, the installer may select those connectors.

[0019] The at least one inlet connector and at least one outlet connector provided on the outside of the heat pump housing may protrude from the heat pump housing.

[0020] The inlet and outlet connectors provided on the outside of the heat pump may be positioned at the back side of the heat pump unit, or on the top side of the heat pump unit, close to the back side. These connectors may be used when there is sufficient space on the back side of the heat pump unit and tank to connect the heat pump to the tank. If there is sufficient space, there is good access for the tools and hands, good ergonomics, and a good visibility on the connection and sealing. Moreover, it allows for a simple geometry of pipes and conduits to connect the heat pump unit to the tank: there is free space, allowing for a straightforward connection without the need for many/complicated turns and bends. So it allows for rigid copper piping /conduits (better perceived quality, durability and strength).

[0021] However, if there is not enough space or access to the back of the heat pump unit, it is difficult to establish the connection: no space for tools and hands, no visibility, not enough space for making the rigid piping/conduits etc... Also, if there is sufficient space on the back of the heat pump unit but the connections on the water tank are on the front side (maybe because not enough access or to have a better visibility), long and complex piping / conduits are required to make the connection. So, in this case, the connectors on the inside of the heat pump unit may be more convenient.

[0022] According to an embodiment the heat pump unit comprises a heat pump housing, wherein at least one inlet connector and at least one outlet connector are provided inside the heat pump housing and are accessible by opening or removing the front panel or at least one inlet connector and at least one outlet connector are provided inside the heat pump housing and are accessible by opening or removing a hatch in a panel of the heat pump housing.

[0023] By providing connectors accessible for an installer by opening or removing the front panel, it is ensured that there are always connectors available for an installer, irrespective if the tank is positioned on top, below, or next to the heat pump unit.

[0024] These connectors are accessible with similar ease and in a similar way as other components of the heat pump unit, which may for instance need to be accessed for installation or maintenance purposes. These connectors can be accessed by opening or removing only the front panel of the heat pump unit. It makes it possible to install the system in a wider range of locations.

[0025] According to an embodiment the heat pump unit comprises a heat pump housing, wherein at least one inlet connector and at least one outlet connector are provided on a top side or back side of the housing.

[0026] The top side of the heat pump housing is the side of the heat pump unit that forms the upper side when the heat pump unit is positioned in its intended orientation. The connectors provided on the top side of the housing are reachable by an installer by leaning over the heat pump unit. The heat pump housing may for instance comprise a top panel and the at least one inlet connector and at least one outlet connector are provided in the top panel or at a surface parallel to or flush with the top panel.

[0027] By providing connectors at the top panel, a safe location for connectors is provided. When connecting the heat pump unit and the tank using connection conduits, these conduits do not protrude sideways, making them vulnerable to collisions with users and by-passers.

[0028] The connectors provided on the top side of the housing may for instance advantageously be used when positioning the tank next to the heat pump unit, while the connectors provided in the inside of the housing may advantageously be used when positioning the tank below or on top of the heat pump unit (tower configuration).

[0029] According to an embodiment the liquid circuit comprises a liquid inlet conduit configured to receive liquid from the tank, and wherein the at least two inlet connectors for receiving liquid from the tank are connected in parallel to the liquid inlet conduit and/or wherein the at least two inlet connectors are connected to the liquid inlet conduit upstream of, in particular any, control, operating or safety elements of the heat pump unit interacting with the liquid circuit.

[0030] According to an embodiment the liquid circuit comprises a liquid outlet conduit configured to discharge liquid to the tank, and wherein the at least two outlet connectors for discharging liquid to the tank are connected in parallel to the liquid outlet conduit and/or wherein the at least two outlet connectors are connected to the liquid outlet conduit downstream of, in particular any, control, operating or safety elements of the heat pump unit interacting with the liquid circuit.

[0031] These embodiments provide easy and reliable ways of providing two or more inlet connectors and two or more outlet connectors, without requiring difficult constructions.

[0032] The liquid inlet conduit may comprise an inlet splitter (Y- or T-splitter) to connect the liquid inlet conduit with a first and a second inlet connector. The liquid outlet conduit may comprise an outlet splitter (Y- or T-splitter) to connect the liquid outlet conduit with a first and a sec-

ond outlet connector.

[0033] By providing the inlet splitter upstream or of any control operating or safety element of the heat pump unit and/or providing the outlet splitter downstream or of any control operating or safety element of the heat pump unit, the functioning of the heat pump unit is not influenced by the selection of the selected inlet connector.

[0034] According to an embodiment the at least two inlet connectors and the at least two outlet connectors are configured to be closed, for instance with one of: a plug, a sealing cap, a screw cap, a clip-on cap, a cap fixed with reversible quick-coupling means such as a pin.

[0035] The means for closing the inlet and/or outlet connectors are preferably leakproof and/or removable.

[0036] Preferably, the outlet connectors and inlet connectors are compatible to be closed by the same closure means. Upon installing the heat pump unit, one inlet connector and one outlet connector may be closed, and in case the installer prefers to use one or two of the other inlet and outlet connectors, the closing means can simply be re-used.

[0037] Any other closing means may be used as well instead of a plug or sealing cap. The connectors that are not used can simply be closed by using a plug or a sealing cap.

[0038] The heat pump may further comprise two quick-couplings for connecting connection conduits to the selected inlet connector and selected outlet connector.

[0039] According to an embodiment the heat pump unit comprises a condenser configured to heat up the liquid by exchanging heat with a refrigerant.

[0040] According to an embodiment

- one inlet connector is orientated in a vertical direction and one inlet connector is orientated in a horizontal direction, and/or
- one outlet connector is orientated in a vertical direction and one outlet connector is orientated in a horizontal direction.

[0041] Vertically orientated inlet and outlet connectors have a vertical connection direction, i.e. a connection can be made by moving a connection conduit towards the connectors in a vertical direction. Horizontally orientated inlet and outlet connectors have a horizontal connection direction, i.e. a connection can be made by moving a connection conduit towards the connectors in a horizontal direction. Preferably, at least one inlet connector and at least one outlet connector are orientated in a horizontal direction and are provided in an inner space of the heat pump housing, and at least one inlet connector and at least one outlet connector are orientated in a vertical direction and are provided on an outside of the heat pump housing.

[0042] By having inlet and outlet connectors orientated in different directions, more optionality is provided to the installer making installation and connection of a heat pump unit with a tank more convenient, ergonomically, easier and thereby safer.

[0043] According to a further aspect there is provided an assembly of a heat pump unit according to the above and a tank, wherein the tank is fluidly connected to the heat pump unit by a first connection conduit connected to one inlet connector and by a second connection conduit connected to one outlet connector.

[0044] The liquid may be water. The tank may be a tank, comprising a reservoir. The tank may be configured to receive water from the heat pump unit directly in the tank reservoir via the first connection conduit connected to the inlet connector and discharge water from the tank reservoir via the second connection conduit connected to the outlet connector.

[0045] Alternatively, the tank comprises a tank heat exchanger positioned inside the tank reservoir, the tank heat exchanger being configured to receive water from the heat pump unit via the first connection conduit connected to the inlet connector and discharge water from the tank heat exchanger via the second connection conduit connected to the outlet connector. The tank heat exchanger is configured to heat up water present in the reservoir, surrounding the tank heat exchanger.

[0046] The connection conduits may be flexible or rigid and allow the tank to be connected to the heat pump unit, regardless of the arrangement chosen: one above the other (heat pump unit or tank on top) or next to the other.

[0047] The heat pump unit has the advantage that the tank can be positioned on top, below or next to the heat pump unit, always allowing for easy and reliable connection as there are multiple inlet and outlet connectors provided. An assembly of a heat pump unit and tank can be provided in different locations, including locations with a relative low height, where stacking the heat pump unit and the tank is not possible.

[0048] According to an embodiment the assembly comprises protective panels configured to cover the first and second connection conduits.

[0049] A protective cover may be arranged on the front side of the heat pump unit and tank. The front side of the tank and the heat pump unit may be configured such that a protective cover can be arranged thereon. This cover covers the connection conduits. This has aesthetic reasons as well as safety reasons: the connection conduits are hot so that a person could burn themselves on the pipe and a person could accidentally damage the connection conduits.

[0050] According to an embodiment there is provided an assembly comprising a first connection conduit connecting one of the at least two inlet connectors to the tank and a second connection conduit connecting one of the at least two outlet connectors to the tank, wherein the first and the second connection conduits are positioned inside the heat pump housing and the tank.

[0051] According to an embodiment wherein

- the heat pump unit and the tank are positioned next to each other, or

- the tank is positioned on top of the heat pump unit, or
- the heat pump unit is positioned on top of the tank.

[0052] According to a further aspect there is provided a method of installing a heat pump unit according to the above and a tank, the method comprising

- installing the heat pump unit,
- installing the tank,
- selecting an inlet connector and fluidly connecting a liquid outlet of the tank to the selected inlet connector,

selecting an outlet connector and fluidly connecting a liquid inlet of the tank to the selected outlet connector.

[0053] The method may further comprise removing the top panel from the heat pump unit and put the tank on the top of the heat pump unit, remove one or more panels from the heat pump unit and the tank, make the fluid connections and put back the one or more panels removed from the heat pump unit and the tank.

[0054] According to an embodiment the method further comprises

- opening the selected inlet connector and the selected outlet connector to allow connecting to the tank, or
- closing non-selected inlet connectors and non-selected outlet connectors.

[0055] In case the inlet and outlet connectors are closed at the start of the installation, the installer will open the selected inlet connector and the selected outlet connector to allow connecting to the tank.

[0056] In case the inlet and outlet connectors are open at the start of the installation, the installer will close the non-selected inlet connectors and non-selected outlet connectors.

[0057] The inlet and/or outlet connectors may be provided with quick-couplings. The method may comprise removing the quick-couplings and possibly the closing means, connecting the connection conduits to the selected connectors, re-inserting the quick-couplings to fasten the connection conduits and apply to the closing means to the non-selected connectors.

[0058] In the figures, the subject-matter of the invention is schematically shown, wherein identical or similarly acting elements are usually provided with the same reference signs.

Figure 1 schematically shows a perspective view of part of an interior of a heat pump unit according to an embodiment,

Figures 2a-b schematically show an assembly of a heat pump unit and a tank according to an embodiment,

Figure 3 schematically shows an assembly of a heat pump unit and a tank according to a different embodiment,

Figures 4a-b schematically show an assembly of a heat pump unit and a tank according to an embodiment.

[0059] With reference to Figure 1, a perspective view of part of an interior of a heat pump unit 1 is shown. Inside the heat pump unit 1 a liquid circuit is provided, through which a liquid, in particular water, can flow that is to be heated by the heat pump unit 1. The heat pump unit 1 further shows a refrigerant circuit through which a refrigerant is cycled. The refrigerant circuit comprises a network of piping and components, including at least a first heat exchanger (evaporator), a compressor, an expansion valve and a second heat exchanger (condenser). In the second heat exchanger, heat is transferred from the refrigerant to the liquid. The second heat exchanger or condenser is fluidly connected to the liquid circuit as well as to the refrigerant circuit.

[0060] The refrigerant circuit (which is not depicted in Fig. 1) comprises a loop for circulating the refrigerant through a compressor, the first heat exchanger (condenser), an expansion valve and the second heat exchanger (evaporator) subsequently and repeatedly. The refrigerant is compressed and thereby heated by the compressor. From the compressor, the compressed and heated refrigerant flows to the condenser to transfer heat to the liquid to be heated. The cooled down refrigerant flows to the expansion valve, where the pressure is reduced, thereby further cooling the refrigerant. The decompressed and cooled down refrigerant then flows to the evaporator to be heated by a heat source or source fluid before it is returned to the compressor.

[0061] Fig. 1 shows a heat pump unit 1 configured to be connected to a tank 20 (shown in Fig. 2 and 3). The tank 20, in particular a water tank, may be fluidly connected to the liquid circuit of the heat pump unit 1 such that liquid can flow from the tank to the heat pump unit 1 to be heated up by the condenser and flow back to the tank. Connectors 2, 3, 4, 5 are provided on the heat pump unit 1 to make this connection.

[0062] As shown in Fig. 1 the heat pump unit 1 comprises two inlet connectors 2, 3 configured to receive liquid from the tank 20, and two outlet connectors 4, 5 configured to discharge liquid to the tank 20. Fig. 1 further shows a heating outlet for guiding warm water to the building to be heated, e.g. to a radiator or the like.

[0063] The heat pump unit 1 comprises a heat pump housing 10. The liquid circuit and the refrigerant circuit are at least partially provided in an inner space of the housing 10. The heat pump housing 10 has a front panel 11 which can be removed or opened to allow access to at least part of the inner space of the heat pump unit 1. The heat pump unit also comprises a top panel 12, not shown in the Figures.

[0064] As can be seen in Fig. 1, one inlet connector 3 and one outlet connector 5 are provided in an inner space of the heat pump housing 10, and one inlet connector 2 and one outlet connector 4 are provided on an outside

of the heat pump housing 10, which protrude from the housing. At least one inlet connector 3 and one outlet connector 5 are provided inside the heat pump housing 10 and are accessible by opening or removing the front panel 11.

[0065] The liquid circuit comprises a liquid inlet conduit 6. The inlet connectors 2, 3 are connected in parallel to the liquid inlet conduit 6. The inlet connectors 2, 3 are connected to the liquid inlet conduit 6 upstream of control, operating or safety elements of the heat pump unit 1 interacting with the liquid circuit. An inlet splitter 8 is provided to make the connection between the two inlet connectors 2, 3 and the liquid inlet conduit 6.

[0066] The liquid circuit comprises a liquid outlet conduit 7. The outlet connectors 4, 5 are connected in parallel to the liquid outlet conduit 7. The outlet connectors 4, 5 are connected to the liquid outlet conduit 7 downstream of control, operating or safety elements of the heat pump unit 1 interacting with the liquid circuit. An outlet splitter 9 is provided to make the connection between the two outlet connectors 4, 5 and the liquid outlet conduit 7.

[0067] As can be seen in Fig. 1, inlet connector 2 is orientated in a vertical direction and inlet connector 3 is orientated in a horizontal direction, and one outlet connector 4 is orientated in a vertical direction and one outlet connector 5 is orientated in a horizontal direction.

[0068] Fig.'s 2a-b schematically show an assembly of a heat pump unit 1 and a tank 20 according to an embodiment, where the tank 20 is positioned on top of the heat pump unit 1. Fig. 3 schematically shows an assembly of a heat pump unit and a tank according to a different embodiment, where the tank and the heat pump unit 1 are positioned next to each other. Fig. 2 shows a front side view, Fig. 3 shows a rear side view.

[0069] In both embodiments of Fig. 2 and Fig. 3 the tank 20 is fluidly connected to the heat pump unit 1 by a first connection conduit 21 connected to one of the inlet connectors 2, 3 and by a second connection conduit 22 connected to one of the outlet connectors 4, 5.

[0070] In the embodiment of Fig. 2, the first and second connection conduits 21, 22 are connected to the inlet connector 3 and the outlet connector 5 which are in the inner space of the heat pump housing 10. In Fig. 2b a protective panel 13 is provided to cover the connections conduits 21, 22. Also, the connection conduits 21, 22 are positioned inside the heat pump housing 10 and the tank. The connection conduits 21, 22 are thus not exposed or visible from the outside. Fig. 2a shows the same with the protective panel removed. The protective panel 13 may be provided on the tank 20, on the heat pump unit 1 or both. It may be formed out of a single piece, or by a plurality of sub-panels.

[0071] In the embodiment of Fig. 3, the first and second connection conduits 21, 22 are connected to the inlet connector 2 and the outlet connector 4 which are provided on an outside of the heat pump housing 10.

[0072] Fig. 3 further shows the domestic hot water connection 25 of the tank 20 for domestic hot water and cold water connection 26 to allow cold domestic water to enter the tank 20 to be heated.

[0073] Fig.'s 4a and 4b show an embodiment similar to Fig. 3, which a heat pump unit 1 and tank 20 positioned next to each other, being connected with connection conduits 21. Fig. 4a shows the tank 20 being provided with a protective panel 13. Fig. 4b shows the tank without protective panel 13. The tank 20 has a tank outlet 23 and a tank inlet 24. The tank outlet 23 is fluidly connected to the heat pump unit 1, in particular the inlet connector 2 (or alternatively 3) via first connection conduit 21. The tank inlet 24 is fluidly connected to the heat pump unit 1, in particular the outlet connector 4 (or alternatively 5) via second connection conduit 22. The tank outlet 23 and the tank inlet 24 may be fluidly connected to a reservoir inside the tank for storing water or to a tank heat exchanger configured to heat up water stored in the reservoir. Different tank outlets 23 and tank inlets 24 may be provided to provide optionality to connect to either the reservoir or the tank heat exchanger.

[0074] The embodiment shown in fig. 4 differs from the embodiment shown in fig. 3 in that the tank 20 is rotated by 180°. Thus, the tank inlet 24 and the tank outlet 23 are arranged on the front that is the visible side to the user. The orientation of the tank 20 depends on the installation site. In particular, the tank 20 is orientated such that the tank inlet 24 and the tank outlet 23 can be easily connected. The same protective panel 13 as used in the embodiment shown in fig. 3 can be used to protect the tank inlet 24 and tank outlet 23. By doing so, you have the same esthetical result as in the embodiment shown in fig. 3.

Reference Signs

[0075]

1. Heat pump unit
2. Inlet connector
3. Inlet connector
4. Outlet connector
5. Outlet connector
6. Liquid inlet conduit
7. Liquid outlet conduit
8. Inlet splitter
9. Outlet splitter
10. Heat pump housing
11. Front panel
13. Protective panel
14. Heating outlet
20. Tank
21. First connection conduit
22. Second connection conduit
23. Tank outlet
24. Tank inlet
25. Hot water connection
26. Cold water connection

Claims

1. Heat pump unit (1) comprising a liquid circuit, the heat pump unit (1) being configured to heat up liquid flowing through the liquid circuit, wherein the liquid circuit comprises connectors for fluidly connecting the liquid circuit to a tank (20), wherein the liquid circuit comprises

   - at least two inlet connectors (2, 3) configured to receive liquid from the tank (20), and
   - at least two outlet connectors (4, 5) configured to discharge liquid to the tank (20).

2. Heat pump unit (1) according to claim 1, wherein the heat pump unit (1) comprises a heat pump housing (10) and wherein

   - at least one inlet connector (3) and at least one outlet connector (5) are provided in an inner space of the heat pump housing (10), and
   - at least one inlet connector (2) and at least one outlet connector (4) are provided on an outside of the heat pump housing (10).

3. Heat pump unit (1) according to any one of the preceding claims, wherein the heat pump unit (1) comprises a heat pump housing (10), wherein

   - at least one inlet connector (3) and at least one outlet connector (5) are provided inside the heat pump housing (10) and are accessible by opening or removing front panel (11) of the heat pump housing (10) or
   - at least one inlet connector (3) and at least one outlet connector (5) are provided inside the heat pump housing (10) and are accessible by opening or removing a hatch in a panel of the heat pump housing (10).

4. Heat pump unit (1) according to any one of the preceding claims, wherein the heat pump unit (1) comprises a heat pump housing (10), wherein at least one inlet connector (2) and at least one outlet connector (4) are provided on a top side or back side of the housing.

5. Heat pump unit (1) according to any one of the preceding claims, wherein the liquid circuit comprises a liquid inlet conduit (6) configured to receive liquid from the tank, and wherein the at least two inlet connectors (2, 3) for receiving liquid from the tank (20) are connected in parallel to the liquid inlet conduit (6) and/or wherein the at least two inlet connectors (2, 3) are connected to the liquid inlet conduit (6) upstream of, in particular any, control, operating or safety elements of the heat pump unit (1) interacting with the liquid circuit.

6. Heat pump unit (1) according to any one of the preceding claims, wherein the liquid circuit comprises a liquid outlet conduit (7) configured to discharge liquid to the tank (20), and wherein the at least two outlet connectors (4, 5) for discharging liquid to the tank (20) are connected in parallel to the liquid outlet conduit and/or wherein the at least two outlet connectors (4, 5) are connected to the liquid outlet conduit (7) downstream of, in particular any, control, operating or safety elements of the heat pump unit (1) interacting with the liquid circuit.

7. Heat pump unit (1) according to any one of the preceding claims, wherein the at least two inlet connectors (2, 3) and the at least two outlet connectors (4, 5) are configured to be closed with one of: a plug, a sealing cap, a screw cap, a clip-on cap, a cap fixed with reversible quick-coupling means such as a pin.

8. Heat pump unit (1) according to any one of the preceding claims, wherein the heat pump unit (1) comprises a condenser configured to heat up the liquid by exchanging heat with a refrigerant.

9. Heat pump unit (1) according to any one of the preceding claims, wherein

   - one inlet connector (2) is orientated in a vertical direction and one inlet connector (3) is orientated in a horizontal direction, and/or
   - one outlet connector (4) is orientated in a vertical direction and one outlet connector (5) is orientated in a horizontal direction.

10. Assembly of a heat pump unit (1) according to any one of the preceding claims and a tank (20), wherein the tank (20) is fluidly connected to the heat pump unit (1) by a first connection conduit (21) connected to one inlet connector (2, 3) and by a second connection conduit (22) connected to one outlet connector (4, 5).

11. Assembly according to claim 10, wherein the assembly comprises protective panels configured to cover the first and second connection conduits.

12. Assembly according to any one of the claims 10 - 11, comprising a first connection conduit connecting one of the at least two inlet connectors (2, 3) to the tank (20) and a second connection conduit connecting one of the at least two outlet connectors (4, 5,) to the tank (20), wherein the first and the second connection conduits are positioned inside the heat pump housing (10) and the tank (20).

13. Assembly according to any one of the claims 10 -12, wherein

- the heat pump unit (1) and the tank (20) are positioned next to each other, or
- the tank (20) is positioned on top of the heat pump unit (1), or
- the heat pump unit (1) is positioned on top of the tank (20).

14. Method of installing a heat pump unit (1) according to any one of the claims 1 - 9 and a tank (20), the method comprising

- installing the heat pump unit (1),
- installing the tank (20),
- selecting an inlet connector (2, 3) and fluidly connecting a liquid outlet of the tank (20) to the selected inlet connector (2, 3),
- selecting an outlet connector (4, 5) and fluidly connecting a liquid inlet of the tank (20) to the selected outlet connector (4, 5).

15. Method according to claim 14, wherein the method further comprises

- opening the selected inlet connector and the selected outlet connector to allow connecting to the tank, and/or
- closing non-selected inlet connectors and non-selected outlet connectors.

Fig. 1

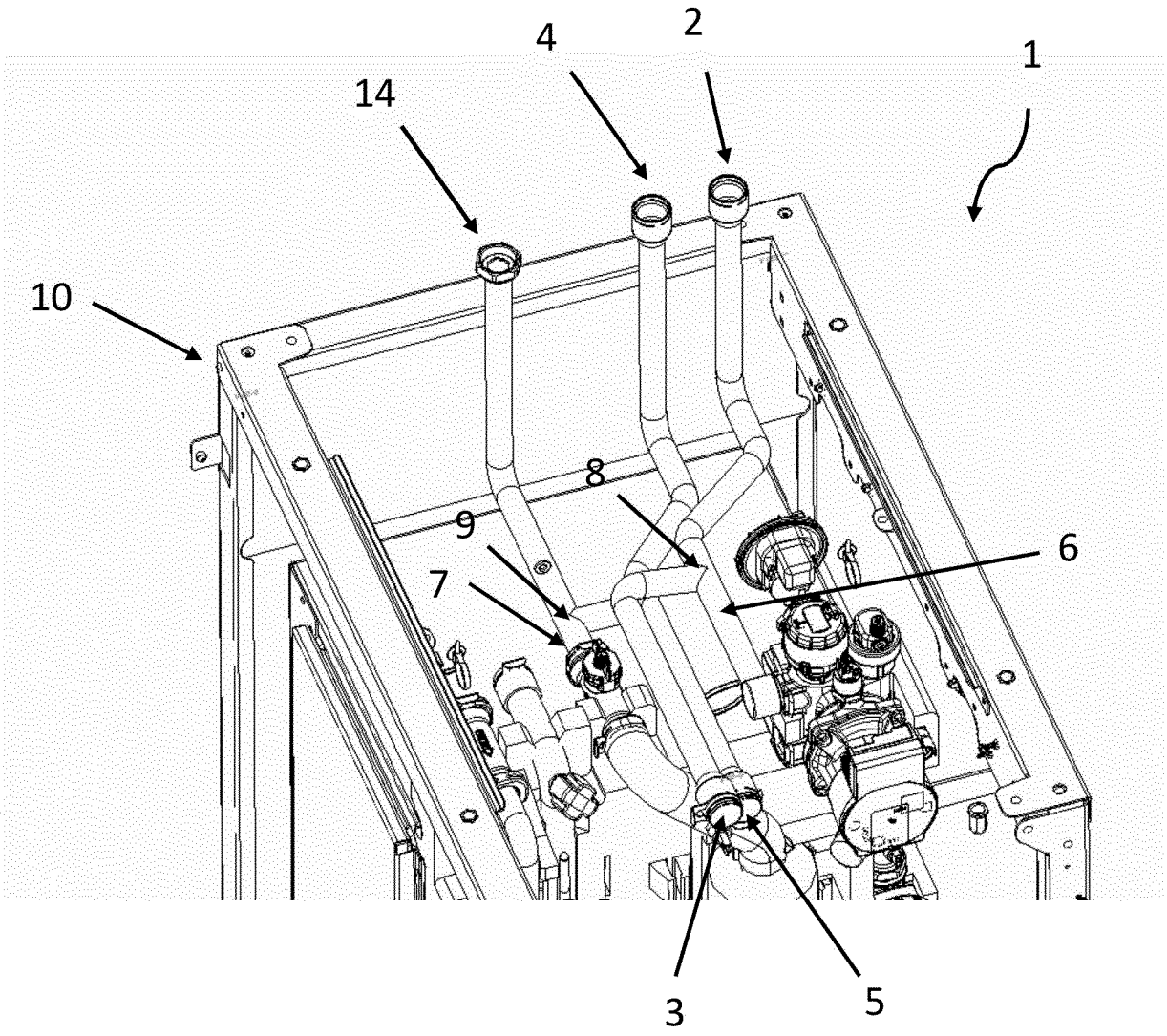


Fig. 2a

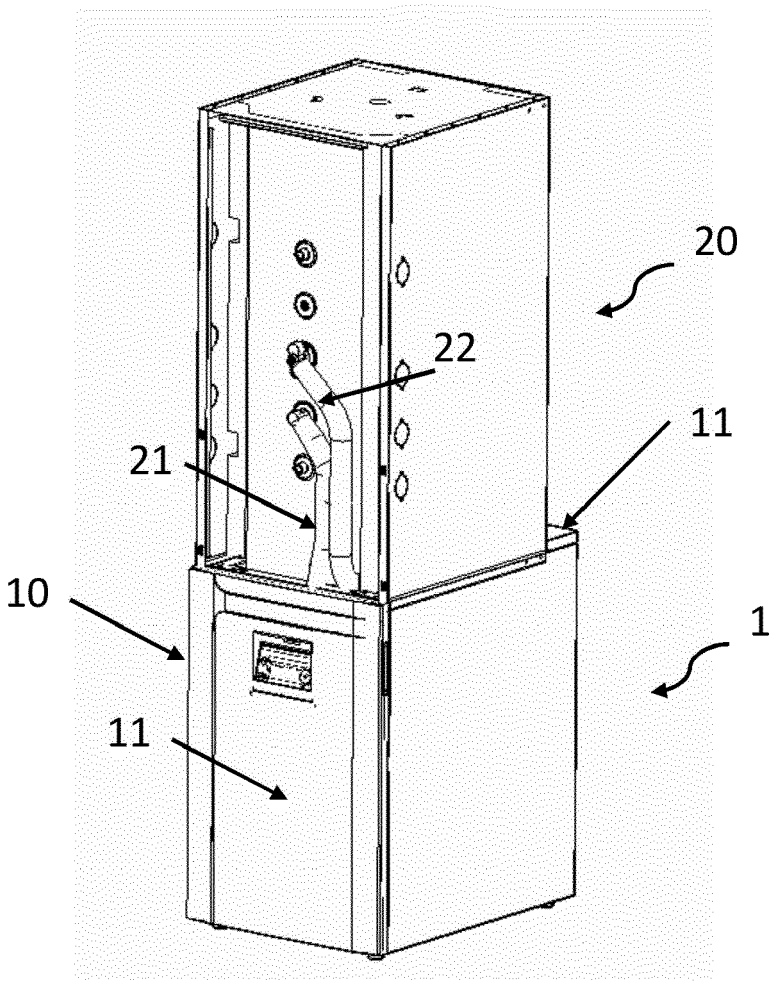


Fig. 2b

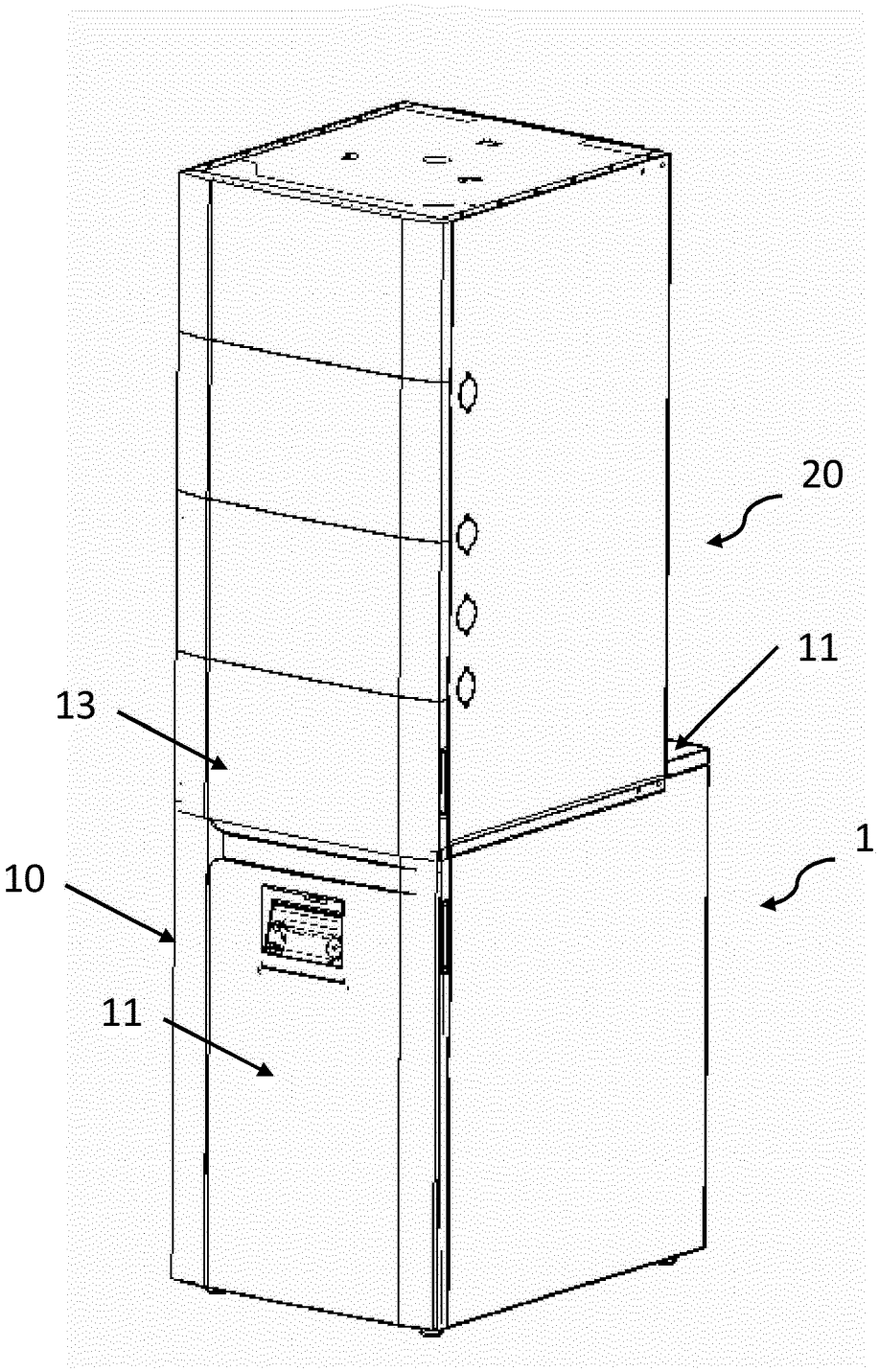


Fig. 3

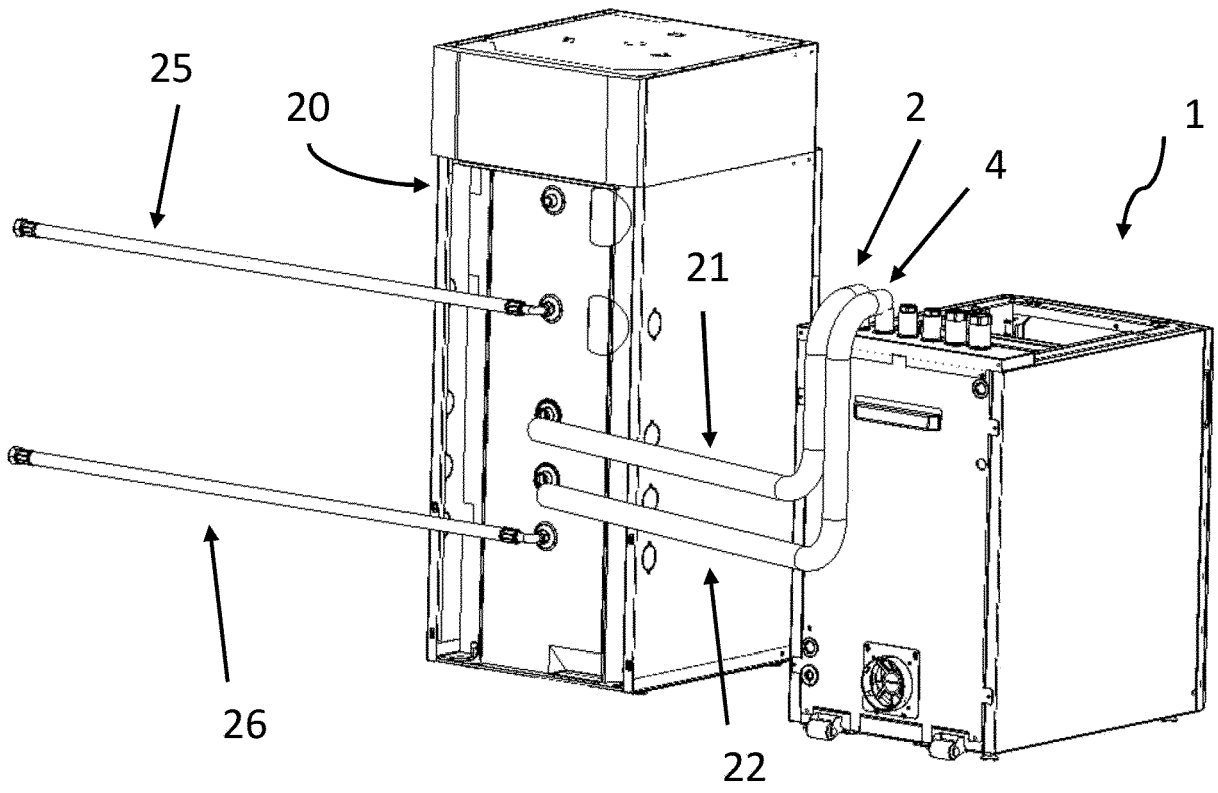


Fig. 4a

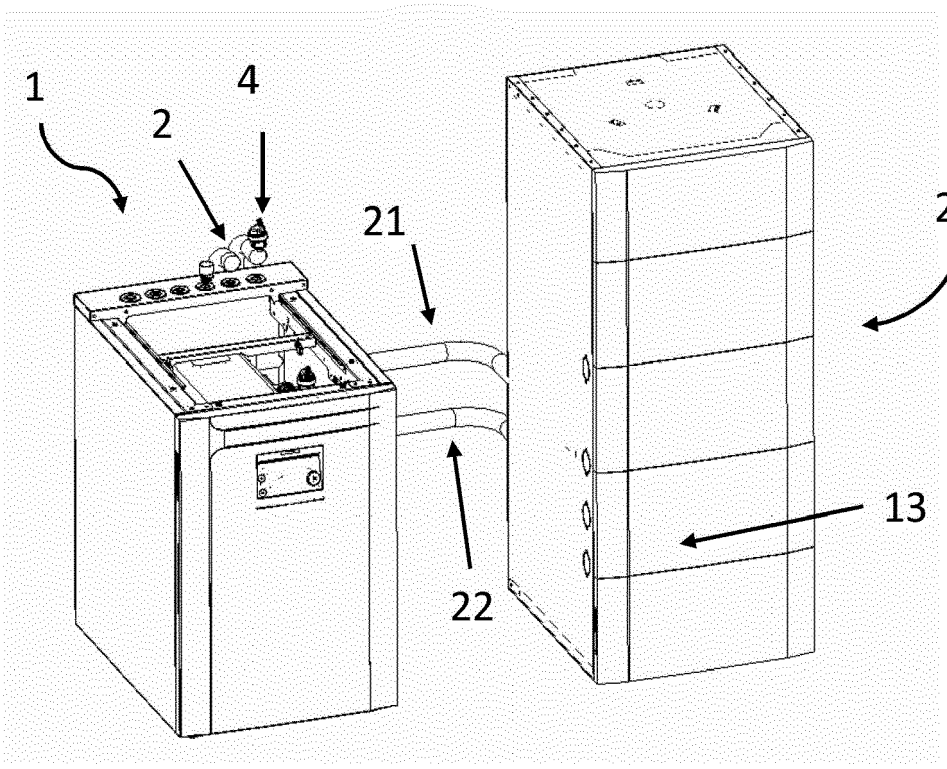
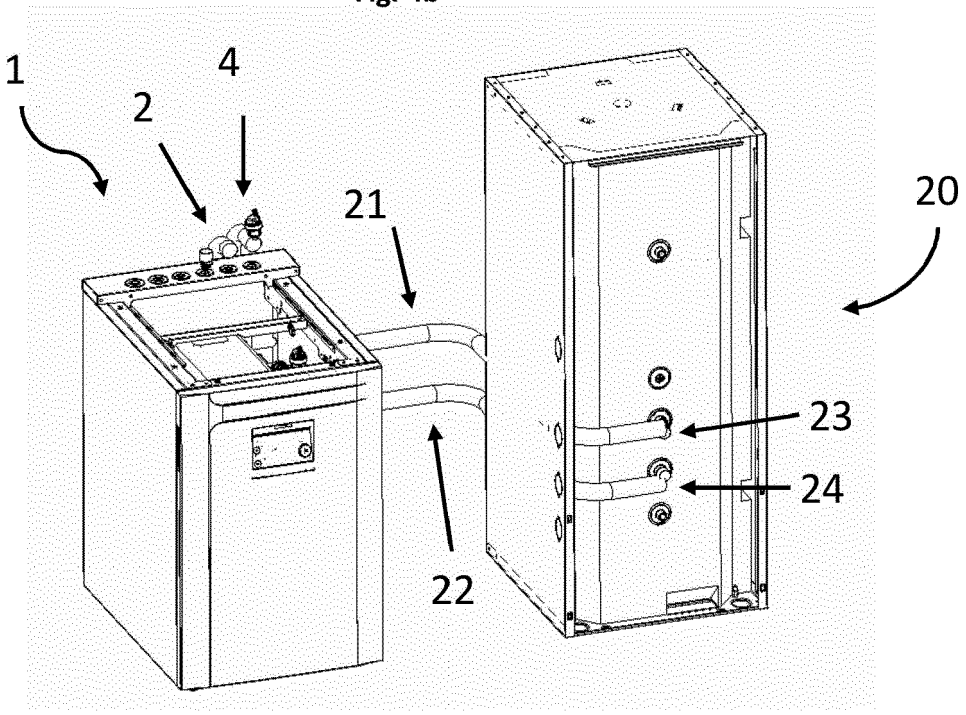


Fig. 4b



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 15 3946

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 3 839 360 A1 (DAIKIN EUROPE NV [BE]; DAIKIN IND LTD [JP]) 23 June 2021 (2021-06-23) * paragraphs [0074] - [0080], [0085] - [0091], [0105] - [0107]; figures 2, 3, 8 *	1-15	INV. F24D3/08 F24D11/02 F24D17/02 F24H4/04 F24H9/02
X	EP 1 906 107 A1 (TOSHIBA CARRIER CORP [JP]) 2 April 2008 (2008-04-02) * paragraph [0036] - paragraph [0048]; figures 1, 5, 6 *	1-4, 7-11, 13-15	
X	US 2016/109156 A1 (YIN JIANMIN [US]) 21 April 2016 (2016-04-21) * paragraph [0022] - paragraph [0029]; figure 1 *	1-15	
X	DE 11 2019 007040 T5 (MITSUBISHI ELECTRIC CORP [JP]) 30 December 2021 (2021-12-30) * paragraphs [0019], [0029]; figures 3,9 *	1,4,8, 10-14	
A	EP 3 462 103 A1 (DAIKIN IND LTD [JP]; DAIKIN EUROPE NV [BE]) 3 April 2019 (2019-04-03) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)
F24D
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 July 2023	Riesen, Jörg

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 23 15 3946

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.

03-07-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3839360 A1	23-06-2021	CN 114423999 A	29-04-2022
		EP 3839360 A1	23-06-2021
		JP 2022548564 A	21-11-2022
		US 2022341613 A1	27-10-2022
		WO 2021125354 A1	24-06-2021
EP 1906107 A1	02-04-2008	CA 2613820 A1	11-01-2007
		EP 1906107 A1	02-04-2008
		JP 4700690 B2	15-06-2011
		JP WO2007004460 A1	22-01-2009
		NO 341499 B1	27-11-2017
		US 2008135636 A1	12-06-2008
		WO 2007004460 A1	11-01-2007
US 2016109156 A1	21-04-2016	CN 105526710 A	27-04-2016
		US 2016109156 A1	21-04-2016
DE 112019007040 T5	30-12-2021	DE 112019007040 T5	30-12-2021
		JP 7031059 B2	07-03-2022
		JP WO2020188790 A1	21-10-2021
		WO 2020188790 A1	24-09-2020
EP 3462103 A1	03-04-2019	NONE	

EPO FORM P0459

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