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## HEAT PUMP HEATING DEVICE FOR HEATING OF A BUILDING OR AN INDUSTRIAL WATER STORAGE DEVICE

The invention relates to a heat pump heating device for heating a building and/or an industrial water storage device with a heat pump according to the preamble of claim 1. Document EP 1 731 846 A1 discloses a heat pump heating device having the features of the preamble of claim 1.

### Prior art

Heat pump heating extracts heat from the environment, e.g., from the surrounding air, groundwater, surface water, sewage or soil, and uses a heat pump to raise this heat to a usable higher temperature level in order to be able to heat buildings or other facilities or industrial water.

The heat pump extracts heat from the environment or a reservoir and thus cools the heat source. However, the efficiency of the heat pump – expressed in the coefficient of performance – decreases the lower the temperature of the source. This means that the use of the heat pump is more efficient, the lower the desired temperature difference between the heat reservoir, for example approx. 10°C ground temperature, and the “inlet temperature” of the building's heating system.

Earth heat exchangers are often used as ground heat collectors, which are “heating coils” laid in the ground (substantially horizontally) at a shallow depth of approx. 1 to 1.5 m. The heat is mainly brought in by seeping rainwater or groundwater that is flowing through. The heat extraction rate depends very much on superficial conditions, such as solar radiation, rain, frost, etc. The disadvantage here is that a layer of ice, a kind of permafrost, can form around the coils if the heat is extracted for a long time. Ice is an insulating layer and significantly impairs the heat transfer.

In addition, earth heat probes are used as earth heat exchangers. Substantially vertical boreholes are drilled up to several 100 metres into the ground. If the output of one earth heat probe is insufficient, several boreholes are provided. The high costs for the deep boreholes are disadvantageous.

In addition, heat pumps are also used, which extract heat from an ice store or water store, for example. So-called “seasonal storage” can also be used as a heat reservoir.

Corresponding heat pump heating systems are often used in so-called passive houses or low-energy houses. These buildings usually also have active, central/decentralised ventilation systems installed. Central ventilation systems in particular have a so-called

cross heat exchanger or cross countercurrent heat exchanger and/or plate heat exchanger, with which the sucked-in (cold) outdoor air is heated by the extracted (warm) indoor air or exhaust air. This is used for energy recovery and thus to improve the energy efficiency of the building.

Heat pump heating systems are already known which are combined or connected with active ventilation systems. This serves to further optimise the energy efficiency, wherein the energy recovery/use is usually improved or the aim is to increase the coefficient of performance of the heat pump. DE 10 2004 039 569 A1 relates to such a system, wherein the heat source circuit is connected to the active ventilation system via a heat exchanger in order to increase the coefficient of performance of the heat pump.

#### Object and advantages of the invention

The object of the invention, on the other hand, is to propose a heat pump heating device for heating a building and/or an industrial water storage device with a heat pump of the type mentioned at the outset, which at least partially improves the disadvantages of the prior art, in particular at low (outdoor) temperatures, and/or improves the usability of the heat source.

Proceeding from a heat pump heating device of the type mentioned at the outset, this object is achieved by the features of claim 1. Advantageous embodiments and developments of the invention are possible using the measures mentioned in the dependent claims.

Accordingly, a heat pump heating device according to the invention is characterised in that the heat source circuit has at least one second air heat exchanger through which the heat source fluid can flow for heat transfer between one of the air flows of the ventilation system and the heat source fluid.

With the help of this measure, the heat pump heating device can be adapted to a wide variety of operating modes such as summer, winter operation or to the changing transition period as well as to heating mode and a cooling mode for cooling the building, in particular by means of the ventilation system, etc. Thus, with the aid of the invention or the second air heat exchanger, a novel or repeated combination of the ventilation system and the heat pump or the heat pump circuit can be implemented. This enables an improved or more flexible energy management of the building, which leads to an increase in energy recovery and energy efficiency. As a result, individual components can also be made correspondingly smaller and therefore more economical.

In the sense of the invention, the heat pump is, in a known manner, a unit which

substantially has a (usually completely) closed heat pump circuit comprising a heat pump fluid, which, among other things, has an evaporator for vaporising the heat pump fluid and a compressor or a pump for pressurising the heat pump fluid and comprises a liquefier or condenser for liquefying/condensing the heat pump fluid and an expansion valve or the like. The liquefier or condenser is designed as a first heat pump heat exchanger, which is provided for dissipating the heating energy/heat by means of the heating fluid, in particular industrial water and/or heating water. The evaporator is designed as a second heat pump heat exchanger, which is provided for supplying or using the heat source or energy from the heat source by means of the heat source fluid, in particular a brine made from water and glycol and/or salt.

Advantageously, the first air heat exchanger is configured as an exhaust-air heat exchanger, wherein the exhaust-air heat exchanger is arranged after/downstream of the heat exchanger unit when viewed in the flow direction of the first air stream flowing out of the building, and/or in that the second air heat exchanger is configured as an outdoor-air heat exchanger, wherein the outdoor-air heat exchanger is arranged upstream of the heat exchanger unit when viewed in the flow direction of the second air flow flowing into the building. This can achieve a significant improvement in energy recovery and thus an increase in the efficiency of the entire system. A particularly flexible or advantageous interlinking or combination of the heat pump circuit with the ventilation can also be implemented in this way.

Accordingly, the exhaust-air heat exchanger in particular enables energy to be recovered in addition to the heat exchanger unit or the cross heat exchanger from the exhaust air flowing out of the building, which would otherwise escape unused into the atmosphere. In this way, the heat source circuit can advantageously be heated by this energy or amount of energy additionally held in the system, and thus the efficiency of the heat pump or its coefficient of performance can be improved. Under normal operating conditions, this can mean a considerable gain in energy, which, for example, is particularly important in modern low-energy or passive houses with regard to hot water preparation and/or building heating.

With the outdoor-air heat exchanger, on the one hand, the inflowing outside air can advantageously be heated ahead of the heat exchanger unit. This is particularly important at very low outside temperatures of below zero degrees, especially at around  $-10^{\circ}\text{C}$  and less. This is because, inter alia, freezing of the heat exchanger unit and thus the associated reduction in performance of the heat exchanger unit can be effectively prevented in winter.

On the other hand, with the advantageous outdoor-air heat exchanger at higher outside temperatures, especially above approx. 5°C or even above 15°C, or in summer and possibly during the so-called transition periods, heat from the outdoor air can advantageously be provided to the heat source circuit. This means that, as described above in relation to the exhaust-air heat exchanger, this additional energy or amount of energy made available or usable to the entire system advantageously heats the heat source circuit and thus the efficiency of the heat pump or its coefficient of performance can be improved. Consequently, especially in this operating case, the combination of the two air heat exchangers according to the invention is of particular energetic advantage, which also further improves the economy of the invention.

In a particular development of the invention, the heat source circuit comprises at least one connecting element, through which the heat source fluid can flow, for connecting the first air heat exchanger to the second air heat exchanger. In this way, an advantageous direct, fluidic connection or interlinking of the two air heat exchangers can be realised, i.e., the heat source fluid flows, in particular directly/immediately and adjacent or successively, from one air heat exchanger to the other.

The first and second air heat exchangers are advantageously connected in series or connected to one another. Accordingly, under special operating conditions, for example, a multi-stage or two-stage temperature increase in the temperature of the heat source fluid can be achieved. According to the invention, this is preferably implemented in that in the heat source circuit the first air heat exchanger is arranged upstream of the second air heat exchanger when viewed in the flow direction of the heat source fluid. This means, among other things, that in this embodiment of the invention the air heat exchanger(s) are integrated or incorporated in the heat source circuit upstream of the evaporator of the heat pump.

It is possible that the first and/or second air heat exchanger is/are arranged in the heat source circuit or viewed in the flow direction of the heat source fluid (directly/immediately) upstream of the heat pump and/or an outflow opening of the heat pump, in particular behind/after the heat source heat exchanger or the ground probe or ground collector. Accordingly, the above-mentioned "energy gains" for the heat source circuit and thus the temperature increase of the heat source fluid are made available directly to the heat pump. This improves the mode of operation or efficiency of the heat pump and thus also the economy of the heat pump heating device according to the invention.

In a preferred variant of the invention, in the heat source circuit the first air heat exchanger and/or the second air heat exchanger is/are arranged after/downstream of the heat pump

and/or an outflow opening of the heat pump when viewed in the flow direction of the heat source fluid. Alternatively or in combination with this, in the heat source circuit the first air heat exchanger and/or the second air heat exchanger is/are arranged upstream of the heat source heat exchanger when viewed in the flow direction of the heat source fluid. This means, among other things, that in these advantageous variants of the invention the air heat exchanger(s) are integrated or incorporated in the heat source circuit after/downstream of the evaporator of the heat pump. In this way, for example, the comparatively low temperature of the heat source fluid in the heat source circuit downstream of the heat pump or the evaporator can advantageously be particularly high and/or, for example, also be already/still somewhat raised/heated due to the relatively low/cool temperatures of the outdoor-air heat exchanger in winter or at lower outside temperatures. Among other things, this increases the above-mentioned usability of the outdoor-air heat exchanger for generating energy for the heat pump. If necessary, the exhaust-air heat exchanger with a slightly higher temperature level of the heat source fluid than the outdoor-air heat exchanger can be integrated/incorporated into the heat source circuit after/downstream of the outdoor-air heat exchanger. This can be achieved on the one hand by means of an advantageous parallel connection of the two air heat exchangers and/or with a corresponding arrangement in series with the two air heat exchangers. The latter, for example, in a bypass circuit of the heat source circuit.

In addition, the realisable energy input or energy gain by means of the first/second air heat exchanger in the heat source circuit or the temperature increase of the heat source fluid is achieved in an advantageous manner that, compared to the state of the art, the heat source heat exchanger or the so-called ground probe or the surface collector does not ice or at least ices up less even under unfavourable operating conditions.

Rather, it is even achieved with the aid of the invention that a ground freezing or a so-called "permafrost" area around/on the heat source heat exchanger or the ground probe is heated and thawed. This decisively improves the heat transfer between the heat source heat exchanger or the ground probe and its surroundings, i.e., the energy source. Accordingly, in comparison with the prior art, the dimensions of the heat source heat exchanger or the ground probe can be significantly reduced. This has a significant positive effect on the economy or the production of the heat source heat exchanger or the ground probe and, in some cases, also on the size of the land required for the smaller ground probe or the ground collector.

Basically, it should be noted that, according to the invention, energy from the ventilation system can be used to heat the heat source heat exchanger or the ground probe or the

ground collector. This means that energy is advantageously taken from the ventilation system and can be used for deicing/heating the heat source heat exchanger or the ground probe or the ground collector. This is a departure from previous measures in ventilation systems and heating systems that aim at energy recovery. According to the invention, however, in contrast to this, energy from the ventilation system is used to heat the energy source in certain operating conditions, i.e., energy is given off/returned to the environment or the energy source, which at first glance means a “waste of energy” in the previous sense.

However, it has been shown that especially in winter operation and sometimes in so-called transitional periods, a relatively long-term extraction of energy from the energy source or the ground leads to ground freezing or a permafrost area, which forms or “grows” more and more around the heat source heat exchanger or the ground probe or the ground collector and is a disadvantageous thermal insulation. According to the invention, especially in so-called transitional periods, e.g., with comparatively large temperature fluctuations in the course of the day, but also partly in winter operation, this ground freezing or the permafrost area on the heat source heat exchanger or ground probe or ground collector can be removed or at least reduced significantly, i.e., thawed. Initial calculations show that sometimes only a few hours a day with correspondingly advantageous heating, e.g., outside temperature above approx. 0°C, are sufficient to thaw the heat source heat exchanger or the ground probe according to the invention or around the same. This improves the efficiency of the heat pump or the heat source circuit to a considerable extent and is in many cases well above the (associated) “energy loss” of the ventilation equipment or ventilation system.

Possibly the first and/or second air heat exchanger is/are completely incorporated/integrated into the heat source circuit, i.e., the complete heat source fluid flow flows through these heat exchangers. Correspondingly, in this variant, the first and/or second air heat exchanger are arranged or connected/incorporated in a series connection to the heat pump and/or to the heat source heat exchanger or to the ground probe. For this purpose, however, these must be comparatively large in size.

Preferably (therefore) at least one (two) branch point and/or an air/heat exchanger parallel circuit and/or a bypass is provided so that (if necessary or depending on the operating mode/conditions) a part flow can flow through the first and/or second air heat exchanger. A main stream flows/circulates in an advantageous manner directly to or between the heat source heat exchanger/ground probe and heat pump. With this/these branch point(s) or the bypass/parallel circuit, a dimensioning or regulation of the quantity

of the heat source fluid flow flowing through the first and/or second air heat exchanger can be implemented independently of the main flow or total flow. This is energetically and economically advantageous as well as for reasons of space. The first/second air heat exchanger(s) can be designed/dimensioned correspondingly smaller and more cost-effectively.

The heat source circuit advantageously comprises at least one actuator for controlling the heat source fluid. In this way, an advantageous regulation/control of the heat source fluid flow flowing through the first/second air heat exchanger or its amount per unit of time can be implemented.

For example, the actuator is designed as a control valve and/or switch. At least two actuators/valves are preferably provided so that each of the two air heat exchangers or their heat source fluid partial flow can be controlled or adjusted separately. This increases the flexibility of the system according to the invention.

Alternatively or in combination with the aforementioned variants according to the invention, the actuator is advantageously configured in such a way that a part flow of the heat source fluid can flow through the first air heat exchanger and/or second air heat exchanger and/or in that one part, in particular the part-flow not flowing through the first and/or second air heat exchanger, flows directly to the heat source heat exchanger after flowing through the heat pump.

For example, the heat source circuit is designed in such a way that each air heat exchanger and/or the heat source heat exchanger or the ground probe can be controlled separately or independently of one another or the heat source fluid can flow through them and can thus be put into operation, partial operation or out of operation.

The heat source circuit can also comprise at least one actuator or control element for setting a maximum or defined heat source fluid quantity per unit of time.

In an advantageous embodiment of the invention, the heating circuit comprises at least one third air heat exchanger for heat transfer between the second air flow of the ventilation system flowing into the building, and the heating fluid. In this way, for example, advantageous post-heating or additional heating, i.e., a further increase in temperature in the air flow flowing into the building, can be achieved. This can be of great advantage, especially in so-called transitional periods.

Advantageously, the invention can be used to achieve an advantageous temperature smoothing effect in the case of the heat source heat exchanger/ground collector or in the case of the ground probe. This is of considerable advantage to be able to operate the heat source heat exchanger/ground collector or the ground probe more efficiently, in

particular to prevent or at least reduce the disadvantageous ice formation or formation of a so-called permafrost area on/around this.

The first calculations/simulations show that it is even possible to thaw this “ice mantle” or permafrost area, even in cold external conditions or in winter and especially in transitional periods. Here, weather changes from one day to the next and/or even only (larger) temperature fluctuations in the course of the day are sufficient to generate defrosting or thawing. What is essential here is the additional energetic input or energy input from the ventilation system into the heat source heat exchanger/ground collector or into the ground probe.

The “energy losses” according to the invention or the energetic “disadvantage” for the ventilation system contradict the previous developments in energetic building management and are of minor importance compared to the previously mentioned advantage or “gain” for the heat source circuit and also for the overall system or energy management of the building. Rather, according to the invention, a considerable reduction in the dimensions and thus the costs of the heat source heat exchanger/ground collector or the ground probe, inter alia, for laying or drilling and manufacturing can be achieved.

#### Exemplary embodiment

An exemplary embodiment of the invention is shown in the drawing and is explained in more detail below with reference to the figures.

In the figures:

- Figure 1 shows a schematic block diagram of a first heat pump heating device according to the invention,
- Figure 2 shows a schematic block diagram of a second heat pump heating device according to the invention,
- Figure 3 shows a schematic block diagram of a third heat pump heating device according to the invention,
- Figure 4 shows a schematic block diagram of a fourth heat pump heating device according to the invention,
- Figure 5 shows a schematic block diagram of a fifth heat pump heating device according to the invention,
- Figure 6 shows a schematic block diagram of a sixth heat pump heating device according to the invention and
- Figure 7 shows a schematic block diagram of a seventh heat pump heating device according to the invention.

The figures show different exemplary embodiments, which substantially relate to different arrangements or integration and interconnection options of a first air heat exchanger 1 and a second air heat exchanger 2 in a heat pump circuit 3 according to the invention driven by a pump 15. Here, the same reference symbols substantially designate the same or comparable components or features.

The heat pump circuit 3 comprises at least one heat pump 4 and a heat source heat exchanger 5, which is preferably designed as a ground probe 5 or a ground collector 5, as a so-called ice store 5, as a so-called seasonal store 5 or the like. A power supply 14 and/or control 14 or circuit board 14 is preferably assigned to the heat pump 4, which is not shown schematically in all figures.

The heat pump 4 is constructed in a known manner and substantially comprises (not shown in detail) a closed circuit, especially with a condenser, an evaporator and an expansion valve as well as a pump, wherein the evaporator as a heat exchanger is a component of the heat pump circuit 3, i.e., integrated/incorporated therein and is thus passed through by a heat pump fluid on the one hand and a heat source fluid on the other. The condenser is accordingly incorporated or integrated into a heating circuit 6 as a heat exchanger in a known manner. The heating circuit 6 also comprises a hot water boiler 7 or heating element 7, in particular so-called surface heating element 7, or the like and an optionally provided third air heat exchanger 11 (see variants according to Figure 1, 2, 6 or 7).

The second air heat exchanger 2 is designed as a so-called outdoor-air heat exchanger 2 and a first air flow flows through it, which is referred to as so-called outdoor air 8, i.e., it is drawn in from the outside or comes from the atmospheric air. This air heat exchanger 2 is arranged upstream of a so-called cross heat exchanger 9 or plate heat exchanger 9 in the flow direction of the outdoor air 8. The cross heat exchanger 9 is designed for heat recovery, wherein a second, warmer air flow from the inside of the building or from the inside or sucked in, which is referred to as so-called indoor air 10, passes through.

The first air flow after the cross heat exchanger 9 when flowing into the building is also referred to as so-called supply air 12, wherein this optionally flows through the third air heat exchanger 11 before flowing into a building interior (see above). The second air flow after the cross heat exchanger 9 when flowing out of the building is also referred to as so-called exhaust air 13, wherein this flows through the first air heat exchanger 1 before flowing out of the building or into the atmosphere (see above).

In the preferred variant of the invention according to Figure 7, but also implemented in other figures or variants, the two air heat exchangers 1, 2 are incorporated or integrated in

the heat pump circuit 3 via a first branch point 16 and/or an actuator 17 or valve 17 and a second branch point 18. Correspondingly, in relation to the ground heat exchanger 5 or to the heat pump 4, a parallel connection of the two air heat exchangers 1, 2 connected in series with one another is implemented. In this way, by means of the actuator 17 and/or the dimensioning, in particular the cross-sections, of the branch points 16, 18, a part flow or the proportion of the main circuit can be set/regulated in an advantageous manner. A dashed line according to Figure 1 or a very thin line according to Figure 7 is intended to make it clear that the components contained therein can be implemented together as a structural unit 26 or a separately manageable ventilation device 26. This can also be implemented accordingly for the other variants according to Figures 2 to 7.

The variants according to Figures 1, 2 or 7 each have a connecting line 27 between the two air heat exchangers 1, 2. This enables a two-stage temperature change of the heat source fluid to be implemented. The exhaust-air heat exchanger 1 preferably takes energy/heat from the outflowing, relatively warm air flow and uses it to heat the air flow or the outdoor air 8 flowing into the building in order to reduce or avoid ice formation in the cross heat exchanger 9 at particularly low outside temperatures.

In the other variants of the invention according to Figures 3, 4, 5, systems with two separate connections of the two air heat exchangers 1, 2 can also be implemented in an advantageous manner. In this case, further branch points 19, 21 and/or a further actuator 20 or valve 20 are provided.

In addition, it is advantageous, with the aid of a further actuator 24 or valve 24 or branch point 24, for a bridging 25 or a bypass 25 for the first or second air heat exchanger 1, 2 arranged in the partial circle (see Figures 1, 2, 7) to be realised. This allows the respective air heat exchanger 1 or 2 to be switched on or decoupled separately, wherein the valve 24 can also be arranged at the input or upstream of the respective air heat exchanger 1, 2. This ability to switch the respective air heat exchanger 1 or 2 on and off increases the flexibility of the system again.

The V shown in the figures with the associated arrow(s) represents a further variant V of the respective figure, otherwise not shown in more detail, in which the corresponding components, e.g., air heat exchangers 1, 2 according to Figure 1, could be exchanged with regard to their place in the partial circuit or system or the respective connections or branching points could be relocated according to the arrow.

According to the variant of Figure 6, the outdoor-air heat exchanger 2 can also be operated with a separate or second ground heat exchanger 22 with a separate pump 23. In principle, various sensors such as temperature sensors and/or flow sensors or the like

in the system can be of great advantage for the control/regulation and the most diverse modes of operation.

List of reference numerals

1	Air heat exchanger
2	Air heat exchanger
3	Heat pump circuit
4	Heat pump
5	Earth heat exchanger
6	Heating circuit
7	Boiler/radiator
8	Outdoor air
9	Cross heat exchanger
10	Indoor air
11	Air heat exchanger
12	Supply air
13	Exhaust air
14	Control
15	Pump
16	Branch point
17	Valve
18	Branch point
19	Branch point
20	Valve
21	Branch point
22	Ground heat exchanger
23	Pump
24	Valve
25	Bypass
26	Structural unit
27	Connection
V	Variant

## Varmepumpeopvarmningsanordning til opvarmning af en bygning eller en brugsvandsbeholder

### Patentkrav

1. Varmepumpeopvarmningsanordning til opvarmning af en bygning og/eller en brugsvandsbeholder (7) med en varmepumpe (4), hvor varmepumpeopvarmningsanordningen i det mindste delvist omfatter varmepumpen (4), et varmekildekredsløb (3), et ventilationsanlæg (26) samt et varmekredsløb (6), hvor varmekildekredsløbet (3) omfatter mindst én varmekildevarmeveksler (5) til udnyttelse af varmeenergi fra en varmekilde, særligt et jordlegeme eller lignende, og en Pumpe (15) til pumpning og/eller cirkulation af en varmekildevæske, særligt en brine, samt i det mindste delvist varmepumpen (4), hvor varmekredsløbet (6) omfatter mindst ét varmelegeme (7), der kan gennemstrømmes af en varmevæske, særligt opvarmningsvand,, særligt panelradiator og/eller radiator og/eller brugsvandsbeholderen (7), samt en varmepumpe til pumpning og/eller cirkulation af varmevæsken og i det mindste delvist varmepumpen (4), hvor ventilationsanlægget (26) indeholder mindst én varmevekslerenhed (9) til varmeoverførsel mellem en første luftstrøm (10, 13), der strømmer ud af bygningen, og en anden luftstrøm (8, 12), der strømmer ind i bygningen, hvor varmekildekredsløbet (3) indeholder mindst én første luftvarmeveksler (1), der kan gennemstrømmes af varmekildevæsken, til varmeoverførsel mellem en af luftstrømmene (8, 10, 12, 13) i ventilationsanlægget (26) og varmekildevæsken, kendetegnet ved, at varmekildekredsløbet (3) indeholder mindst én anden luftvarmeveksler (2), der kan gennemstrømmes af varmekildevæsken, til varmeoverførsel mellem en af luftstrømmene (8, 10, 12, 13) i ventilationsanlægget (26) og varmekildevæsken.

2. Varmepumpeopvarmningsanordning ifølge krav 1, kendetegnet ved, at den første luftvarmeveksler (1) er udformet som en aftræksluftvarmeveksler (1), hvor aftræksluftvarmeveksleren (1) set i strømningsretningen af den første luftstrøm (10, 13), der strømmer ud af bygningen, er placeret efter/bag varmevekslerenheden (9), og/eller at den anden luftvarmeveksler (2) er udformet som udeluftvarmeveksler (2), hvor udeluftvarmeveksleren (2) set i strømningsretningen af den anden luftstrøm (8, 12), der strømmer ind i bygningen, er placeret før varmevekslerenheden (9).

3. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet

ved, at varmekildekredsløbet (3) omfatter mindst ét forbindelseselement (27), der kan gennemstrømmes af varmekildevæsken, til forbindelse af den første luftvarmeveksler (1) med den anden luftvarmeveksler (2).

4. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at den første luftvarmeveksler (1) i varmekildekredsløbet (3) set i strømningsretningen af varmekildevæsken er placeret før den anden luftvarmeveksler (2).

5. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at den første luftvarmeveksler (1) og/eller den anden luftvarmeveksler (2) i varmekildekredsløbet (3) set i varmekildevæskens strømningsretning er placeret efter/bag varmepumpen (4) og/eller en udløbsåbning på varmepumpen (4).

6. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at den første luftvarmeveksler (1) og/eller den anden luftvarmeveksler (2) i varmekildekredsløbet (3) set i varmekildevæskens strømningsretning, er placeret før varmekildevarmeveksleren (5).

7. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at varmekildekredsløbet (3) omfatter mindst én aktuator (17, 20) til kontrol af varmekildevæsken.

8. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at aktuatoren (17, 20) er udformet på en sådan måde, at den første luftvarmeveksler (1) og/eller anden luftvarmeveksler (2) kan gennemstrømmes af en delstrøm af varmekildevæsken, og/eller at en del, særligt den delstrøm, der ikke strømmer gennem den første og/eller anden luftvarmeveksler (1, 2), efter gennemstrømning af varmepumpen (4), strømmer direkte hen til varmekildevarmeveksleren (5).

9. Varmepumpeopvarmningsanordning ifølge et af de foregående krav, kendetegnet ved, at varmekredsløbet (6) omfatter mindst én tredje luftvarmeveksler (11) til varmeoverførsel mellem den anden luftstrøm (12, 13), der strømmer ind i bygningen, i ventilationsanlægget (26) og varmevæsken.

10. Bygning med en varmepumpeopvarmningsanordning ifølge et af de foregående krav.

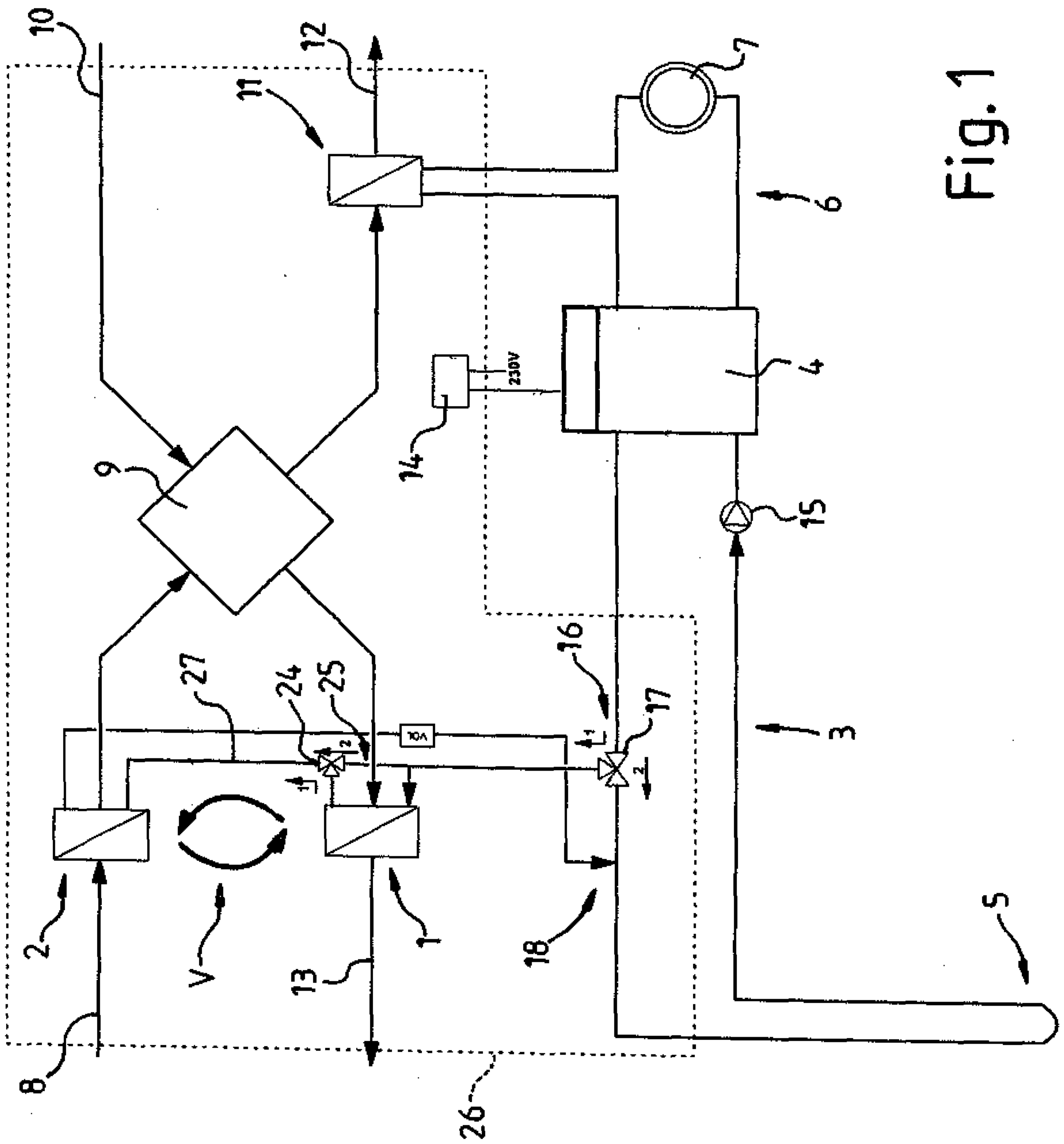


Fig. 1



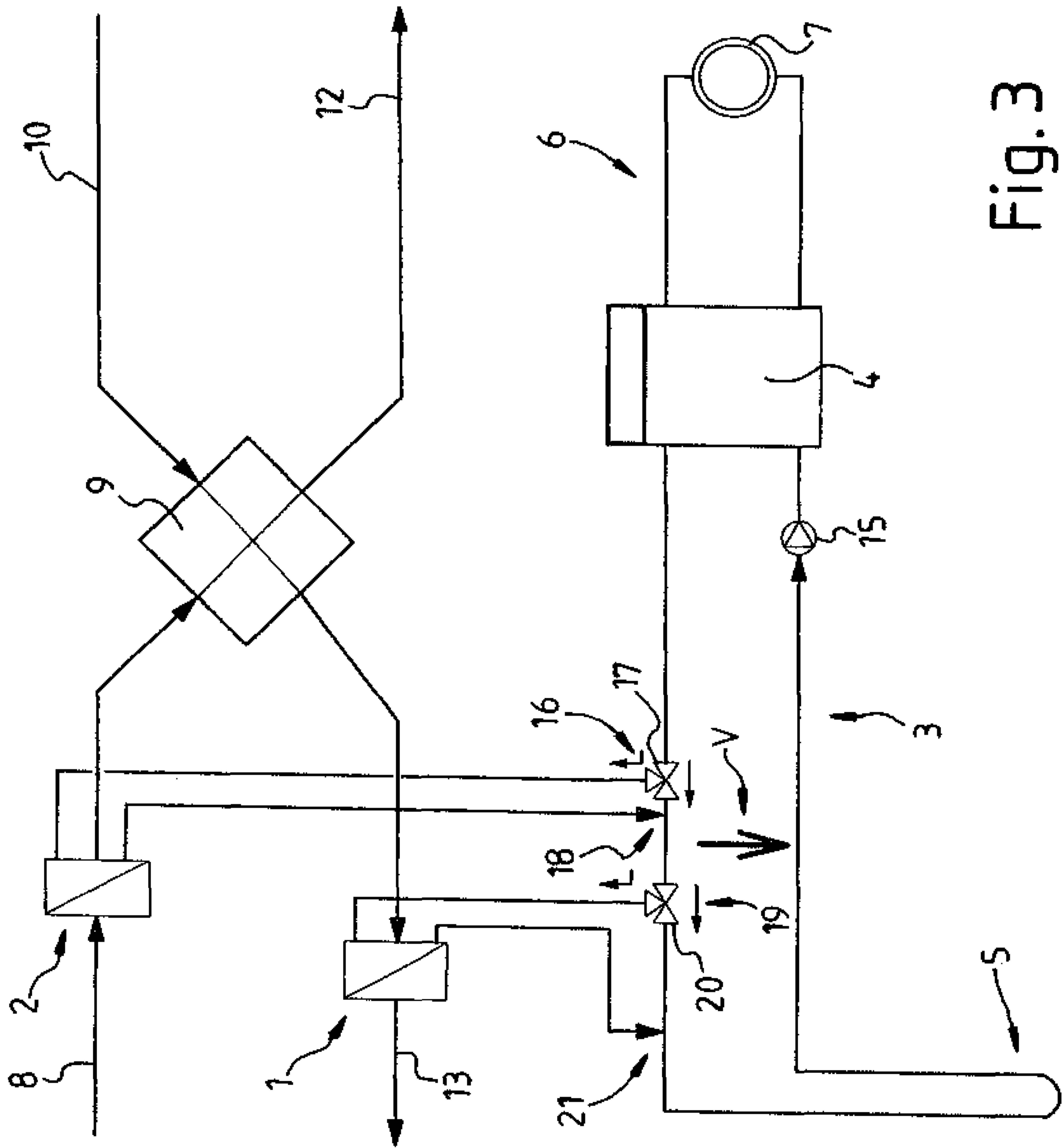


Fig. 3

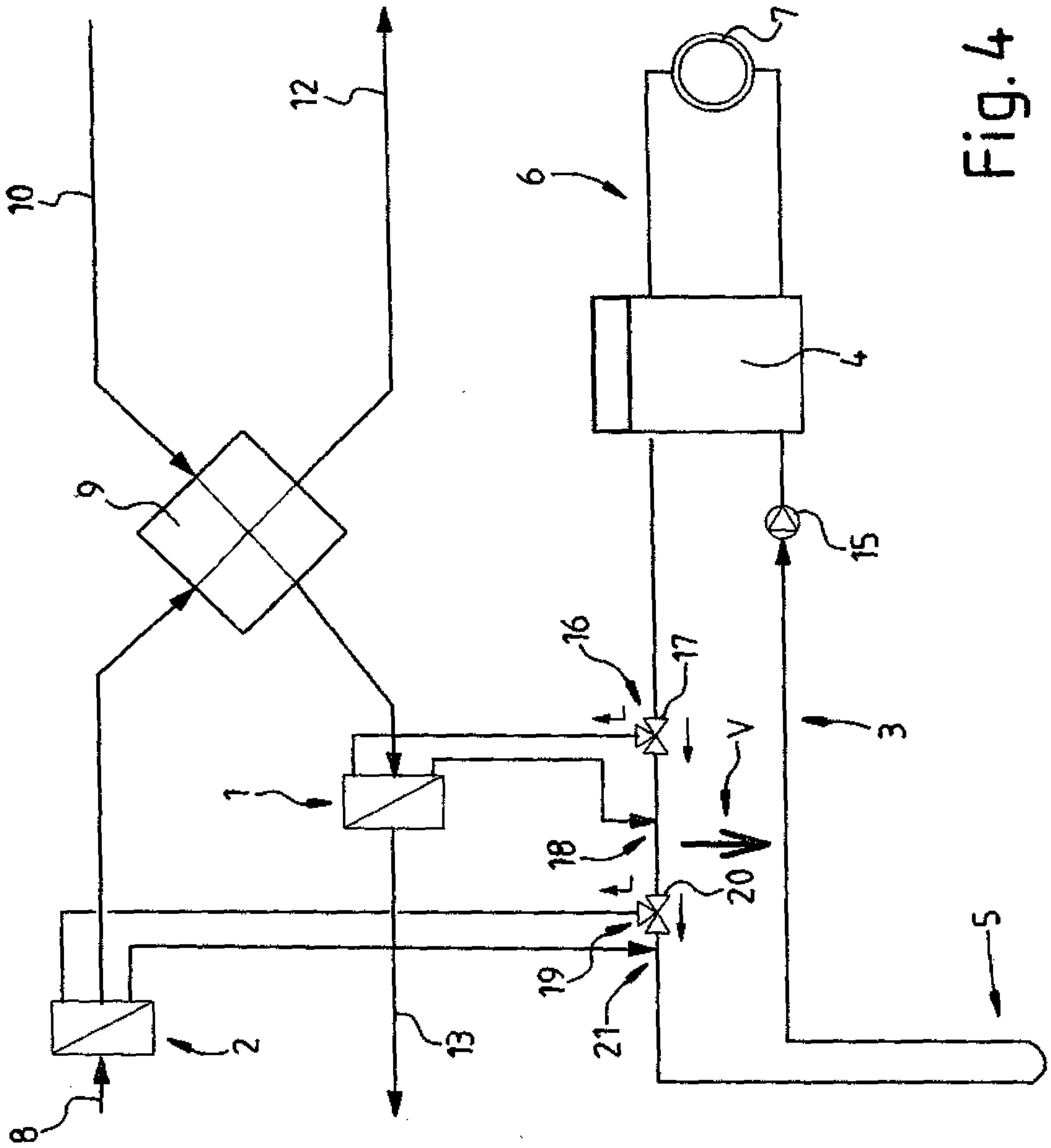


Fig. 4

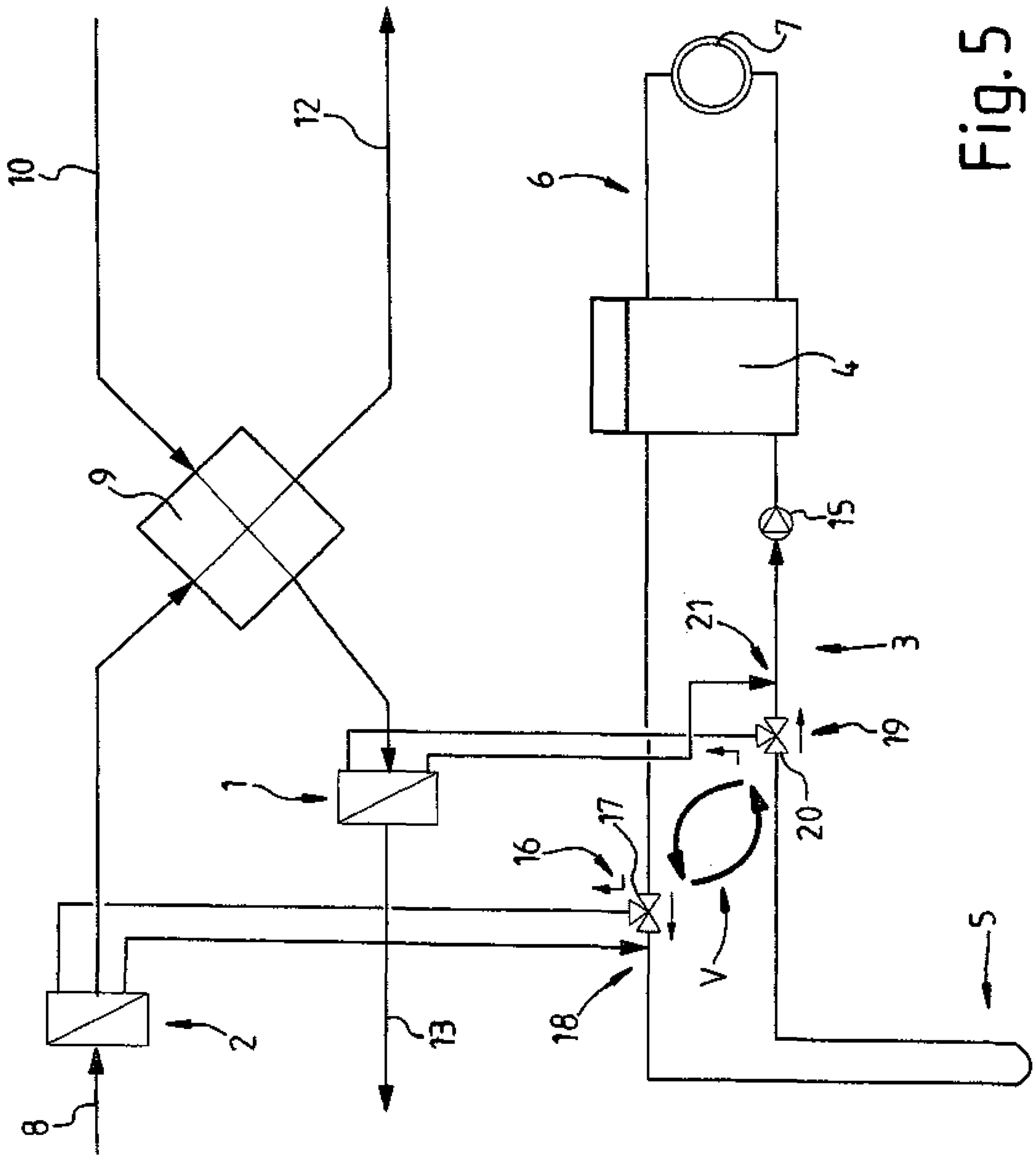


Fig. 5

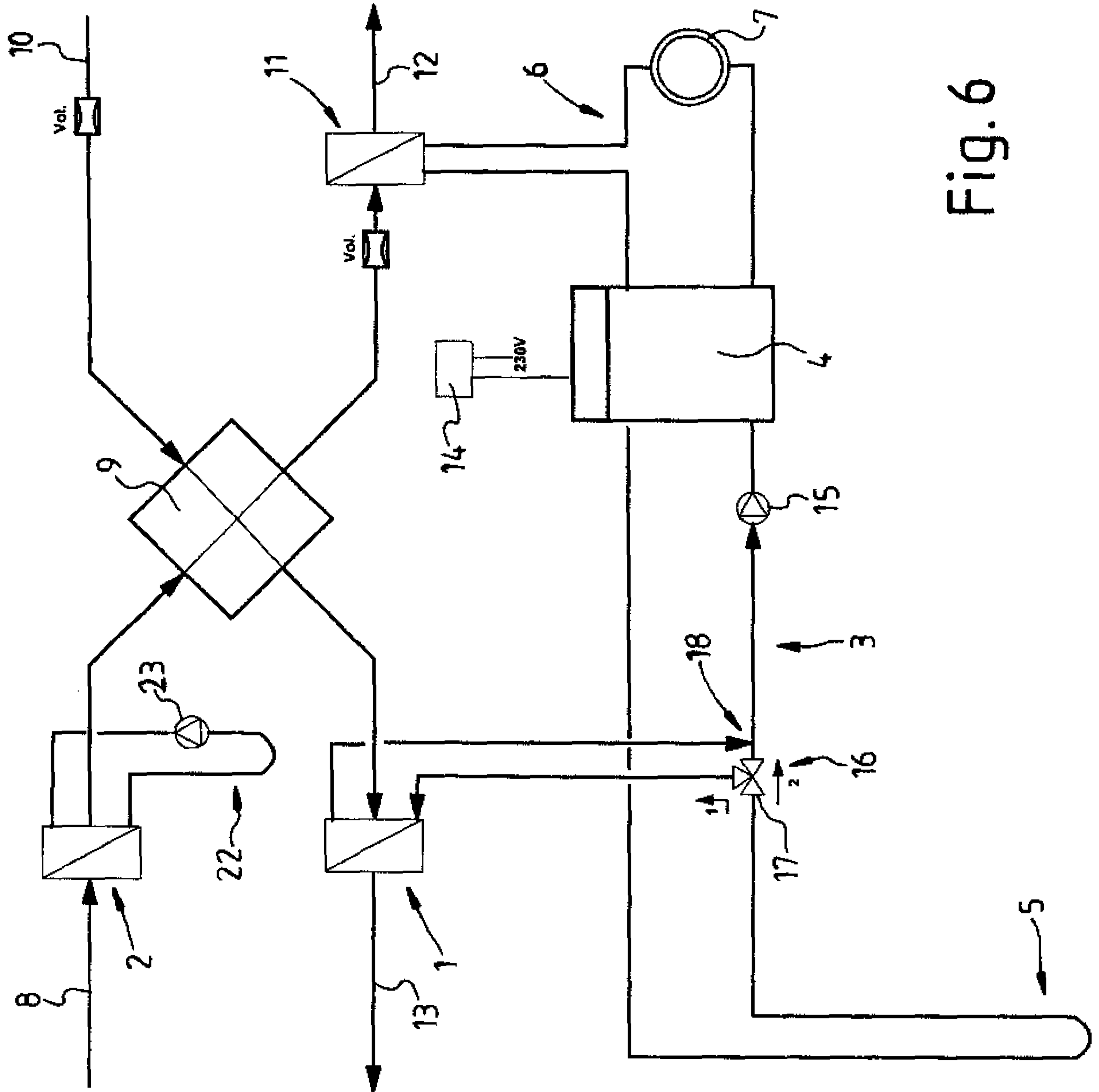


Fig. 6

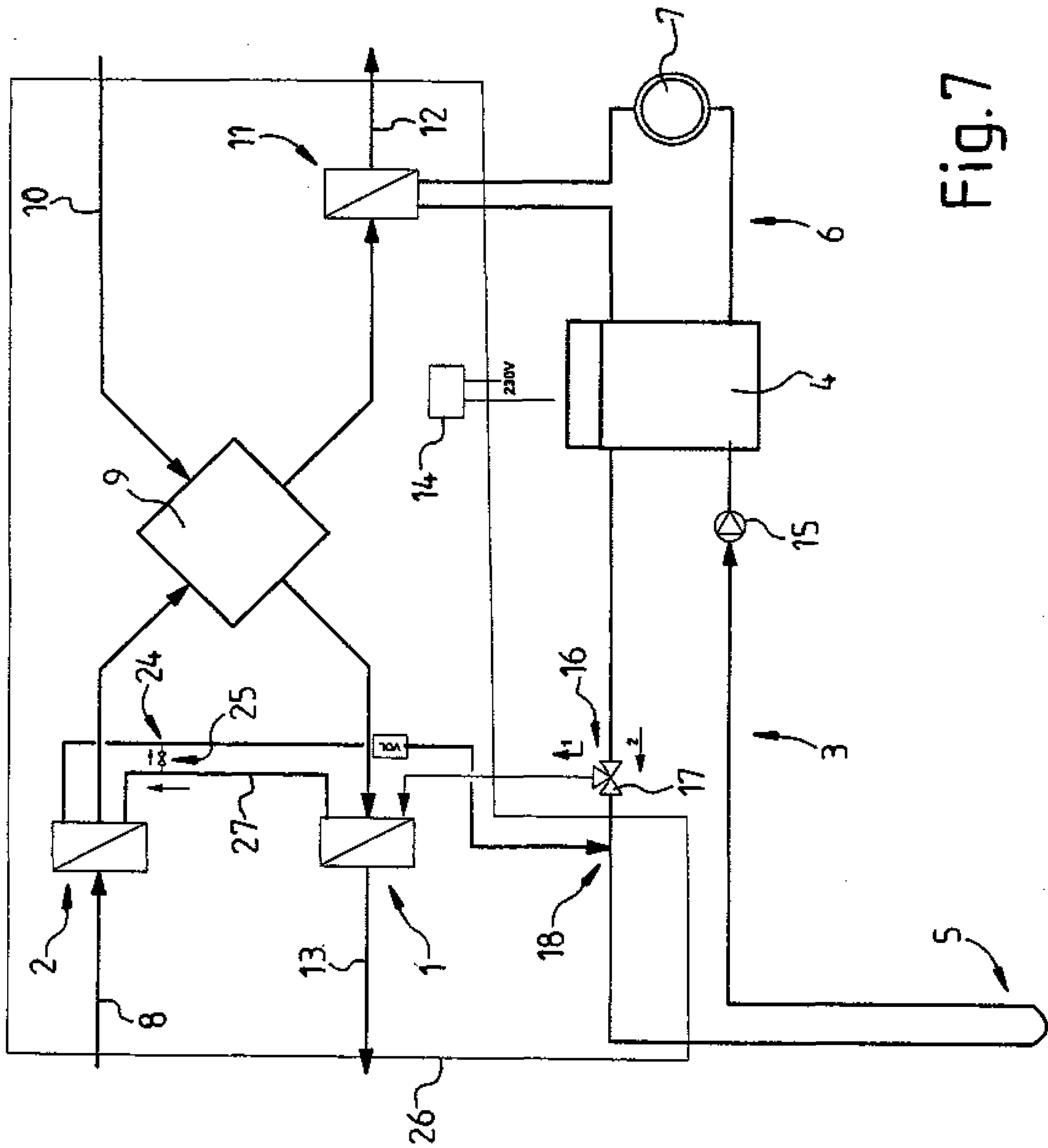


Fig.7