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DESCRIPTION

The invention relates to a heating installation.

- 5 It is known that the function of an air/water heat pump system designed for heating of locations is to collect heat from the outside environment at a temperature corresponding to winter conditions, and to restore this heat to a heat-exchange fluid. This heat-exchange fluid, which is generally water which may
10 or may not have antifreeze or anti-corrosion products added to it, and is often known as the heating water, is used to heat the locations by means of various systems for exchange of heat with the inside air, such as underfloor heating or radiators.
- 15 These air/water heat pump systems can be built in two parts, one being placed outside the locations, and the other inside. Reference is then made to a heat pump system with separate elements.
- 20 The outside part contains all the thermodynamic part of the machine apart from the condenser, and the inside part contains the condenser and everything relating to the hot water heating circuit. The two parts are connected by pipes containing the heat-exchange fluid with a change of state which is specific
25 to this type of machine (also known as coolant fluid or refrigerant fluid), for example R410A or R32.

The associated heating system generally comprises emitters which make possible the lowest possible heating water
30 temperatures, so that the difference between the temperature of the cold source (outside air) and the temperature of the hot source (water of the heating circuit) is small as possible (Carnot's principle). Low-temperature underfloor heating or low-temperature radiators represent two examples of this type
35 of emitter. Their operating temperature as far as the heating water is concerned is between 27°C and 55°C maximum.

When a dwelling has initially been designed to be heated by a

liquid or gaseous fuel boiler, the associated heating system is on the other hand designed to operate at higher temperatures extending over a range which can be from 55°C to 80°C.

5

Replacement of the original boiler by a heat pump system leads to the design of heat pump systems which are suitable for these temperature ranges (also known as water ranges).

10 These so-called "high-temperature" heat pumps can be designed in two ways:

a) either all of the thermodynamic circuit is designed for this usage (the compressor and fluid are then adapted
15 accordingly), which leads in general to machines which are costly, and moreover low-performance in certain parts of the field of use, taking into account the technical constraints;

b) or a second coolant circuit is added to the first coolant
20 circuit, in relation to which it constitutes a second stage. This second stage can use a second coolant fluid which is well-suited to high temperatures, such as R134a for example.

This second solution known in the prior art is particularly
25 advantageous when the second stage is added at the level of the inside unit. In fact, the low-temperature outside part then remains identical to that of the current low-temperature machines, which advantageously makes it possible to retain their price and good adaptation to low outside temperatures.

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It is also known from document EP 2 532 983 that the two stages of this solution need not communicate by means of a direct exchange between the two coolant circuits, for example by means of a plate exchanger, but by using the water of the
35 heating circuit as an intermediate fluid.

Document EP 2 827 068 adopts this type of geometry once more by insisting on the need to use a buffer reservoir (already

included in document EP 2 532 983), with a size which is large enough (150l for example according to document E 2 827 068) to ensure that energy is provided during the defrosting cycles of the first stage, or when the thermal power of the two stages is different during operation.

The juxtaposition of the three heat exchangers necessary (condenser of the first stage, evaporator of the second stage and condenser of the second stage) and of the buffer reservoir makes this type of solution quite voluminous.

The objective of the invention is to eliminate this disadvantage by proposing a heating installation using the principle of the air/water heat pump, and comprising:

- at least one heating circuit in which water can circulate;
- a heat pump system PAC connected to the said at least one heating circuit and which can heat the water of the said at least one heating circuit, the system PAC comprising two stages which each comprise a compressor, a condenser, an expander and an evaporator, the first stage being configured to operate in a low-temperature heating mode between the outside air and the water coming from the return of the said at least one heating circuit, the second stage being configured to operate in a high-temperature heating mode between, on the one hand, a pipe connected to the return of the said circuit, and on the other hand, an outlet pipe connected to the said starting point of the at least one heating circuit, characterised in that the condenser of the first stage and the evaporator of the second stage are configured either to be immersed in the same container of water, or to be immersed respectively in two containers of water communicating with one another by means one or a plurality of ducts, the primary of the evaporator of the second stage and the secondary of the condenser of the first stage using the same water of the container(s).

The fact that the condenser of the first stage and the evaporator of the second stage are configured to be immersed in a single container or in two containers which communicate with one another via one or a plurality of ducts makes it possible to reduce the size of the installation. This arrangement also makes it possible to simplify the design of the installation, in particular with reference to the means which make it possible to go from one heating mode to another.

10 The condenser of the first stage can thus discharge into the container (this is the container in which the condenser is disposed when there are a plurality of containers) the water circulating in the secondary of the condenser, irrespective of the heating mode (low-temperature or high-temperature). The
15 water is heated thanks to the first stage, which collects energy from the outside air (via a primary fluid circulating in the first stage, in particular at the level of its evaporator), and restores it to a temperature higher than that of the water circulating in the secondary of the condenser.
20 The water which fills the container or containers (when there are two containers) obtained from the secondary of the condenser is thus heated by the first thermodynamic stage.

In addition, the evaporator of the second stage can draw its
25 primary (heated) fluid from the container (this is the container in which the evaporator is disposed when there are a plurality of containers), when the installation is operating in high-temperature heating mode (second stage in operation in addition to the first stage). The primary fluid of the
30 evaporator is in this case the same as the secondary fluid of the condenser, since the water is that which fills the container or containers (when there are two containers).

It will be noted that, with a constant volume, two containers
35 can be easier to accommodate in terms of geometry than a single container, which provides great flexibility of use.

In addition, a device for recirculation of fluid in the

containers and between the two containers, such as a pump, can be installed on one of the ducts which connects the two containers. This arrangement can in this case also provide great flexibility of installation of the device (e.g. pump).

5

The water, whether it contains additives or not, of the container or containers (if there are a plurality of them) can be put into recirculation according to the operating mode of the installation.

10

According to other possible characteristics:

- the water used by the primary of the evaporator of the second stage and the secondary of the condenser of the first stage is either shared with the said at least one heating circuit of the system, or separate from the said at least one

heating circuit of the installation;

20 - in low-temperature heating mode, for example up to 55°C, the system is configured so that the secondary of the condenser of the first stage is in direct communication with the said at least one heating circuit (the water of the said at least one heating circuit supplies the secondary of the condenser of the first stage);

25 - in high-temperature heating mode, for example beyond 55°C, the installation is configured so that the water of the said at least one heating circuit supplies the secondary of the condenser of the second stage, and no longer supplies the secondary of the condenser of the first stage;

30 - the installation comprises at least one flow control unit (such as a single-passage solenoid valve) between the inlet of the secondary of the condenser of the first stage and the inlet of the secondary of the condenser of the second stage, the said at least one flow control unit allowing the installation, by going from an open state to a closed state or

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vice versa, to operate in low-temperature heating mode (the water of the said at least one heating circuit supplies the secondary of the condenser of the first stage, where it is heated before supplying the secondary of the condenser of the second stage, which is non-operational) or high-temperature heating mode (the water of the said at least one heating circuit supplies the secondary of the condenser of the second stage directly, and no longer supplies the secondary of the condenser of the first stage);

- the installation comprises a pumping device which is actuated in order to put into circulation the water in the container, or containers if there are two of them, in a loop between the condenser and the evaporator such that, firstly, the water discharged from the secondary of the condenser supplies the primary of the evaporator and, secondly, the water discharged from the primary of the evaporator supplies the secondary of the condenser; the actuation of the pumping device is carried out in high-temperature heating mode when the second stage of the installation is operating, whether there is a single heating circuit or two of them;

- the said at least one heating circuit comprises two separate heating circuits, a first, low-temperature heating circuit, and a second, high-temperature heating circuit;

- the installation is configured so that, in the low-temperature heating mode of the two circuits, the return water of the first and second heating circuits supplies the inlet of the secondary of the condenser of the first stage where it is heated (the return water of the two circuits are mixed in this mode), and the outlet of the secondary of the condenser of the first stage supplies both the starting point of the first heating circuit and the starting point of the second heating circuit;

- the installation is configured so that, in the low-temperature heating mode of the first circuit and in the high-

temperature heating mode of the second circuit:

the return water of the first heating circuit supplies the inlet of the secondary of the condenser of the first stage, where it is heated, and the outlet of the secondary of the condenser of the first stage supplies both the starting point of the first heating circuit and the inlet of the evaporator of the second stage;

the water is also recirculated in a loop in the container, or the containers if there are two of them, thanks to the actuated pumping device;

the return water of the second heating circuit supplies the inlet of the secondary of the condenser of the second stage, where it is heated, and the outlet of the secondary of the condenser of the second stage supplies the starting point of the second heating circuit;

- the installation comprises a flow control unit which is configured, on the one hand, to allow the heated water coming from the secondary of the condenser of the first stage to supply both the starting point of the first heating circuit and the starting point of the second heating circuit, in the low-temperature heating mode of the two circuits, and on the other hand, to make the two heating circuits independent, in the low-temperature heating mode of the first circuit and in the high-temperature heating mode of the second circuit; the flow control unit is thus configured to prevent the water coming from the secondary of the condenser of the first stage from supplying the starting point of the second heating circuit, and to allow the return water of the second heating circuit to supply the secondary of the condenser of the second stage, and no longer the return of the first heating circuit; the flow control unit is for example a three-way valve.

Other characteristics and advantages will become apparent from the following description, provided purely by way of non-

limiting example, and with reference to the appended drawings in which:

- 5 - figure 1 is a simplified schematic view of a heating installation according to a first embodiment of the invention;
- figure 2 is a simplified schematic view of the installation in figure 1 in low-temperature operating mode;
- 10 - figure 3 is a simplified schematic view of the installation in figure 1 in high-temperature operating mode;
- figure 4 is a detailed schematic view of an example of the installation in figure 1;
- 15 - figure 5 is a simplified schematic view of a heating installation according to a second embodiment of the invention;
- 20 - figure 6 is a simplified schematic view of the installation in figure 5 in low-temperature operating mode of the two circuits;
- figure 7 is a simplified schematic view of the installation in figure 5 in low-temperature operating mode for the first circuit and in high-temperature operating mode for the second circuit;
- 25 - figure 8 is a simplified schematic view of heating installation according to another embodiment of the invention.
- 30

As represented schematically in figure 1 and designated by the general reference indicated as 10, a heating installation according to a first embodiment of the invention uses the principle of the air/water heat pump.

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This installation 10 comprises:

- a heating circuit in which a heat-exchange fluid such as water (or water with additives, i.e. water comprising additives such as an antifreeze such as, for example, mono propylene glycol) can circulate (only the pipe 12 which is directly connected to the return of the heating circuit is represented here, and the heating circuit, for its part, is represented in figure 4);

- a heat pump system (PAC) 14 which is connected to the heating circuit, and can heat the water of the heating circuit.

The PAC system 14 comprises two thermodynamic stages 16 and 18 which each comprise a compressor, a condenser, an expander and an evaporator. These different components are illustrated in figure 4, which will be described hereinafter. In figure 1, only the condenser Cd1 of the first stage 16 and the evaporator Ev2 of the second stage 18 are represented.

The first stage 16 is configured to operate, in a low-temperature heating mode (this operating mode is illustrated in figure 2), between the outside air and the water obtained from the return of heating circuit, via the pipe 12.

The second stage 18 is configured to operate, in a high-temperature heating mode (this operating mode is illustrated in figure 3), between two pipes which are connected respectively to the starting point and the return of the heating circuit, as will be seen hereinafter.

As represented in figure 1, the condenser Cd1 of the first stage and the evaporator Ev2 of the second stage are configured to be immersed in a single container 20 filled with fluid, i.e. in a single volume of fluid, for example water. This container is a tank or enclosure (it can be a reservoir or vessel) which contains the two heat exchangers, and is for example filled with the water of the heating circuit (it will be noted that a heat-exchange fluid other than water can be

used as an alternative in the heating circuit). The water of the container is used for the operation of the condenser Cd1 of the first stage and the evaporator Ev2 of the second stage.

5 In high-temperature heating mode (this operating mode is illustrated in figure 3), the first stage 16 is configured to operate between the outside air and the water of the container 20.

10 Figure 1 also represents:

- the primary Cd1.1 and the secondary Cd1.2 of the condenser Cd1 of the first stage 16, with the pipe 12 supplying the secondary Cd1.2;

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- the primary Ev1.2 and the secondary Ev2.2 of the evaporator Ev2 of the second stage 18;

- a pump 22 or any other device which ensures recirculation of the water in the container 20;

- a flow non-return unit 24, such as a non-return valve, which is fitted on the pipe 12, and prevents any return of water into the return of the heating circuit (via the pipe 12).

25

In addition, the secondary Cd1.2 of the condenser Cd1 has a free end provided with an outlet orifice O1 which allows the water circulating in the secondary Cd1.2 to fill the container 20.

30

The installation also comprises a pipe 26 with a free end provided with an inlet orifice O2 which is inside the container 20, in order to allow the water contained in the latter to use the orifice O2 to be discharged from the container and circulate in the pipe 26.

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The primary Ev2.1 of the evaporator Ev2 has a free end

provided with an inlet orifice 03 which is inside the container 20 (in an area spaced from that where the orifice 02 is located), so that water which is contained in the container 20 can use the orifice 03 and circulate in the primary Ev2.1.

5

It will be noted that an outside duct 27 connects the outlet of the primary Ev2.1 to the inlet of the secondary Cd1.2, in order to permit recirculation of the water. In particular, the pump 22 is installed on this outside duct.

10

Figure 2 illustrates a low-temperature operating mode of the installation in figure 1, and additional details of the PAC and of the heating installation are represented there. In particular, the condenser Cd2 of the second stage 18 is represented with its primary Cd2.1 and its secondary Cd2.2.

15

The installation comprises:

- a bypass 32 which is provided with a flow control unit (stoppage or passage of flow) V1 such as a valve (e.g. solenoid valve), and which is connected downstream from the pipe 26 exiting from the container 20;

20

- the secondary Cd2.2 of the condenser Cd2;

25

- a pipe 34 which is connected firstly to the outlet of the secondary Cd2.2, and secondly to the starting point of the heating circuit (not represented here), and a pump 36 installed on the pipe 34 which makes water circulate towards the emitters, not represented, of the heating circuit.

30

In low-temperature operating mode:

- the second stage 18 is at a standstill (the compressor of this stage is stopped);

35

- the first stage 16 collects energy from the outside air AE (this air is put into movement by a fan, not represented

here, and the compressor of this stage, also not represented here, is in operation), and returns it to the condenser Cd1 of the stage at a temperature higher than that of the return water of the heating circuit, thus heating the return water of the heating circuit which is circulating in particular in the pipe 12 (the water is for example at a temperature of 55°C at the outlet of the condenser);

- the water which is heated in the condenser Cd1 is discharged into the container 20 via the orifice 01, then is collected from this container via the orifice 02 (drawing off) in order to circulate in the pipe 26 and supply the secondary Cd2.2 of the condenser Cd2 (the water obtained from the outlet of the first stage passes through the condenser Cd2 without changing temperature);

- the pump 36 sends water discharged from the secondary Cd2.2 of the condenser Cd2 in the pipe 34, to the starting-point pipe (not represented) of the heating circuit.

In this operating mode, the water is for example heated to 55°C by the first stage 16.

Figure 3 illustrates a high-temperature operating mode of the installation in figure 1. The two stages 16 and 18 are in operation in this mode.

In high-temperature operating mode:

- the first stage 16 collects energy from the outside air AE and returns it to the condenser Cd1 of this stage at a higher temperature (e.g. 55°C);

- the pump 22 re-circulates water in the secondary Cd1.2 of the condenser Cd1 from water which is collected from the container via the orifice 03, and passes through the primary Ev2.1 of the evaporator Ev2 of the second stage 18;

- the water which supplies the secondary Cd1.2 and is reheated in it is discharged directly into the container 20 via the orifice 01;

5 - the non-return unit 24 prevents the water recirculated by the pump 22 from being sent into the heating circuit;

- the valve V1 is open and the return water of the heating circuit which is circulating in the pipe 12 can therefore pass
10 via the bypass 32, and is sent into the secondary Cd2.2 of the condenser Cd2 of the second stage 18;

- the second stage 18 thus collects energy from the water contained in the container 20 at the level of the evaporator
15 Ev2, and supplies it to the water of the heating circuit starting from the condenser Cd2 (the compressor of the second stage is operating);

- the pump 36 sends water discharged from the secondary
20 Cd2.2 of the condenser Cd2 (water heated to a high temperature, for example higher beyond 55°C, and in particular to a temperature of approximately 60 to 70°C) into the pipe 34, towards the starting point of the heating circuit.

25 Thus, in the two aforementioned operating modes, the water (or the water with additives) heated by the first stage, and discharged from the secondary of the condenser Cd1, is emptied into the container 20.

30 This heated water is:

- either taken directly from the container, in order to supply the heating circuit (low-temperature mode);

35 - or taken from the container by the primary of the evaporator of the second stage, in order to make the latter operate, and generate for the condenser of the said second stage a temperature higher than that of the water collected,

with the water being put back into circulation in the container via the secondary of the condenser of the first stage (circulation in a loop of the fluid in this high-temperature mode thanks to the pumping device 22).

5

In the high-temperature mode, the water of the heating circuit goes directly into the secondary of the condenser of the second stage, in order to be heated to a high temperature.

10 It will be noted that, in the high-temperature mode, the second stage is configured to operate between the pipe 12 (which is connected to the return of the heating circuit) and the pipe 34 (which is connected to the starting point of the heating circuit), whilst short-circuiting the outlet of the
15 first stage (secondary Cd1.2 of the condenser Cd1).

A plurality of modes of defrosting of the heating installation (i.e. more specifically of the evaporator of the first stage) can be envisaged according to the circumstances of use of this
20 installation.

In general, irrespective of the heating mode used, two defrosting power levels are accessible. Irrespective of the heating mode (high-temperature or low-temperature), the first
25 defrosting power level is made possible thanks to the use of the calorific energy of the fluid (e.g. water) filling the container.

The two defrosting power levels each disrupt the installation progressively between the first and the second level.
30

If the installation is in high-temperature operating mode (figure 3):

35 - and if the defrosting does not need to be too stringent (little energy is necessary in order to proceed with the defrosting, and it is wished not to disrupt the operation of the installation excessively), then the cycle of the first

stage 16 is inverted (the evaporator generates heat) and the pump 22 is kept operating (the energy of the container 20 is then used for the defrosting);

- 5 - and if the defrosting requires more energy, then the valve V1 is closed in order to obtain calories from the heating circuit.

If the installation is in low-temperature operating mode
10 (figure 2):

- and if the defrosting does not need to be too stringent (little energy is necessary to carry out the defrosting, and it is wished not to disrupt the operation of the installation
15 excessively (when the installation is operating for example at the beginning of winter), then the cycle of the first stage 16 is inverted (the evaporator generates heat), the pump 22 is started up (the energy of the container 20 is thus used for the defrosting), and the valve V1 is open (the two circuits
20 are then operating independently);

- and if the temperature of the container (controlled by at least one temperature sensor) drops to below a predetermined threshold (temperature of the water of the container
25 considered to be too low to permit the defrosting by inversion of the cycle, or approaching its freezing point), then the valve V1 is closed in order to draw calories from the heating circuit.

30 It will be noted that, in high-temperature heating mode, during the defrosting, it is possible to continue to make the compressor of the high-temperature stage 18 continue to operate or stop (this compressor is represented in figure 4), without giving rise to disruptions which detract from the
35 operation of the inner heating loop (minimum disruptions).

Figure 4 is a more detailed view of an example of installation
10 implementing the operating method according to the two,

low-temperature and high-temperature modes as described above.

This figure represents:

- 5 - the components of the first stage 16: evaporator Ev1, compressor Cp1, expander Dt1, cycle inversion valve Vic and condenser Cd1;
- a fan 17 which ensures the circulation of the outside air AE
10 on the evaporator Ev1;
- the components of the second stage 18: evaporator Ev2, compressor Cp2, expander Dt2 and condenser Cd2;
- 15 - different elements of the heating circuit 39: emitters 40, 42, for example two of them, such as, for example, radiators (a larger number of emitters can be envisaged, and different types of emitters can also be envisaged in addition to, or as a replacement for these), a starting point pipe 41 and a
20 return pipe 43, to which the different emitters are connected.

An air vent 44 and an expansion vessel 46 are both fitted for example on the pipe 34 (or for example on the pipe 12).

- 25 Figure 5 illustrates a heating installation 50 according to a second embodiment of the invention. The installation 50 comprises the same two thermodynamics stages 16 and 18 as in figures 1 to 4. The heating circuit 12 in figures 1 to 4 has been replaced by two separate heating circuits, i.e. a first,
30 low-temperature heating circuit, which is not shown in detail, but is simply illustrated by the reference 52, and a second, high-temperature heating circuit which is not shown in detail, but is simply illustrated by the reference 62.

- 35 The installation comprises a starting point pipe 54 towards the first heating circuit 52, and a return pipe 56 coming from this circuit and identical to the pipe 12 in figures 1 to 4.

The starting point pipe 54 is like the pipe 26 in figures 1 to 4, but extends it directly towards the starting point of the heating circuit, without passing via the condenser Cd2 of the second stage 18. The starting point pipe 54 is equipped with a
5 flow non-return unit (e.g. a non-return valve) 58, and a pumping device 60 such as a pump. The starting point pipe 54 sends the water heated in the secondary Cd1.2 of the condenser Cd of the first stage 16 to the starting point of the heating circuit and heat emission elements not represented here. These
10 heat-emission elements can be identical to those in figure 4, or of a different type (e.g. underfloor heating) and/or of a different number.

The installation comprises a starting point pipe 64 towards
15 the second heating circuit 64, and a return pipe 66 which is obtained from this circuit, and returns the water of the circuit to the secondary Cd2.2 of the condenser Cd2 of the second stage 18 (the secondary Cd2.2 heats water which supplies the starting point pipe 64).

20 The starting point pipe 64 comprises in succession a directional three-way valve V2, a flow non-return unit (e.g. a non-return valve) 68, and a pumping device 70 such as a pump. The unit 68 and the device 70 are both fitted on a portion of
25 pipe 65 which supplies directly the starting point of the high-temperature circuit and the heat-emission elements not represented here. These heat-emission elements can be identical to those in figure 4, or of a different type (e.g. underfloor heating) and/or of a different number.

30 Alternatively, the second, high-temperature heating circuit 62 can be used only for the preparation of domestic hot water (ECS) by supplying a coil-type water heater for example. In this possible application, the first, low-temperature heating
35 circuit ensures all the heating requirements of the location(s) with which the installation 50 is associated.

The pipe 64 is connected to a first way of the valve V2,

whereas the pipe portion 65 is connected to a second way of the valve V2.

The installation also comprises:

5

- a pipe or bypass 72 which connects the starting point pipe 54 to the third way of the valve V2;

10

- a pipe or bypass 74 which connects the return pipe 56 to the return pipe 66.

15

In the installation 50, the two circuits 52 and 62 each have their own temperature level. The first, low-temperature circuit 52 can operate only at a low temperature. The second, high-temperature circuit 62, for its part, can operate at a low temperature, then at a high temperature.

20

The two circuits 52 and 62 can operate in parallel, independently from one another, except for the fact that they both draw their energy from the immersed container 20.

25

The fact of having two possible hot water starting points (two different starting point pipes) provides the installation with flexibility.

Figure 6 illustrates the operation of the two circuits of the installation in low-temperature operating mode.

30

In this mode, only the first stage 16 is operating and is supplying the two heating circuits 52 and 62.

35

The pumps 60 and 70 of the two circuits are operating, whereas the pump 22 which ensures the recirculation in the container 20 is at a standstill. This situation is normal since the primary Ev2.1 of the evaporator Ev2 of the second stage 18 does not need to be supplied.

The three-way valve V2 permits the passage of the starting

point hot water obtained from the starting point pipe 54 (first circuit) only from the bypass pipe 72 to the portion of starting point pipe 65 (second circuit).

5 Thus, the two heating circuits 52 and 62 are supplied with energy in parallel from the condenser Cd1 of the first stage 16.

10 It will be noted that operation of this type is valid up to a starting point temperature which is for example equal to 55°C.

Figure 7 illustrates the independent operation of the two circuits of the installation (flexibility of operation of the installation), for the circuit 52, in low-temperature mode, 15 and for the circuit 62, in high-temperature mode.

In this mode, the two stages 16 and 18 are operating, as well as the recirculation pump 22 of the container 20.

20 The three-way valve V2 prevents the passage of the water via the pipe 72, which also prevents the circulation of water in the pipe 74.

In this mode, the second, high-temperature circuit 62 is 25 heated only by the condenser Cd2 of the second stage 18 to a starting point temperature which is for example higher than 55°C.

The return water of the first low-temperature circuit 52 30 (water supplied by the pipe 56), to which there is added the recirculation water of the container 20 generated by the pump 22 (the two flows of water are added to the inlet of the secondary Cd1.2 of the condenser Cd1), is sent to the secondary Cd1.2, where it is heated at low-temperature.

35

The water of the first circuit 52 is collected from the container 20 via the orifice O2, and goes directly into the starting point pipe 54, towards the first circuit.

In a manner similar to that which has been described with reference to the operating mode in figure 3, the pump 22 makes the water of the container 20 circulate in the primary Ev2.1 of the evaporator Ev2 of the second stage 18, via the orifice 03. The second stage 18 collects energy from the container 20, at its evaporator Ev2, and supplies energy at the level of its condenser Cd2 to the water of the second circuit 62.

10 The installation 50 can comprise the same elements/components as those illustrated in figure 4, in particular as far as the two thermodynamics stages 16 and 18 are concerned.

It will be noted that the two compressors of the installations 15 10 and 50 can function at a variable speed or at a fixed speed. Alternatively one can function at a variable speed whereas the other functions at a fixed speed.

Figure 8 illustrates another embodiment of the invention.

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All the elements which are unchanged in comparison with figure 1 retain the same references.

In the installation 10' in figure 8, the condenser Cd1 of the first stage 16 and the evaporator Ev2 of the second stage 18 are accommodated in two containers 20.1 and 20.2 which are distinct and separate from one another: the condenser Cd1 is immersed in a volume of water which fills the container 20.1, and the evaporator Ev2 is immersed in a volume of water which 30 fills the container 20.2.

A first external duct 27.1 connects the outlet of the primary Ev2.1 to the inlet of the secondary Cd1.2, in particular via the pump 22 fitted on the duct.

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A second external duct 27.2 connects the inside of the two containers 20.1 and 20.2, and comprises two free opposite ends, each provided with an orifice 02.1 and 02.2 opening

respectively inside the containers 20.1 and 20.2. Thus, the water which is discharged from the secondary Cd1.2 and pours into the container 20.1 can use the orifice 02.1, the duct 27.2, and be discharged via the orifice 02.2 into the container 20.2, from which it can be discharged via the inlet orifice 03 of the primary Ev2.1.

The external duct 27.2 is also connected to the pipe 26 which is described with reference to figure 1, and sends the water discharged from the reservoirs to the heating circuit.

It will be noted that the initial volume of the container 20 is for example divided into two. However, the respective volumes of the two containers 20.1 and 20.2 can be distributed differently, in particular according to the dimensions of the two exchangers.

It will be appreciated that other arrangements of containers and external connection ducts can be envisaged. As for the modes in the preceding figures, the arrangement of the different elements of the installation can vary (e.g. the pump 22 can be disposed in a different location of the installation on the duct 27 or 27.1, and the same applies for the pump 36). Similarly, the elements such as the units 24, V1, V2, 58, 60, 68, 70, etc., can be arranged differently and/or replaced by elements with a different structure (or with a different number) which fulfil the same function. For example, the three-way valve V2 can be replaced by three single valves.

The installation 10' can also be applied to a plurality of heating circuits, in particular two circuits, as in figures 5 to 7.

The different operating modes described above in relation with figures 2 to 7 are also applicable to the installation 10'.

PATENTKRAV

1. Varmeanlæg der anvender luft/vand-varmepumpeprincippet og som omfatter:

- 5 - mindst et varmekredsløb (39; 52, 62), i hvilket vand er i stand til at cirkulere,
- et varmepumpesystem (PAC) der er forbundet til det mindst ene varmekredsløb, og som er i stand til at opvarme vandet i det mindst ene varmekredsløb, hvilket PAC-system indbefatter
10 to trin (16, 18), som hver omfatter en kompressor, en kondenser, en ekspander og en fordamper, hvilket første trin (16) er konfigureret til at fungere med en opvarmning ved lav temperatur mellem den udvendige luft og returvand i det mindst ene varmekredsløb,
15 hvilket andet trin (18) er konfigureret til at fungere med en opvarmning ved høj temperatur mellem, på den ene side, en ledning (12) der er forbundet med returen i det mindst ene varmekredsløb, og på den anden side, en udløbsledning (34), der er forbundet ved udløbet med det mindst ene varmekredsløb,
20 kendetegnet ved, at kondenseren (Cd1) i det første trin og fordamperen (Ev2) i det andet trin er konfigureret til enten at blive nedsænket i den samme vandbeholder (20) eller nedsænket i henholdsvis to vandbeholdere (20.1, 20.2), der kommunikerer med hinanden med en eller flere ledninger (27.1, 27.2), hvilken primær (Ev2.1) fordamper (Ev2) i det andet trin
25 (18) og den sekundære (Cd1.2) kondenser (Cd1) i det første trin (16) anvender det samme vand i beholderen eller beholderne.

- 30 2. Varmeanlægget ifølge krav 1, kendetegnet ved, at vandet der anvendes af den primære (Ev2.1) fordamper i det andet trin og den sekundære (Cd1.2) kondenser i det første trin er enten delt med det mindst ene varmekredsløb i anlægget eller adskilt fra det mindst ene varmekredsløb i anlægget.

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3. Varmeanlæg ifølge et af kravene 1 til 2, kendetegnet ved, at ved lav temperaturopvarmning er anlægget konfigureret således, at den sekundære (Cd1.2) kondenser i det første trin

er i direkte forbindelse med det mindst ene varmekredsløb.

4. Varmeanlæg ifølge et af kravene 1 til 3, kendetegnet ved, at anlægget ved høj temperaturopvarmning er konfigureret således at vandet af det mindst ene varmekredsløb forsyner den sekundære (Cd2.2) kondenser (Cd2) i det andet trin (18) og ikke længere forsyner den sekundære (Cd1.2) kondenser i det første trin.

5. Varmeanlæg ifølge et af kravene 1 til 4, kendetegnet ved, at anlægget indbefatter mindst et strømningskontrolelement (V1) mellem indløbet af den sekundære (Cd1.2) kondenser i det første trin og indløbet af den sekundære (Cd2.2) kondenser i det andet trin, hvilket mindst ene strømningskontrolelement (V1) tillader anlægget at gå fra en åben tilstand til en lukket tilstand eller omvendt for at fungere ved lav temperaturopvarmning eller høj temperaturopvarmning.

6. Varmeanlæg ifølge et af kravene 1 til 5, kendetegnet ved, at anlægget indbefatter en pumpeindretning (22), der aktiveres for at recirkulere vandet i beholderen (20) eller beholderne (20.1, 20.2), hvis der er to af dem, i en sløjfe mellem kondenseren (Cd1) og fordamperen (Ev2) således at, på den ene side, vandet der forlader den sekundære (Cd1.2) kondenser forsyner den primære (Ev2.1) fordamper, og på den anden side, vandet der forlader den primære (Ev2.1) fordamper forsyner den sekundære (Cd1.2) kondenser.

7. Varmeanlæg ifølge et af kravene 1 til 6, kendetegnet ved, at det mindst ene varmekredsløb indbefatter to separate varmekredse, et første lavtemperaturvarmekredsløb (52) og et andet højtemperaturvarmekredsløb (62).

8. Varmeanlægget ifølge krav 7, kendetegnet ved, at anlægget er konfigureret således, at ved lav temperaturopvarmning af de to kredsløb, forsyner returvandet fra det første (52) og andet (62) varmekredsløb indløbet af den sekundære (Cd1.2) kondensor af det første trin, hvor det opvarmes, og udløbet af

den sekundær (Cd1.2) kondensor i de første trin forsyner både startpunktet for det første varmekredsløb (52) og startpunktet for det andet varmekredsløb (62) .

- 5 9. Varmeanlæg ifølge krav 7 eller 8, kendetegnet ved, at anlægget er konfigureret således, at ved lavtemperaturopvarmning i det første kredsløb (52) og ved højtemperaturopvarmning i det andet kredsløb (62):
- forsyner returvandet fra det første varmekredsløb (52)
- 10 indløbet af den sekundære (Cd1.2) kondensor i det første trin, hvor det opvarmes, og udløbet af den sekundære (Cd1.2) kondensor af det første trin forsyner både startpunktet for det første varmekredsløb (52) og indløbet til fordamperen (Ev2.1) i det andet trin,
- 15 - vandet recirkuleres også i en sløjfe i beholderen (20) eller beholderne (20.1, 20.2), hvis der er to af dem, på grund af den aktiverede pumpeindretning (22),
 - returvandet fra det andet varmekredsløb (62) forsyner indløbet til den sekundære kondensor i det andet trin, hvor
- 20 det opvarmes, og udløbet af den sekundære (Cd2.2) kondensor i det andet trin (18) forsyner startpunktet for det andet varmekredsløb (62) .

10. Varmeanlæg ifølge et af kravene 7 til 9, kendetegnet ved,
- 25 at den omfatter et strømningskontrolelement (V2), der er konfigureret, på den ene side, til at lade det opvarmede vand komme fra den sekundære (Cd1.2) kondensor i det første trin for at forsyne både startpunktet for det første varmekredsløb (52) og startpunktet for det andet varmekredsløb (62), ved
- 30 lavtemperaturopvarmning af de to kredsløb, og på den anden side, for at gøre de to varmekredsløb uafhængige, ved lavtemperaturopvarmning af det første kredsløb og ved højtemperaturopvarmning af det andet kredsløb.

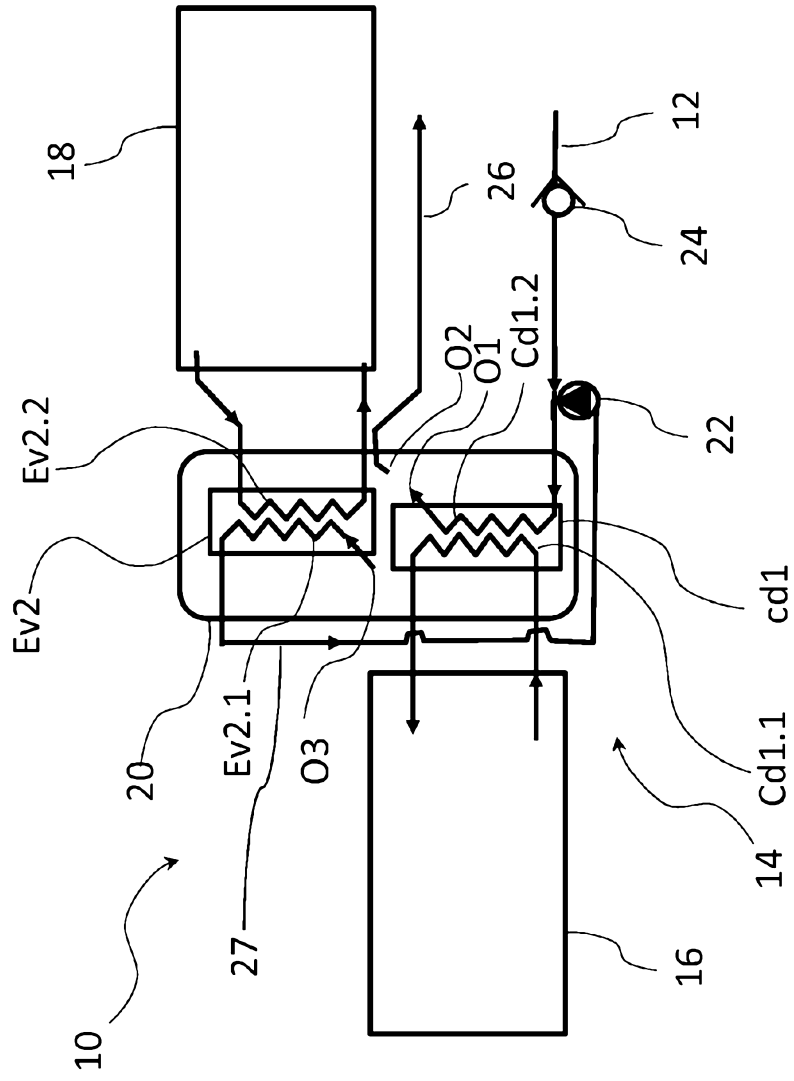


Fig. 1

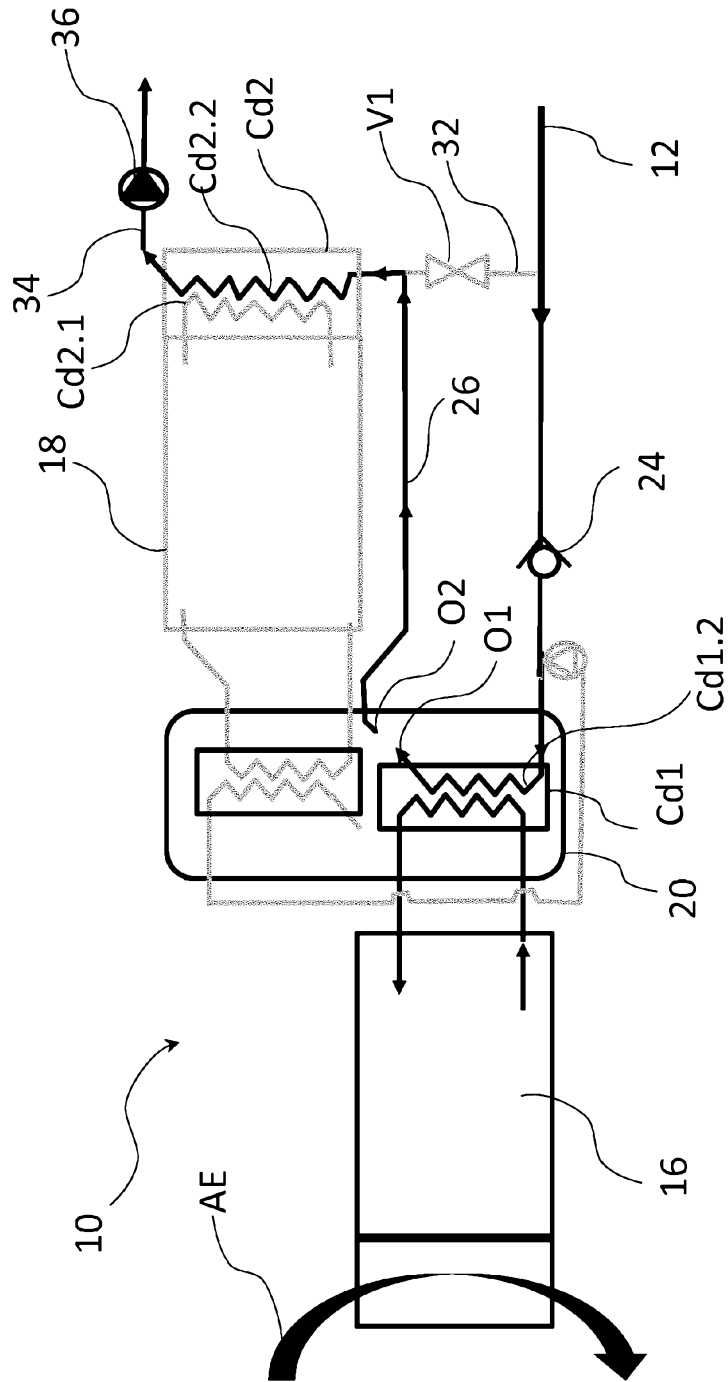


Fig. 2

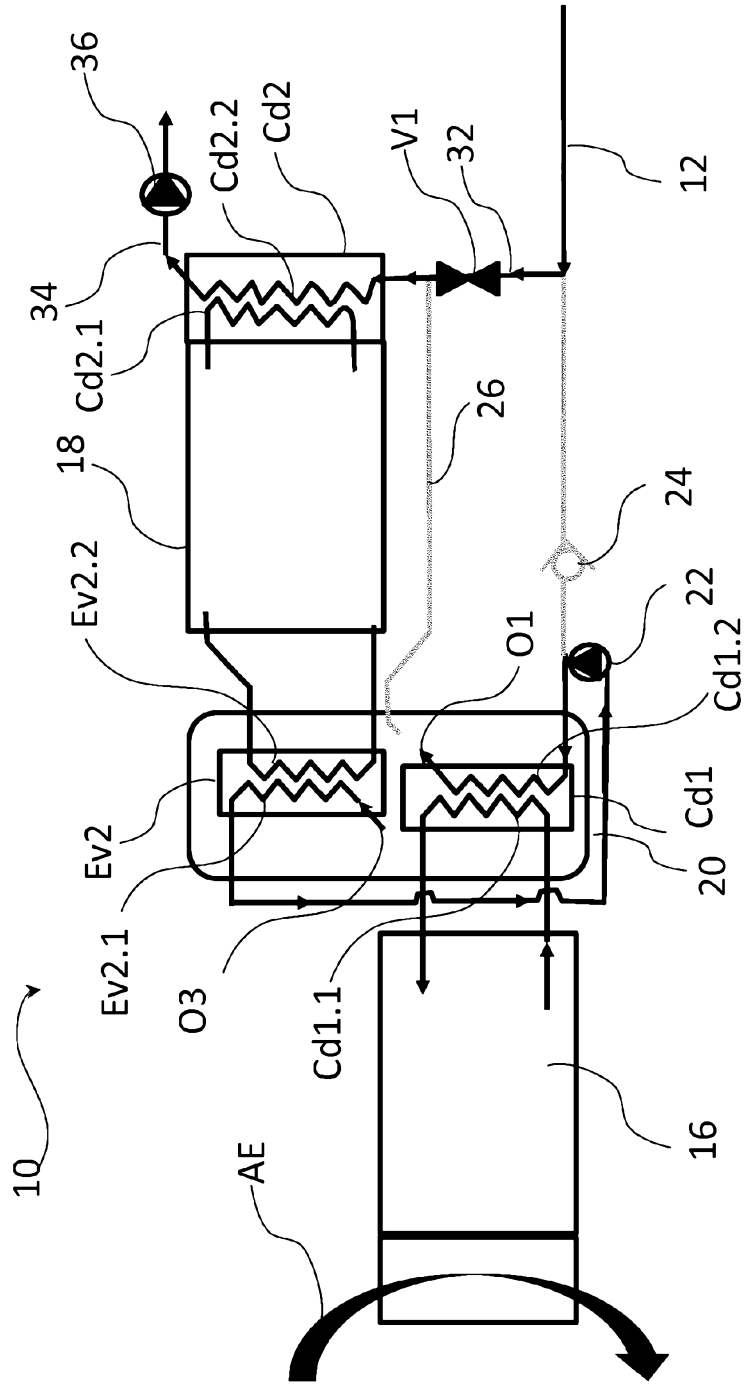
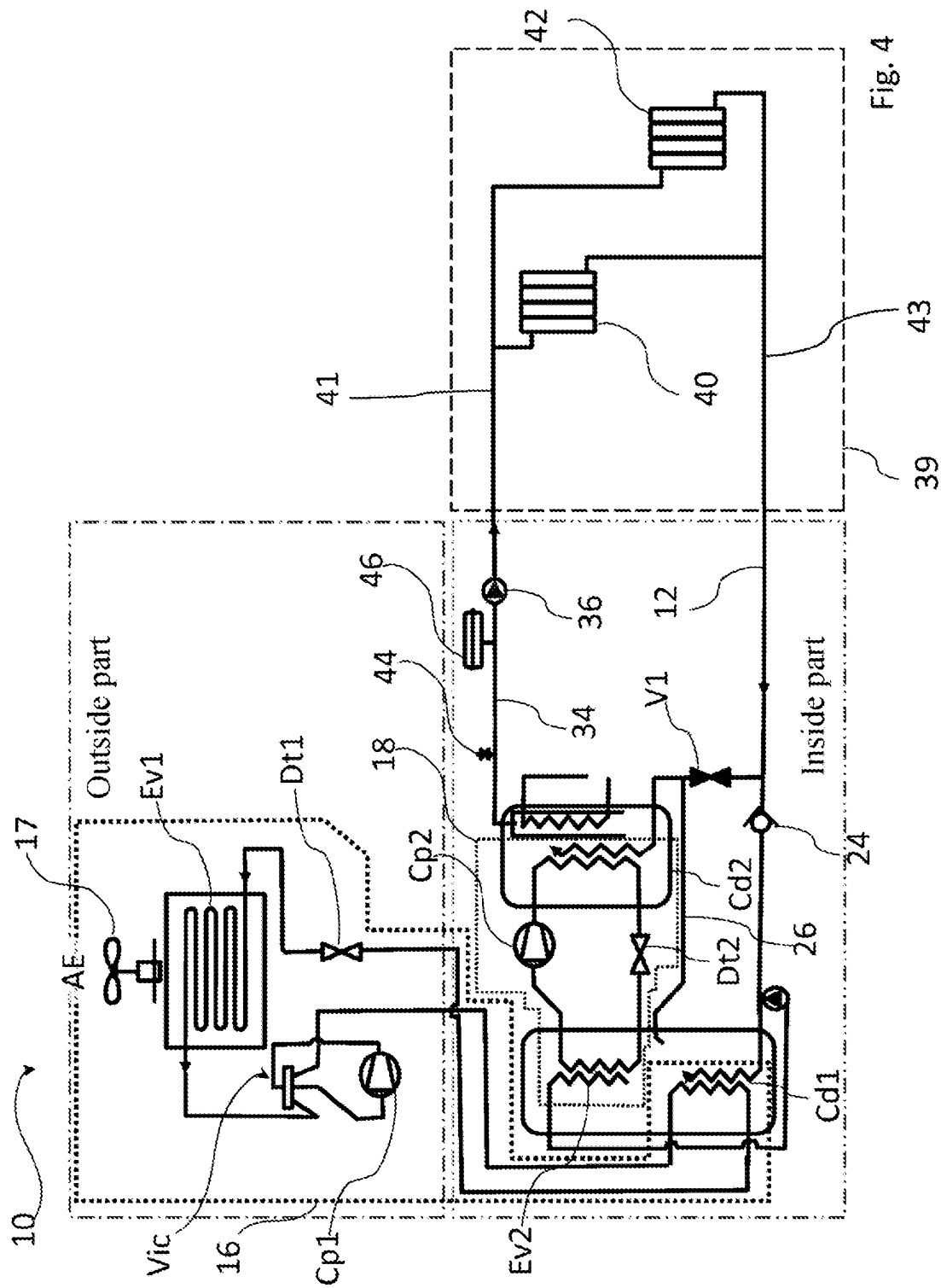


Fig. 3



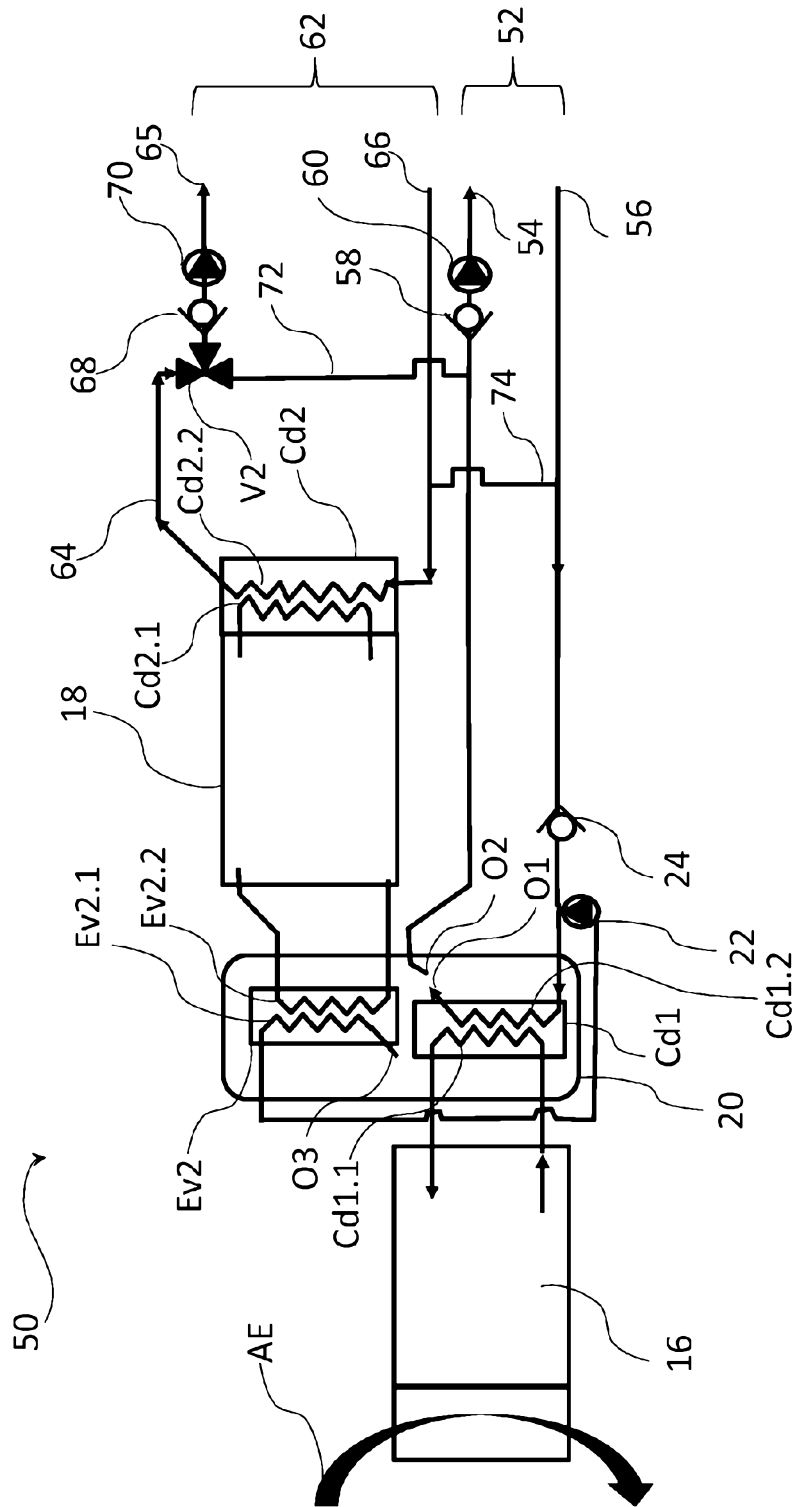


Fig. 5

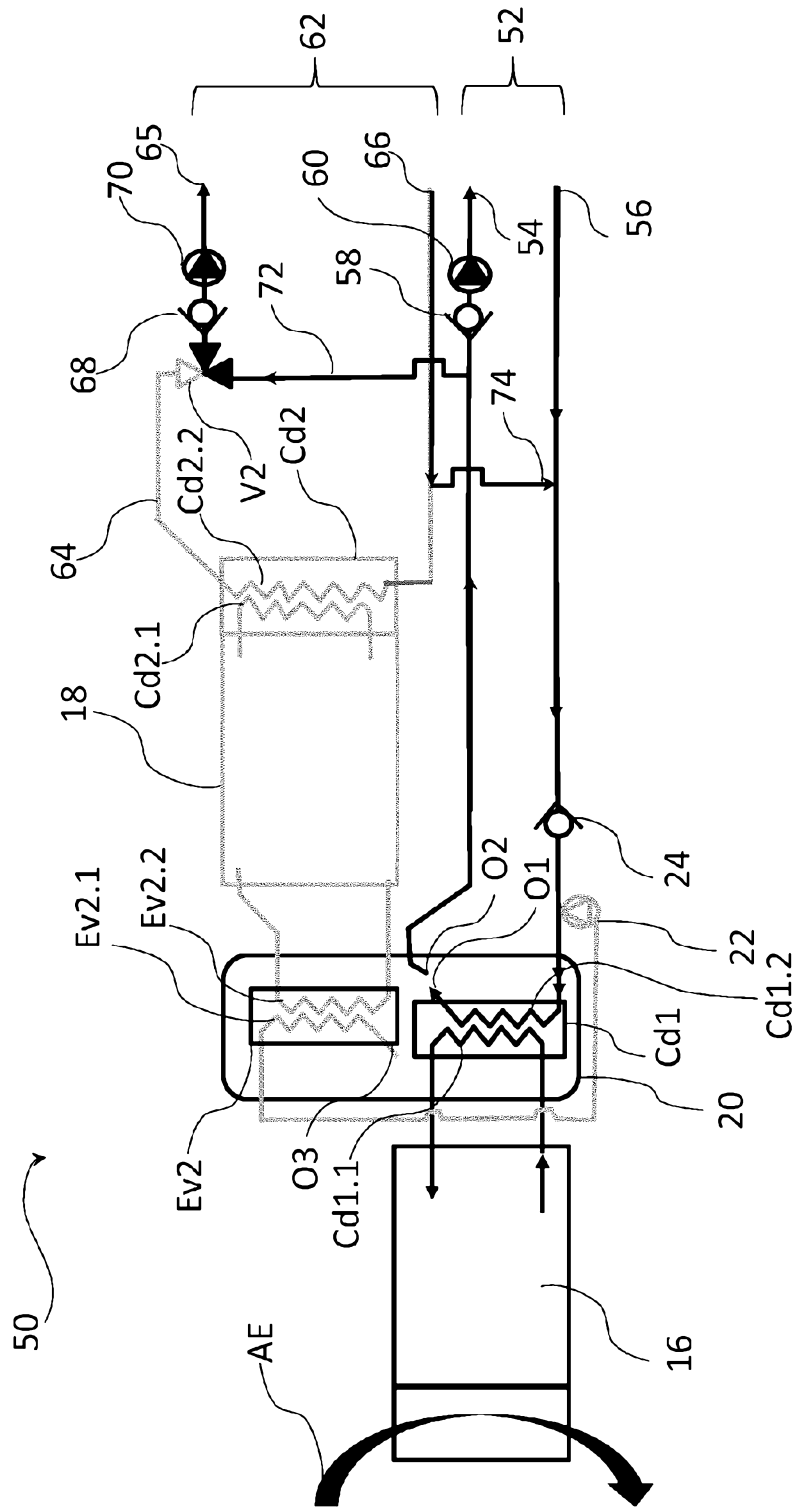


Fig. 6

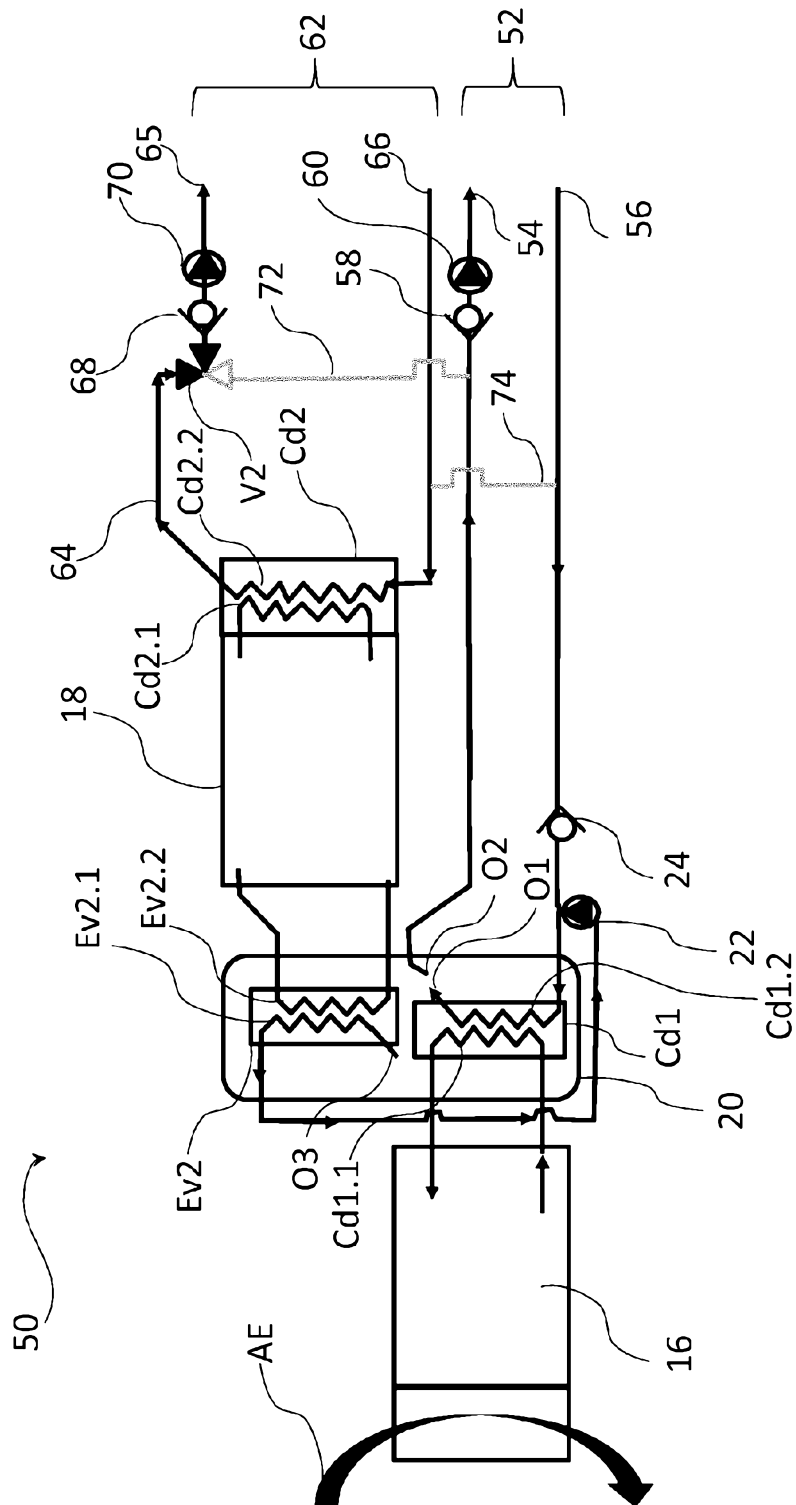


Fig. 7

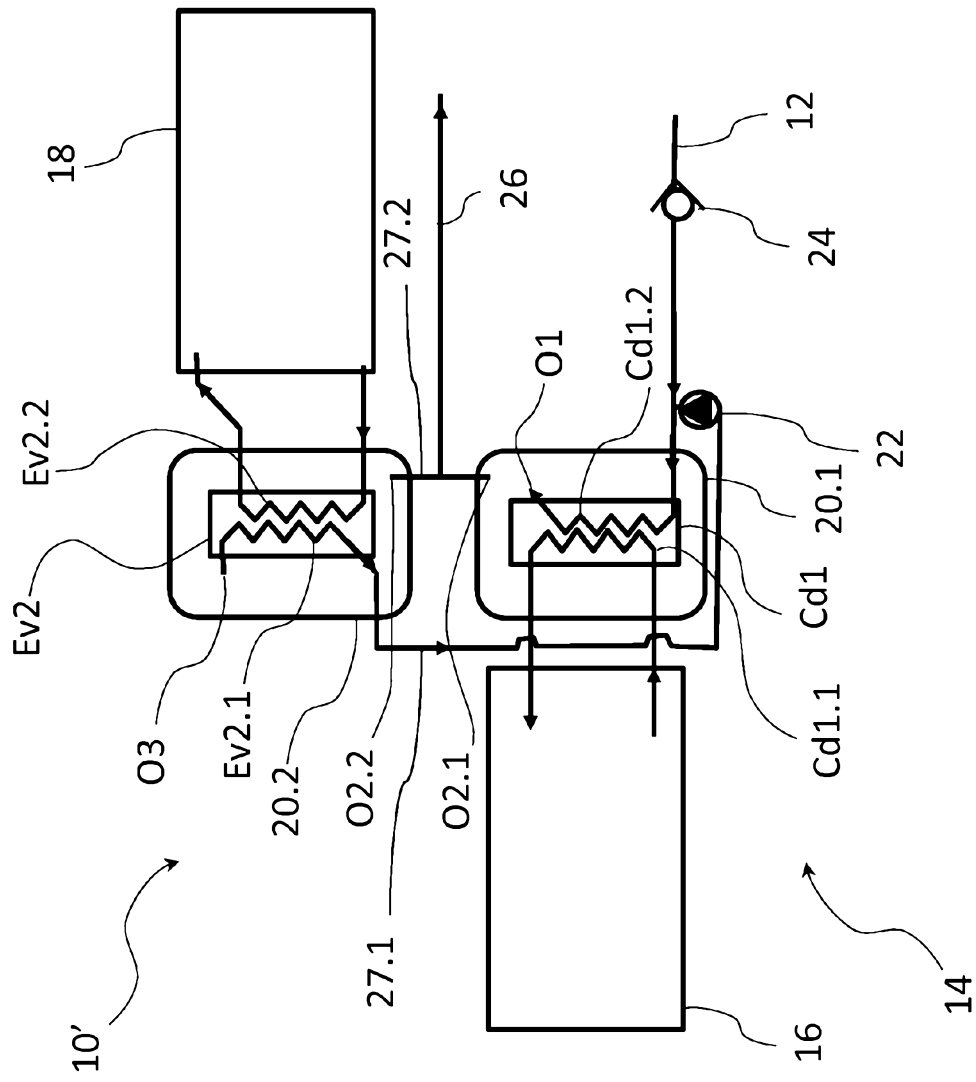


Fig. 8