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(54) **AN AIR HANDLING APPARATUS**

LUFTBEHANDLUNGSVORRICHTUNG

APPAREIL DE GESTION DE L'AIR

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Description

[0001] The present invention relates to an air handling apparatus and in particular to an air handling apparatus used in a ventilating, heating and cooling system according to the preamble of claim 1. Such a system is known from US-A-6 223 545.

[0002] EP 0808441 discloses an air heating and heat recovery ventilation system with one or more solar panels of the type which transmit incident solar radiation into the housing, a solar radiation absorber in the housing and air inlet and outlet ports to enable air to be circulated through the panel to collect heat from the panel. The system includes an air handling apparatus which comprises an air-to-water heat exchanger and means for forcing the heated air from the solar panels through the heat exchanger, thereby transferring heat to water in the domestic hot water supply system and forcing warm air emerging from the heat exchanger to flow around the house. As clearly seen in Figure 7 of EP 0808441 the air handling apparatus comprises four distinct and separate chambers. The air handling apparatus described therein does not respond quickly or easily to changes in temperature or indeed in response to alterations of the control system governing the air heating and heat recovery ventilation system.

[0003] The present invention seeks to alleviate the problems associated with known air handling apparatuses.

[0004] Accordingly the present invention provides an air handling apparatus as claimed in claim 1.

[0005] The features of the invention will be apparent from a consideration of the attached claims 1 to 15.

[0006] Preferably the inlet port attached to the first heat exchanger is connected to the outlet port connected to the second fan. Likewise it is preferable that the inlet port attached to the second heat exchanger is connected to the outlet port connected to the first fan.

[0007] Conveniently the separation means comprises a damper rotatable around a central axis point between the first and second position.

[0008] In the first position, a single loop is formed in which fluid flows through the first fan and fluid outlet port. Fluid re-enters the air handling apparatus through fluid inlet port and passes through the first heat exchanger through the second fan and fluid outlet port. Fluid subsequently re-enters the air handling apparatus 1 again through the fluid inlet port attached to the second heat exchanger.

[0009] The second position forms two distinct closed loops. In the first loop fluid flows through the second fan and fluid outlet re-entering the air handling apparatus through fluid inlet port attached to the second heat exchanger. The second loop comprises fluid exiting the air handling apparatus though the first fan and fluid outlet port subsequently re-entering through the fluid inlet port attached to the first heat exchanger.

[0010] Ideally the damper is operated by a single motor.

[0011] Preferably the air handling apparatus further comprises one or more filters. Conveniently the air handling apparatus uses a plurality of different sized filters. In practice it is preferable to use larger filters as this increases the length of time a filter can operate effectively between filter changes.

[0012] The components of the air handling apparatus are placed in a plurality of separate interconnecting compartments for ease of handling and flexibility. The compartments comprise a first and second fan compartment and a central compartment. The sizes of each compartment being restricted to ensure that each will fit through a standard attic trap door. It will of course be appreciated that the compartments of the invention are not limited to this size and indeed any size can be used.

[0013] Each fan compartment attaches to either side of the central compartment. Ideally the central compartment contains the separation means and at least two heat exchangers.

[0014] Conveniently the fan compartments are sufficiently large to minimise pressure across each of the fans thus allowing the fans to run more efficiently.

[0015] Ideally each compartment contains all further necessary control means and connections required for interfacing the air handling apparatus with external devices.

[0016] Optionally the air handling apparatus can be connected to one or more of solar panels, domestic hot water cylinders, heat recovery ventilation units and/or a further energy source such as a heat pump or boiler.

[0017] Optionally the first fan compartment is large enough to accommodate a selection of different sized connections which act as a manifold for the distribution of air to the house.

[0018] Optionally the second fan box is large enough to accommodate a selection of different sized connections which act as a manifold for the distribution of air to the solar panels. Typically up to three pairs of air solar panels are connected to the manifold. It is of course appreciated that the number of solar panels connected to the system can be increased further by increasing the size of the fan motors.

[0019] Conveniently the air handling apparatus when connected to external devices such as solar panels, domestic hot water cylinder and a heat recovery ventilation unit forms an integrated ventilation heating and cooling system.

[0020] Preferably the integrated ventilation heating and cooling system further comprises a control system which enables the air handling apparatus to respond to external commands. Optionally the control system could further enable the air handling apparatus to automatically respond to pre-set commands such as temperature inputs.

[0021] Optionally the heat exchangers are air to water heat exchangers.

[0022] Conveniently the heat exchanger of the air han-

dling apparatus supplies heat to the ventilation air and/or to the domestic hot water cylinder. Optionally the second heat exchanger is connected to an external heat source for example a boiler or a heat pump, which acts as the main heat source to heat the building.

[0023] Ideally the air handling apparatus can operate with either liquid based solar panels or air based solar panels. Conveniently the heat exchanger operates in opposite directions depending on whether the solar panel is liquid or air based.

[0024] Ideally the first and second fans in the air handling apparatus are used to circulate the air in the solar panel loop or as the main fan for ventilating or heating the house respectively. Conveniently the two fans can run independently as described above or in series. Preferably when the fans are operating in series the ventilation air passes through the solar panel loop and then on to the house. Ideally in this mode the solar panels can be used to heat both the domestic hot water and the house or alternatively just the house in accordance with a defined control strategy. Conveniently the fans are interchangeable such that either fan can to circulate the air in the solar panel loop or operate as the main fan for ventilating or heating the house.

[0025] Conveniently the fans in the air handling apparatus can operate on either DC or AC.

[0026] Optionally the air handling apparatus can also be connected to a heat recovery unit, which will preheat the incoming air and therefore add to the overall efficiency of the system.

[0027] Ideally the most appropriate location for an air handling apparatus in a dwelling house is in the attic space. This is particularly efficient if some of the energy is being generated by solar panels as the air handling apparatus would then be adjacent to the solar panels on the roof.

[0028] The invention is particularly illustrated in the accompanying drawings which show, by way of example only, embodiments of the air handling apparatus according to the invention together with embodiments of a ventilating, heating and cooling system according to the invention.

[0029] In the drawings:

Figure 1 is a schematic drawing illustrating the air handling apparatus of the invention when connected to solar panels and a conventional boiler;

Figure 2 is a schematic drawing illustrating the air handling apparatus of the invention when connected to solar panels and a direct expansion coil of a heat pump;

Figure 3 is a cross-sectional view of the air handling apparatus of the invention;

Figure 4 is a schematic drawing illustrating the air handling apparatus of the invention when simultaneously heating a domestic hot water cylinder using solar panels and ventilating the house.

Figure 5 is a schematic drawing illustrating the air handling apparatus of the invention when heating the house using solar energy and recirculating the hot air within the house.

Figure 6 is a schematic drawing illustrating the air handling apparatus of the invention when heating the house using a mix of recirculated air and fresh air.

Figure 7 is a schematic drawing illustrating the air handling apparatus of the invention when in cooling mode operating in conjunction with a heat pump.

Figure 8 is a schematic drawing illustrating the air handling apparatus of the invention when in heating mode, operating in conjunction with either a heat pump or a boiler.

Figure 9 is a schematic drawing illustrating the air handling apparatus of the invention in conjunction with a dry solar panel when heating the domestic hot water cylinder and simultaneously ventilating the house.

Figure 10 is a schematic drawing illustrating of the invention when the air handling apparatus of the invention in conjunction with a wet solar panel when heating the domestic hot water cylinder and simultaneously ventilating the house.

Figure 11 is a schematic drawing illustrating the air handling apparatus of the invention in conjunction with a wet solar panel when heating the domestic hot water cylinder and providing solar energy to ventilation air.

Figure 12 is a perspective drawing illustrating the position of a ventilating, heating and cooling system of the invention within a house

[0030] Referring now to Figure 1 there is shown a schematic drawing illustrating a first embodiment of the heating and ventilating system of the invention in which the air handling apparatus 1 is connected to two energy supply sources, namely solar panels 10 and a conventional boiler 12. Energy generated by the solar panels 10 is transferred by the air handling apparatus 1 to the domestic hot water cylinder 11 in a first closed loop. Whilst energy generated by the boiler 12 is used to heat the ventilation air 4 of the house thereby heating the house. The air circulated around the house is recovered at 5 and passed through a heat recovery unit 3. There are a number of operational options at the heat recovery unit 3. In a first option circulated air is expelled and fresh air is absorbed 2 which is then heated using both the heat

recovered through the heat recovery unit 3 and the boiler 12 and then circulated through the air handling apparatus 1 around the house. Alternatively some or all of the circulated air re-enters the air handling apparatus 1 via the heat recovery unit 3, this air is then re-circulated. If necessary some fresh air 2 is also circulated into the air handling apparatus 1 to ensure oxygen levels remain static.

[0031] Figure 2 illustrates a second embodiment of the heating and ventilating system of the invention however in this embodiment a heat pump 13 is used to change the temperature of the air circulated to the air handling apparatus 1 which is subsequently circulated around the house. In this scenario either an adsorption or absorption heat pump can be used which either could heat or cool the air via the air handling apparatus 1.

[0032] Turning now to Figure 3 there is shown a first embodiment of the air handling apparatus 1 of the invention. The air handling apparatus 1 comprises two heat exchangers 23 and 24 and two fans 20 and 21. The first heat exchanger 23 is connected to a fluid inlet port 102, whilst the second heat exchanger 24 is connected to a fluid inlet port z The first fan 20 is connected to a fluid outlet port 101 and the second fan 21 is connected to a second fluid outlet port 4. The fluid paths are determined by the orientation of the separation means 26. The separation means 26 comprises a damper rotatable about a central axis point. It has two positions, A or B.

[0033] Position 'A' forms a single loop in which the fluid flows through fan 21 and subsequently through fluid outlet port 4. The fluid re-enters the air handling apparatus 1 through fluid inlet port 103. The connections between fluid outlet port 4 and fluid inlet port 103 are not shown. Fluid then passes through the heat exchanger 24, fan 20 and fluid outlet port 101. Fluid re-enters the air handling apparatus 1 again through fluid inlet port 102 and heat exchanger 23 to start another cycle. As before the connections between fluid outlet port 101 and fluid inlet port 102 are not shown.

[0034] In contrast position 'B' forms two distinct closed loops. In the first loop fluid flows through fan 21 and fluid outlet port 4 re-entering the air handling apparatus 1 through fluid inlet port 103. Fluid then passes through heat exchanger 24 and into fan 21 starting the cycle again. The second loop comprises fluid exiting the air handling apparatus 1 though fan 20 and fluid outlet port 101 subsequently re-entering through fluid inlet port 102 and heat exchanger 23.

[0035] In a first example the fluid inlet and outlet ports 102 and 101 could be connected to solar panels thus forming a closed solar loop. Further inlet and outlet ports can be connected to the domestic hot water cylinder enabling heating of domestic hot water using solar energy. Fluid inlet and outlet ports 4 and 103 could be connected to a house ventilation system which is further connected to another energy source. Thus in position 'B' the house can be simultaneously ventilated and/or heated using a first energy source whilst domestic hot water can be heated using solar energy.

[0036] It is clearly seen in Figure 3 that the air handling apparatus 1 comprises a single unit. However it is appreciated.that the size of the components within air handling apparatus 1 could be quite large depending on the actual requirements of the device. In practice the actual size of the air handling apparatus 1 is restricted so that it will fit through a standard attic trap door as the most appropriate location for the air handling apparatus 1 is in the attic space adjacent to solar panels 10 on the roof, as seen in Figure 12. Consequently the air handling apparatus 1 according to the invention comprises three interconnecting compartments for ease of handling and flexibility. The first and second compartment comprising each of the fans 21 and 20, and a third compartment comprising the heat exchangers 23 and 24 and the damper mechanism 26 whereby the first and second compartments attach to either side of the third compartment. Using interconnecting compartments enables the use of larger fan sections which has the advantage of minimising pressure across the fans 21 and 22 thus allowing the fans 21 and 22 to run more efficiently.

[0037] The external surfaces of the air handling apparatus 1 and the first and second compartments further contain the controllers and connections for interfacing the air handling apparatus 1 with external devices.

[0038] Referring now to Figures 4 to 11 there is shown a number of different embodiments of an integrated ventilation heating and cooling system using the air handling apparatus 1 of the invention.

[0039] In Figure 4 there is shown a damper of the air handling apparatus 1 in a first orientation, position 'B' as described above. Fluid flows through the system as outlined above. The first loop corresponds to the ventilation/heating system of the house 6. Thus fluid flows through fan 21 and fluid outlet port 4 around the house 6. The air circulated around the house 6 is collected and passes through a heat recovery unit 3, fluid from the heat recovery unit and some air 2 enter the air to water heat exchanger 24 through fluid inlet port 103. Air is reheated at the heat exchanger 24 before being circulated around the house 6 again.

[0040] The second loop corresponds to the solar panel loop wherein fluid exiting the air handling apparatus 1 through fan 20 and fluid outlet port 101 passes through solar panels 10 before re-entering the air handling apparatus 1 through fluid inlet port 102 and heat exchanger 23. The domestic hot water cylinder 11 is connected to heat exchanger 23 and fluid is pumped between the heat exchanger 23 and the domestic hot water cylinder 11 using pump 110. Solar energy is transferred from the solar panels 10 to the system for heating the domestic hot water via heat exchanger 23. Figure 4 shows how the air handling apparatus 1 and system of the invention allows simultaneous heating of the domestic hot water using solar power and ventilation or heating of the house 6.

[0041] Figure 5 shows a second orientation of the damper of the air handling apparatus 1 in position 'A'

showing how the house can be heated using solar panels 10 as the sole source of heat. Heat is collected by the heat exchanger 23 from solar panels 10 which is then transferred to the fluid and pumped around the house 6 through fan 21. Optionally fluid can be recirculated directly to heat exchanger 24 as indicated by the dotted line, or can re-enter the heat exchanger 24 after passing through a heat recovery unit 3, the fluid then passes through fan 20 and re-enters the solar panels 10.

[0042] In Figure 6 the damper 26 is in the 'B' position however fluid is being circulated through one chamber only. A mix of re-circulated and fresh air is heated using boiler 12. Heated air is then being circulated around the house 6 as outlined previously. This embodiment does not fall under the scope of the claims.

[0043] Figure 7 shows the damper 26 of the air handling apparatus 1 in the 'B' position and fluid is circulating through both chambers. In the first chamber solar power is being used to heat domestic hot water whilst in the second chamber of the air handling apparatus heat is being extracted from the air using the heat exchanger 24 and the heat pump 13. The cooled air is being circulated through the house 6.

[0044] In Figure 8 the damper is in the 'B' position and fluid is being circulated through one chamber only. Air is being heated using the heat exchanger 24 and either a heat pump 13 or boiler 12. Heated air is then being circulated around the house 6. This embodiment does not fall under the scope of the claims.

[0045] Figure 9 is similar to Figure 4 however the solar panel 10 is a dry solar panel thus operation of the heat exchanger 23 is reversed, i.e. hot air from the solar panel heats the water in heat exchanger 23 which in turn heats the water in the domestic hot water cylinder 11.

[0046] Figure 10 is a schematic drawing illustrating how the performance of a wet solar panel is improved as the operating range of the solar panel is increased whilst simultaneously ventilating the house 6. The solar panel 10 is directly connected to the domestic hot water cylinder 11. Fluid flow is maintained around this loop using a pump 110 and two port motorised valve 111. The solar panel 10 is also connected to the heat exchanger 23 via a mixing valve 113. The water is returned from the heat exchanger 23 to the solar panel 10 via a two port valve 111.

[0047] Figure 11 shows is similar to figure 10 illustrating a wet solar panel having improved operating range however the damper 26 of the air handling apparatus 1 is in the 'A' position thus indicating how the energy generated by a solar panel can be used to heat domestic hot water in addition to ventilating or heating a house 6.

[0048] Figure 12 is a perspective drawing illustrating the position of a ventilating, heating and cooling system of the invention within a house.

[0049] It is to be understood that the invention is not limited to the specific details described herein which are given by way of example only and that various modifications and alterations are possible without departing from the scope of the invention as identified in the appended claims.

Claims

1. An air handling apparatus comprising:

a first heat exchanger (23) and a second heat exchanger (24);
a first fan (20) and a second fan (21);
first and second fan compartments, and a central compartment, the first fan compartment includes the first fan (20), the second fan compartment includes the second fan (21) and the central compartment includes the first heat exchanger (23), the second heat exchanger (24) and a separation means (26),
wherein the first fan compartment comprises at least one first fluid inlet connected to the central compartment and at least one first fluid outlet port (101) connected to the first fan (20) and the second fan compartment comprises at least one second fluid inlet connected to the central compartment and at least one second fluid outlet port (4) connected to the second fan (21), and the central chamber comprises a first inlet port (102) connected to the first heat exchanger (23) and a second fluid inlet port (103) connected to the second heat exchanger (24), the separation means (26) is movable between a first and second position, **characterised in that** in the first position a first chamber is defined containing the first heat exchanger (23) and the first fan (20), and a second chamber is defined containing the second heat exchanger (24) and the second fan (21), and in the second position a first chamber is defined containing the first heat exchanger (23) and the second fan (21) and a second chamber is defined containing the second heat exchanger (24) and the first fan (20), and wherein in the first position two distinct closed loop fluid pathways are defined in which in a first fluid pathway fluid flows through the second fan (21) and the second fluid outlet port (4) and re-enters the apparatus through the second fluid inlet port (103) passing through the second heat exchanger (24) and back to the second fan (21), and in a second fluid pathway fluid flows through the first fan (20) and the first fluid outlet port (101) and re-enters the apparatus through the first fluid inlet port (102) passing through the first heat exchanger (23) and back to the first fan (20), and in the second position a single loop fluid pathway is defined such that fluid flows through the second fan (21) and out of the apparatus via the second outlet port (4), re-enters the apparatus through the second fluid inlet port (103) passing through the second heat exchanger (24) and

through the first fan (20) and first outlet port (101) and then re-enters the apparatus again through the first fluid inlet port (102) passing through the first heat exchanger (23).

2. An air handling apparatus as claimed in claim 1, wherein the separation means comprise a damper (26) rotatable around a central axis point.

3. An air handling apparatus as claimed in Claim 2, wherein the damper is operated by a motor.

4. An air handling apparatus as claimed in any one of the preceding claims, wherein the air handling apparatus further comprises one or more filters.

5. An air handling apparatus as claimed in any one of the preceding claims, wherein the heat exchangers (23, 24) are air to water heat exchangers.

6. An integrated ventilation heating and cooling system comprising the air handling apparatus as claimed in Claims 1 to 5 wherein the air handling apparatus is connected to a heat recovery unit or ventilation unit (3).

7. An integrated ventilation heating and cooling system as claimed in Claim 6 further comprising a control system.

8. An integrated ventilation heating and cooling system as claimed in Claim 6 or 7, wherein the air handling apparatus is connected to either liquid based solar panels or air based solar panels.

9. An integrated ventilation heating and cooling system as claimed in any one of Claims 6 to 8, wherein the air handling apparatus is connected to a heat recovery unit (3).

10. An integrated ventilation heating and cooling system as claimed in Claim 9, wherein a direct expansion coil of a heat pump is placed in the heat recovery unit after the heat recovery module.

11. An integrated ventilation heating and cooling system as claimed in Claim 6, wherein the apparatus includes a solar panel (10) arranged between the first fluid outlet port (101) and first fluid inlet (102) such that fluid exiting the apparatus via the first fluid outlet port flows through the solar panel before re-entering via the first inlet port (102).

12. An integrated ventilation heating and cooling system according to claim 11 wherein a hot water cylinder is connected to the first heat exchanger (23).

13. An integrated ventilation heating and cooling system according to claim 11 or 12 wherein the second heat exchanger (24) is connected to an external heat source.

14. An integrated ventilation heating and cooling system according to claim 13 wherein the external heat source is a boiler or heat pump.

15. An integrated ventilation heating and cooling system according to claim 14 wherein in the second position the second fluid pathway is connected to the hot water cylinder such that the water is heated using solar energy and the first fluid pathway is a ventilation and/or heating pathway for ventilating and/or heating a house.

Patentansprüche

1. Luftbehandlungsvorrichtung, die Folgendes umfasst:

einen ersten Wärmetauscher (23) und einen zweiten Wärmetauscher (24);
einen ersten Lüfter (20) und einen zweiten Lüfter (21) ;
ein erstes und ein zweites Lüfterfach und ein mittleres Fach, wobei das erste Lüfterfach den ersten Lüfter (20) enthält, das zweite Lüfterfach den zweiten Lüfter (21) enthält und das mittlere Fach den ersten Wärmetauscher (23), den zweiten Wärmetauscher (24) und ein Trennmittel (26) enthält,
wobei das erste Lüfterfach wenigstens einen mit dem mittleren Fach verbundenen ersten Fluideinlass und wenigstens einen mit dem ersten Lüfter (20) verbundenen ersten Fluidauslassanschluss (101) aufweist und das zweite Lüfterfach wenigstens einen mit dem mittleren Fach verbundenen zweiten Fluideinlass und wenigstens einen mit dem zweiten Lüfter (21) verbundenen zweiten Fluidauslassanschluss (4) umfasst und die mittlere Kammer einen mit dem ersten Wärmetauscher (23) verbundenen ersten Einlassanschluss (102) und einen mit dem zweiten Wärmetauscher (24) verbundenen zweiten Fluideinlassanschluss (103) umfasst, wobei das Trennmittel (26) zwischen einer ersten und einer zweiten Position beweglich ist, **dadurch gekennzeichnet, dass** in der ersten Position eine erste Kammer definiert ist, die den ersten Wärmetauscher (23) und den ersten Lüfter (20) enthält, und eine zweite Kammer definiert ist, die den zweiten Wärmetauscher (24) und den zweiten Lüfter (21) enthält, und in der zweiten Position eine erste Kammer definiert ist, die den ersten Wärmetauscher (23) und den zweiten Lüfter (21) enthält, und eine zweite

Kammer definiert ist, die den zweiten Wärmetauscher (24) und den ersten Lüfter (20) enthält, und wobei in der ersten Position zwei separate geschlossene Fluipfade definiert sind, wobei in einem ersten Fluidpfad Fluid durch den zweiten Lüfter (21) und den zweiten Fluidauslassanschluss (4) fließt und durch den zweiten Fluideinlassanschluss (103) erneut in die Vorrichtung eintritt, durch den zweiten Wärmetauscher (24) passiert und zurück zum zweiten Lüfter (21) fließt, und in einem zweiten Fluidpfad Fluid durch den ersten Lüfter (20) und den ersten Fluidauslassanschluss (101) fließt und dann durch den ersten Fluideinlassanschluss (102) wieder in die Vorrichtung eintritt, durch den ersten Wärmetauscher (23) passiert und zurück zum ersten Lüfter (20) fließt, und in der zweiten Position ein Einzelkreis-Fluidpfad definiert wird, so dass Fluid durch den zweiten Lüfter (21) und aus der Vorrichtung über den zweiten Auslassanschluss (4) fließt, durch den zweiten Fluideinlassanschluss (103) erneut in die Vorrichtung eintritt, durch den zweiten Wärmetauscher (24) und durch den ersten Lüfter (20) und den ersten Auslassanschluss (101) passiert und dann durch den ersten Fluideinlassanschluss (102) erneut in die Vorrichtung eintritt und durch den ersten Wärmetauscher (23) passiert.

2. Luftbehandlungsvorrichtung nach Anspruch 1, wobei das Trennmittel einen um einen mittleren Achsenpunkt herum drehbaren Dämpfer (26) umfasst.

3. Luftbehandlungsvorrichtung nach Anspruch 2, wobei der Dämpfer von einem Motor betrieben wird.

4. Luftbehandlungsvorrichtung nach einem der vorherigen Ansprüche, wobei die Luftbehandlungsvorrichtung ferner einen oder mehrere Filter umfasst.

5. Luftbehandlungsvorrichtung nach einem der vorherigen Ansprüche, wobei die Wärmetauscher (23, 24) Luft-Wasser-Wärmetauscher sind.

6. Integriertes Ventilationsheiz- und -kühlsystem, das die Luftbehandlungsvorrichtung nach den Ansprüchen 1 bis 5 umfasst, wobei die Luftbehandlungsvorrichtung mit einer Wärmerückgewinnungseinheit oder Ventilationseinheit (3) verbunden ist.

7. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 6, das ferner ein Steuersystem umfasst.

8. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 6 oder 7, wobei die Luftbehandlungsvorrichtung entweder mit Solarplatten auf Flüssigkeitsbasis oder mit Solarplatten auf Luftbasis verbunden ist.

9. Integriertes Ventilationsheiz- und -kühlsystem nach einem der Ansprüche 6 bis 8, wobei die Luftbehandlungsvorrichtung mit einer Wärmerückgewinnungseinheit (3) verbunden ist.

10. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 9, wobei ein Direktverdampfer einer Wärmepumpe in der Wärmerückgewinnungseinheit hinter dem Wärmerückgewinnungsmodul platziert ist.

11. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 6, wobei die Vorrichtung eine Solarplatte (10) beinhaltet, die zwischen dem ersten Fluidauslassanschluss (101) und dem ersten Fluideinlass (102) angeordnet ist, so dass die Vorrichtung verlassendes Fluid über den ersten Fluidauslassanschluss durch die Solarplatte fließt und dann über den ersten Einlassanschluss (102) erneut eintritt.

12. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 11, wobei ein Warmwasserspeicher mit dem ersten Wärmetauscher (23) verbunden ist.

13. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 11 oder 12, wobei der zweite Wärmetauscher (24) mit einer externen Wärmequelle verbunden ist.

14. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 13, wobei die externe Wärmequelle ein Kessel oder eine Wärmepumpe ist.

15. Integriertes Ventilationsheiz- und -kühlsystem nach Anspruch 14, wobei in der zweiten Position der zweite Fluidpfad mit dem Warmwasserspeicher verbunden ist, so dass das Wasser mit Solarenergie erhitzt wird und der erste Fluidpfad ein Ventilations- und/oder Heizpfad zum Ventilieren und/oder Erhitzen eines Hauses ist.

Revendications

1. Appareil de gestion de l'air comprenant :

un premier échangeur de chaleur (23) et un deuxième échangeur de chaleur (24) ;
un premier ventilateur (20) et un deuxième ventilateur (21) ;
des premier et deuxième compartiments de ventilateur, et un compartiment central, le premier compartiment de ventilateur comprenant le premier ventilateur (20), le deuxième compartiment de ventilateur comprenant le deuxième ventilateur (21) et le compartiment central comprenant le premier échangeur de chaleur (23), le deuxième échangeur de chaleur (24) et un moyen de séparation (26),

dans lequel le premier compartiment de ventilateur comprend au moins une première entrée de fluide reliée au compartiment central et au moins un premier orifice de sortie de fluide (101) relié au premier ventilateur (20), et le deuxième compartiment de ventilateur comprend au moins une deuxième entrée de fluide reliée au compartiment central et au moins un deuxième orifice de sortie de fluide (4) relié au deuxième ventilateur (21), et la chambre centrale comprend un premier orifice d'entrée (102) relié au premier échangeur de chaleur (23) et un deuxième orifice d'entrée de fluide (103) relié au deuxième échangeur de chaleur (24), le moyen de séparation (26) étant mobile entre une première et une deuxième position, **caractérisé en ce que**, dans la première position, est définie une première chambre contenant le premier échangeur de chaleur (23) et le premier ventilateur (20), et est définie une deuxième chambre contenant le deuxième échangeur de chaleur (24) et le deuxième ventilateur (21), et dans la deuxième position est définie une première chambre contenant le premier échangeur de chaleur (23) et le deuxième ventilateur (21) et est définie une deuxième chambre contenant le deuxième échangeur de chaleur (24) et le premier ventilateur (20), et dans lequel, dans la première position sont définis deux chemins de fluide en boucle fermée distincts dans lesquels, dans un premier chemin de fluide, un fluide passe par le deuxième ventilateur (21) et le deuxième orifice de sortie de fluide (4) et pénètre de nouveau dans l'appareil par le deuxième orifice d'entrée de fluide (103) en passant par le deuxième échangeur de chaleur (24) et en retournant au deuxième ventilateur (21), et dans un deuxième chemin de fluide, le fluide passe par le premier ventilateur (20) et le premier orifice de sortie de fluide (101) et pénètre de nouveau dans l'appareil par le premier orifice d'entrée de fluide (102) en passant par le premier échangeur de chaleur (23) et en retournant au premier ventilateur (20), et dans la deuxième position un chemin de fluide à simple boucle est défini de telle sorte que le fluide passe par le deuxième ventilateur (21) et sort de l'appareil par le deuxième orifice de sortie (4), pénètre de nouveau dans l'appareil par le deuxième orifice d'entrée de fluide (103) en passant par le deuxième échangeur de chaleur (24) et par le premier ventilateur (20) et le premier orifice de sortie (101) puis pénètre de nouveau dans l'appareil par le premier orifice d'entrée de fluide (102) en passant par le premier échangeur de chaleur (23).

2. Appareil de gestion de l'air selon la revendication 1, dans lequel le moyen de séparation comprend un registre (26) pivotant autour d'un point d'axe central.

3. Appareil de gestion de l'air selon la revendication 2, dans lequel le registre est actionné par un moteur.

4. Appareil de gestion de l'air selon l'une quelconque des revendications précédentes, dans lequel l'appareil de gestion de l'air comprend en outre un ou plusieurs filtres.

5. Appareil de gestion de l'air selon l'une quelconque des revendications précédentes, dans lequel les échangeurs de chaleur (23; 24) sont des échangeurs air-eau.

6. Système de ventilation, chauffage et refroidissement intégré comprenant l'appareil de gestion de l'air selon les revendications 1 à 5, dans lequel l'appareil de gestion de l'air est relié à un groupe de récupération de chaleur ou à un groupe de ventilation (3).

7. Système de ventilation, chauffage et refroidissement intégré selon la revendication 6, comprenant en outre un système de commande.

8. Système de ventilation , chauffage et refroidissement intégré selon la revendication 6 ou 7, dans lequel l'appareil de gestion de l'air est relié à des panneaux solaires à base de liquide ou à des panneaux solaires à base d'air.

9. Système de ventilation, chauffage et refroidissement intégré selon l'une quelconque des revendications 6 à 8, dans lequel l'appareil de gestion de l'air est relié à un groupe de récupération de chaleur (3).

10. Système de ventilation, chauffage et refroidissement intégré selon la revendication 9, dans lequel un serpentin à détente directe d'une pompe à chaleur est placé dans le groupe de récupération de chaleur après le module de récupération de chaleur.

11. Système de ventilation, chauffage et refroidissement intégré selon la revendication 6, dans lequel l'appareil comprend un panneau solaire (10) agencé entre le premier orifice de sortie de fluide (101) et la première entrée de fluide (102) de telle sorte que le fluide sortant de l'appareil par le premier orifice de sortie de fluide passe par le panneau solaire avant de pénétrer de nouveau par le premier orifice d'entrée (102).

12. Système de ventilation, chauffage et refroidissement intégré selon la revendication 11, dans lequel un cylindre d'eau chaude est relié au premier échangeur de chaleur (23).

13. Système de ventilation, chauffage et refroidissement intégré selon la revendication 11 ou 12, dans lequel le deuxième échangeur de chaleur (24) est relié à une source de chaleur extérieure.

14. Système de ventilation, chauffage et refroidissement intégré selon la revendication 13, dans lequel la source de chaleur extérieure est une chaudière ou une pompe à chaleur.

15. Système de ventilation, chauffage et refroidissement intégré selon la revendication 14, dans lequel, dans la deuxième position, le deuxième chemin de fluide est relié au cylindre d'eau chaude de telle sorte que l'eau est chauffée au moyen de l'énergie solaire et le premier chemin de fluide est un chemin de ventilation et/ou de chauffage pour ventiler et/ou chauffer une maison.

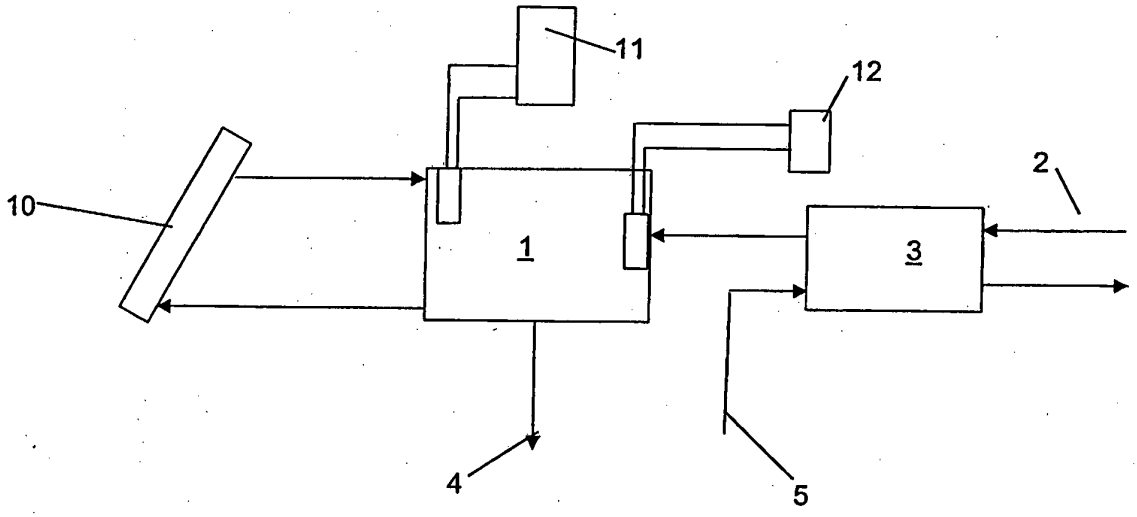


FIGURE 1

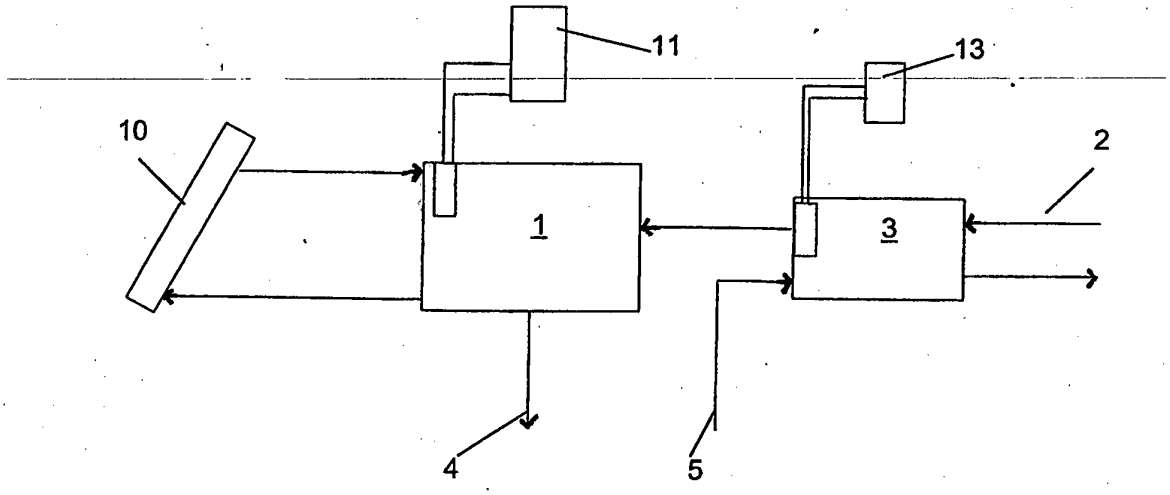


FIGURE 2

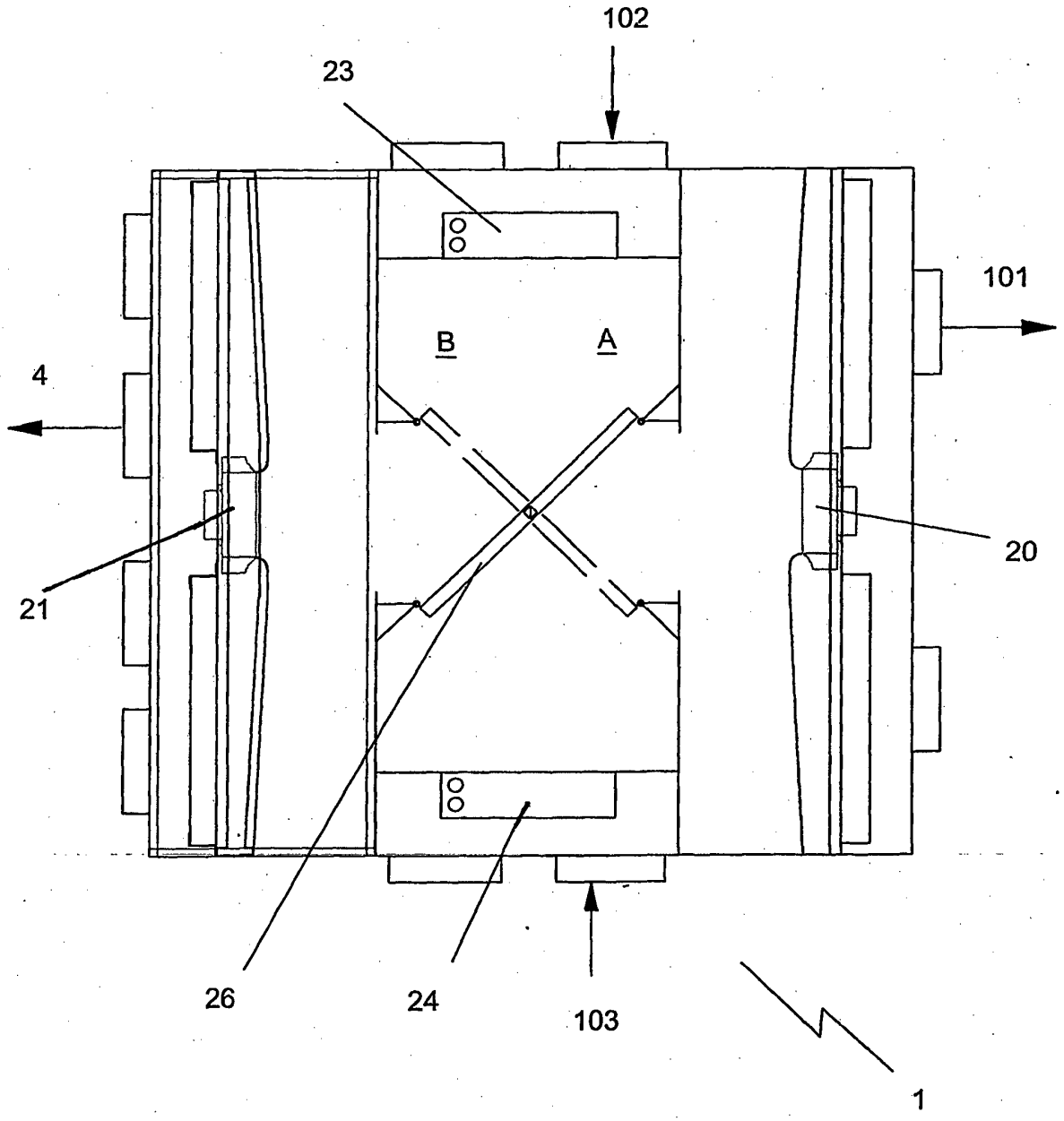


FIGURE 3

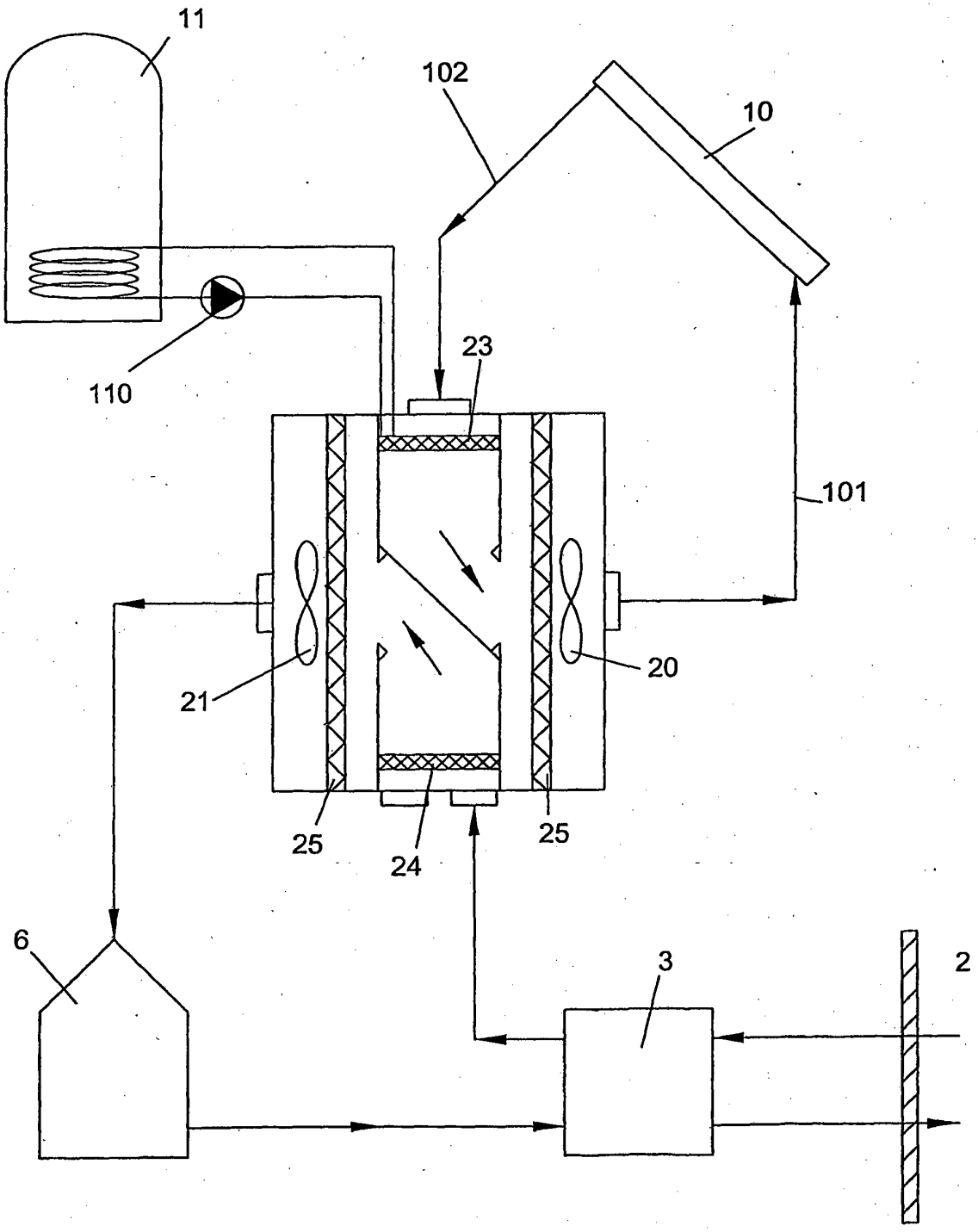


FIGURE 4

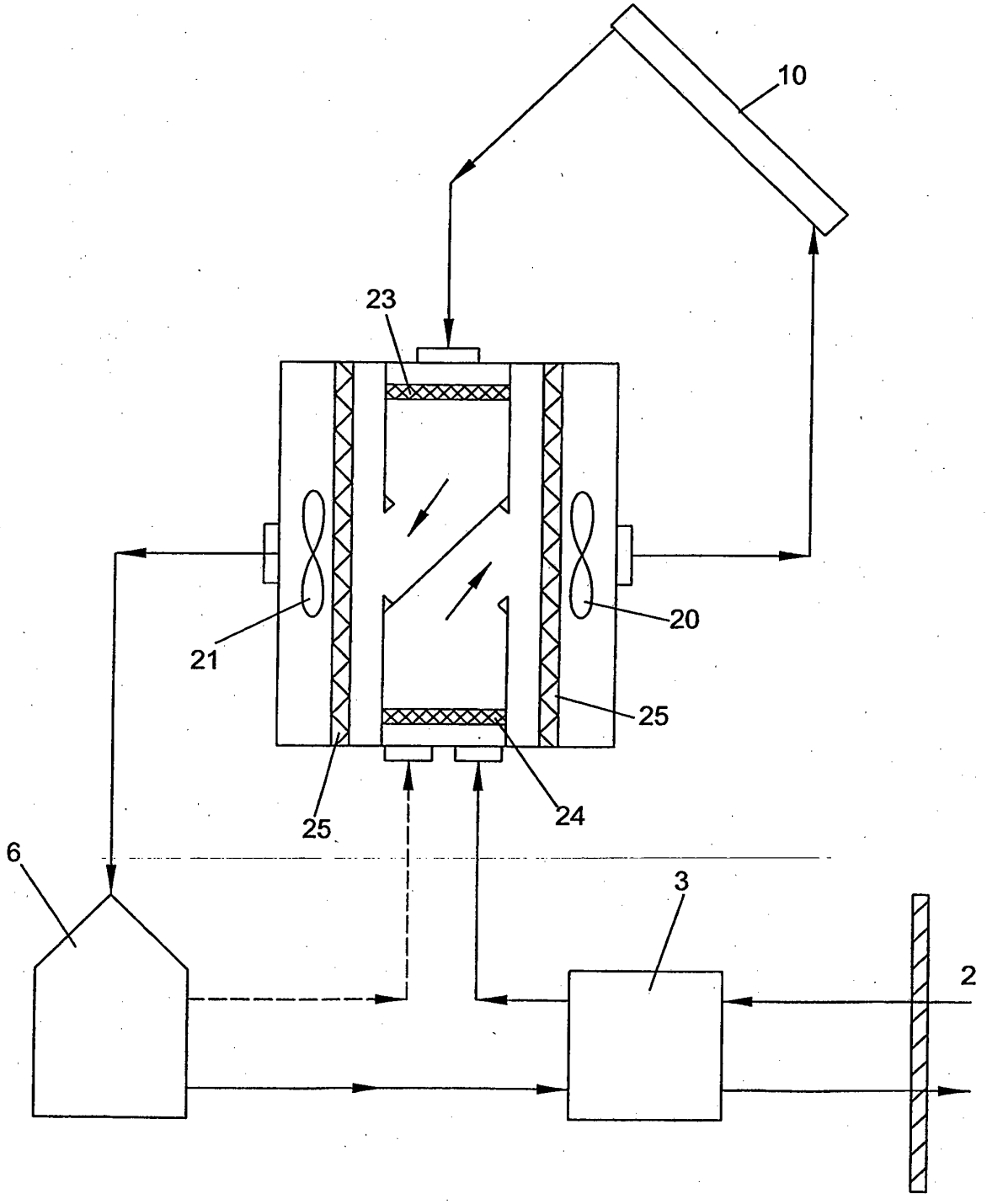


FIGURE 5

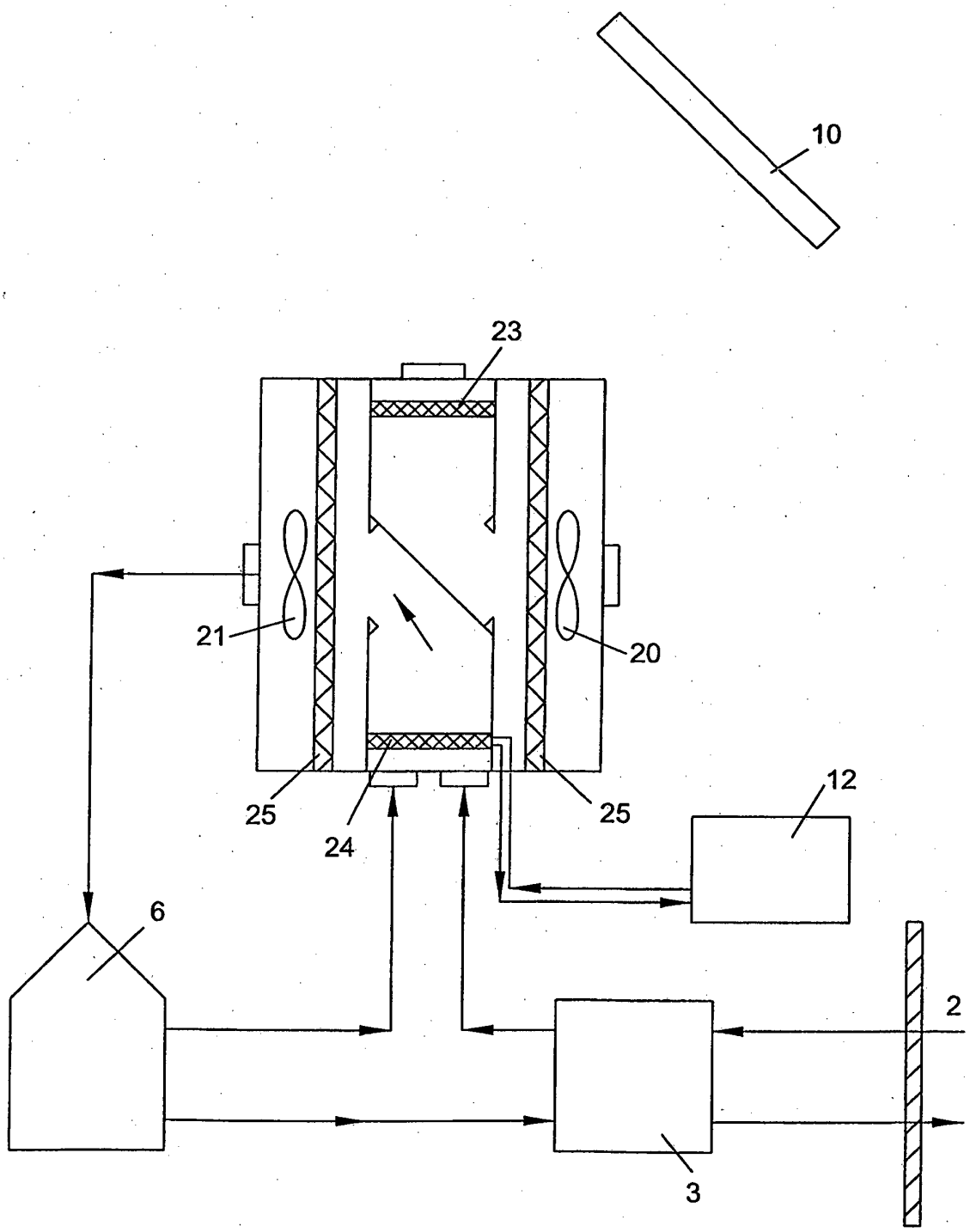


FIGURE 6

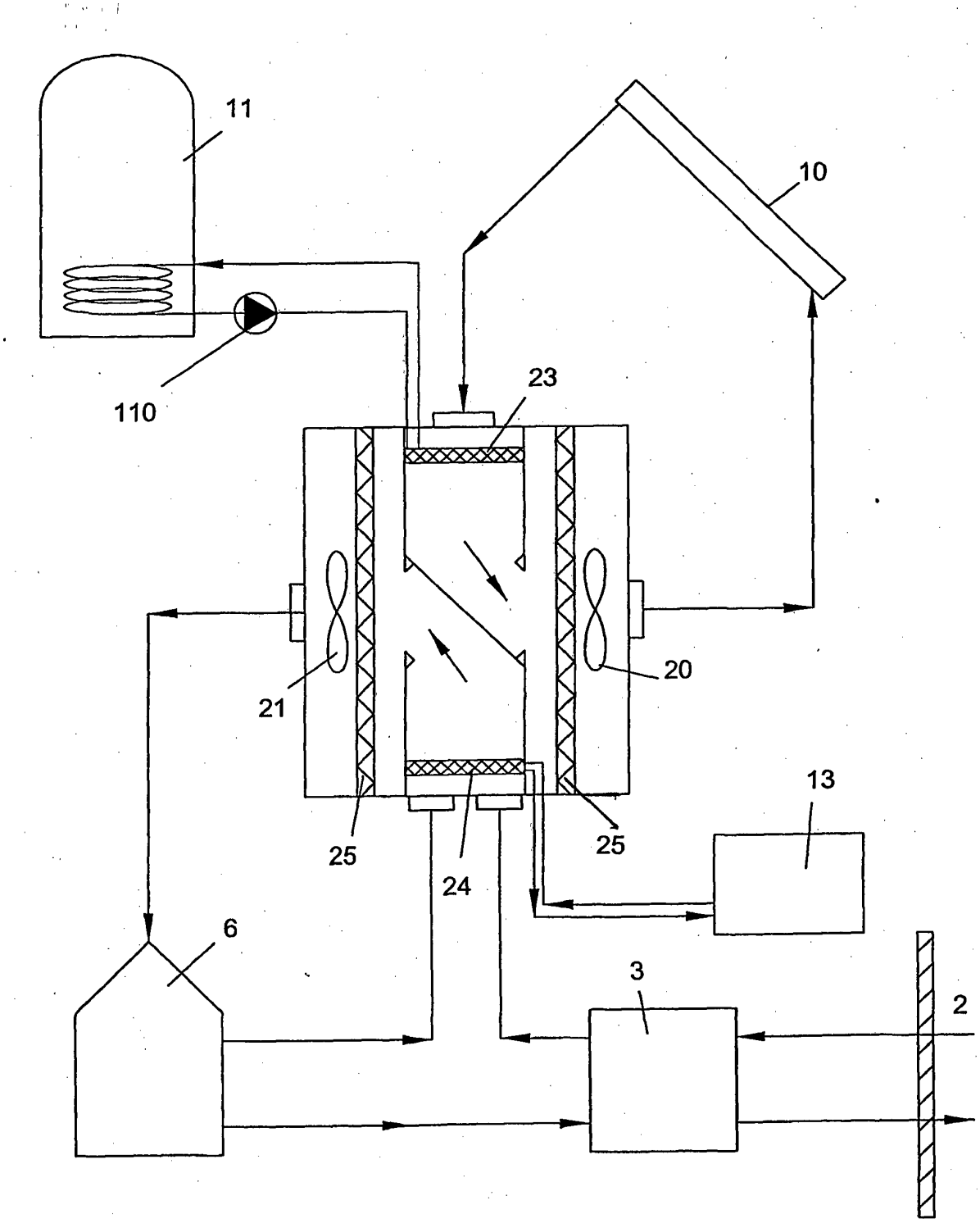


FIGURE 7

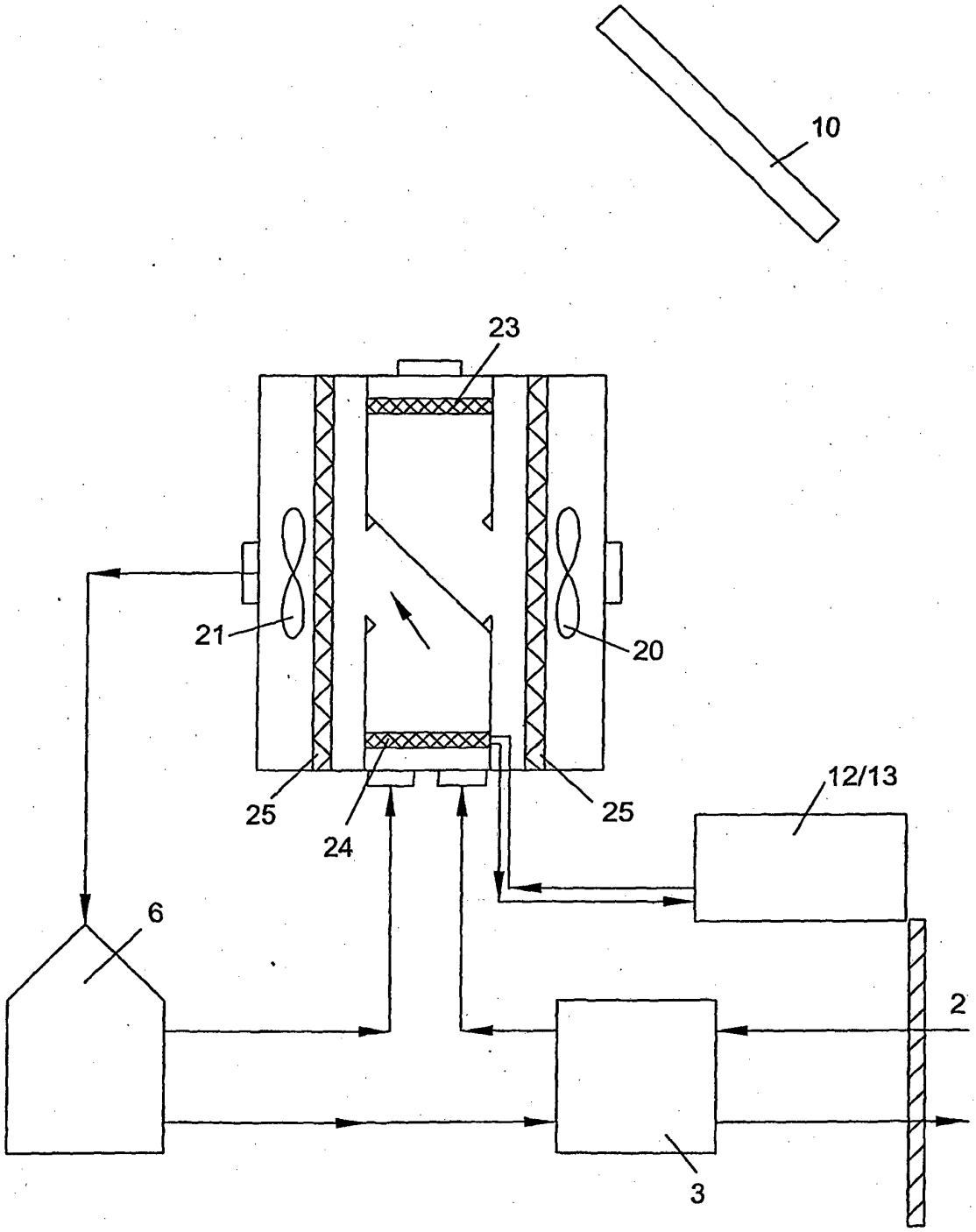


FIGURE 8

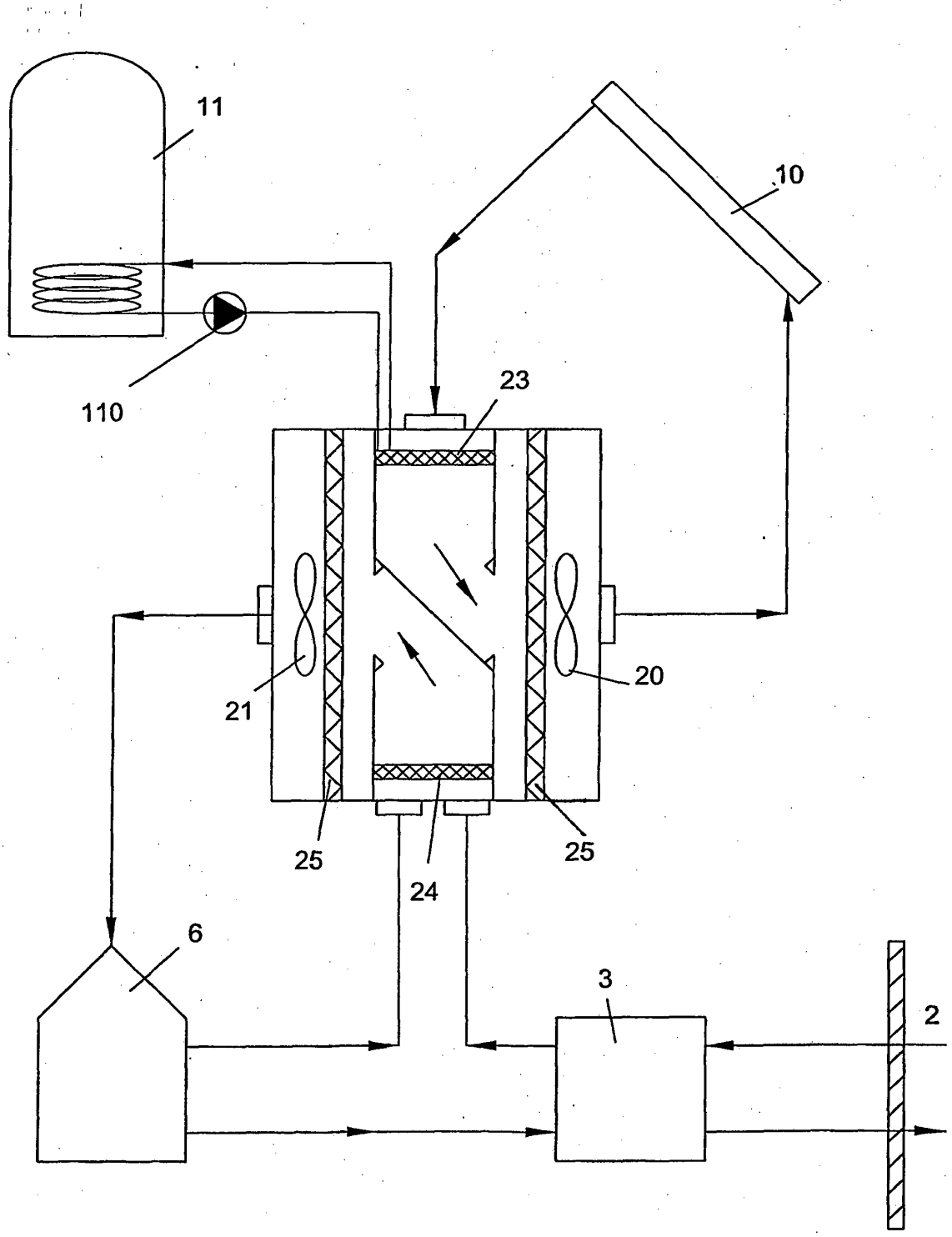


FIGURE 9

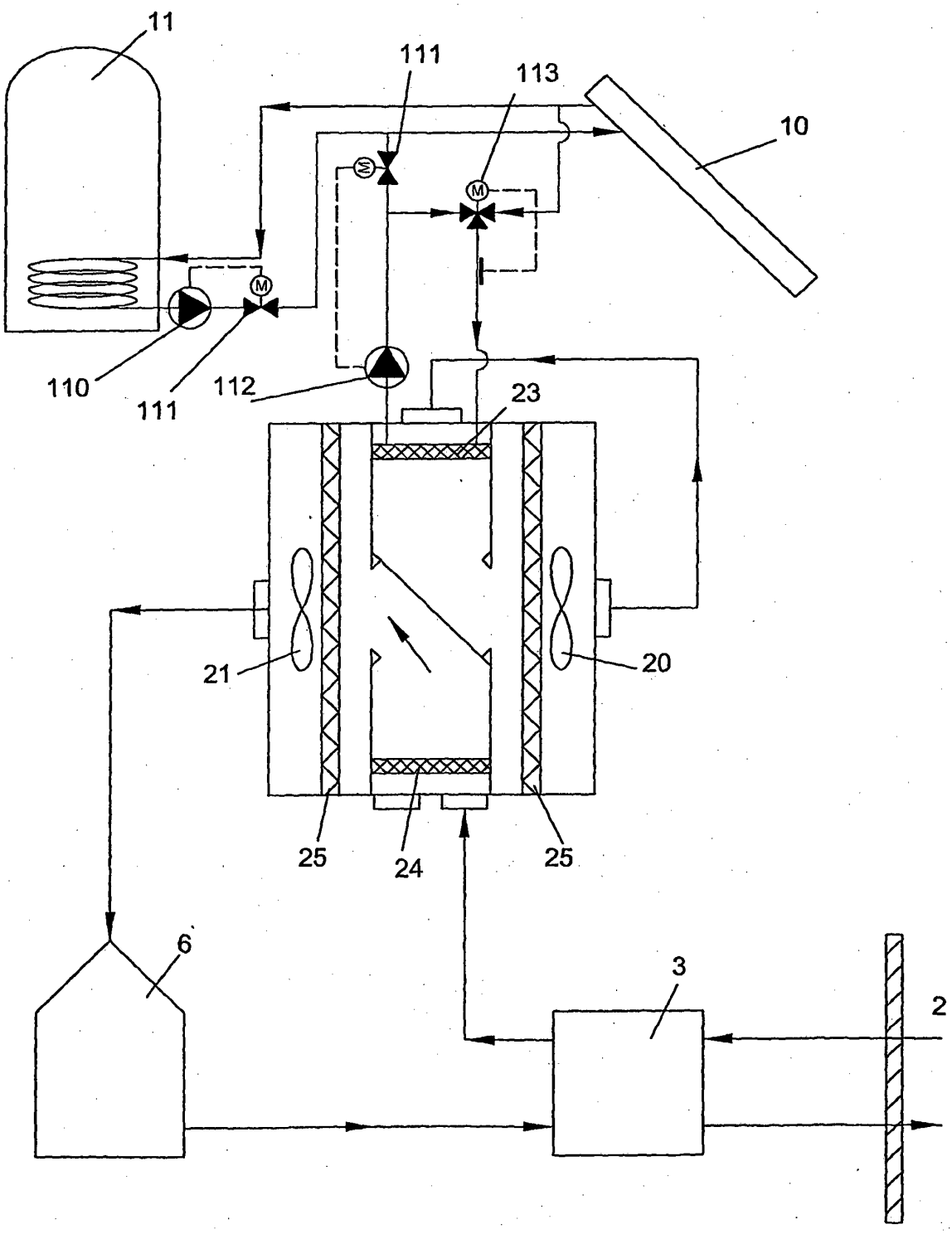


FIGURE 10

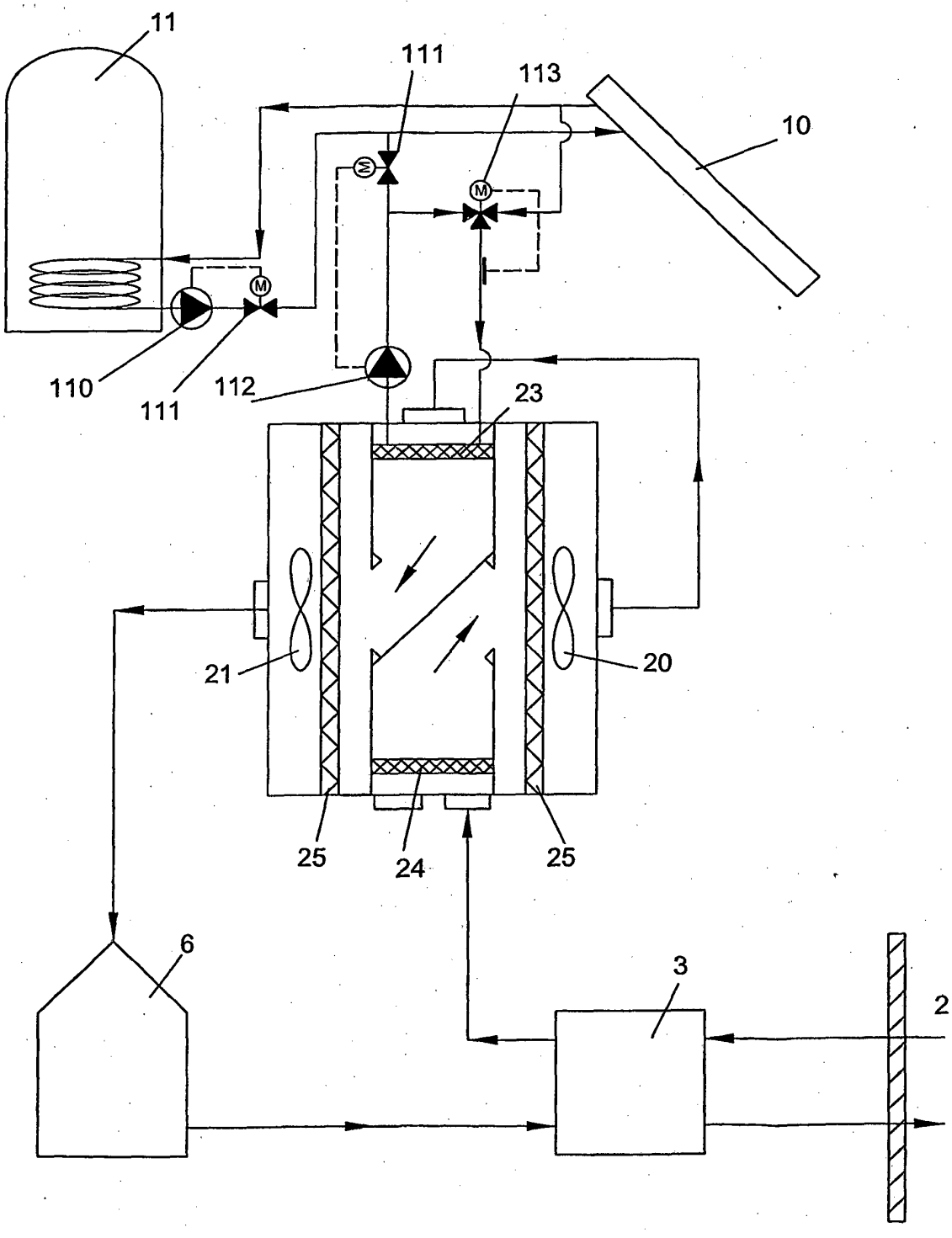


FIGURE 11

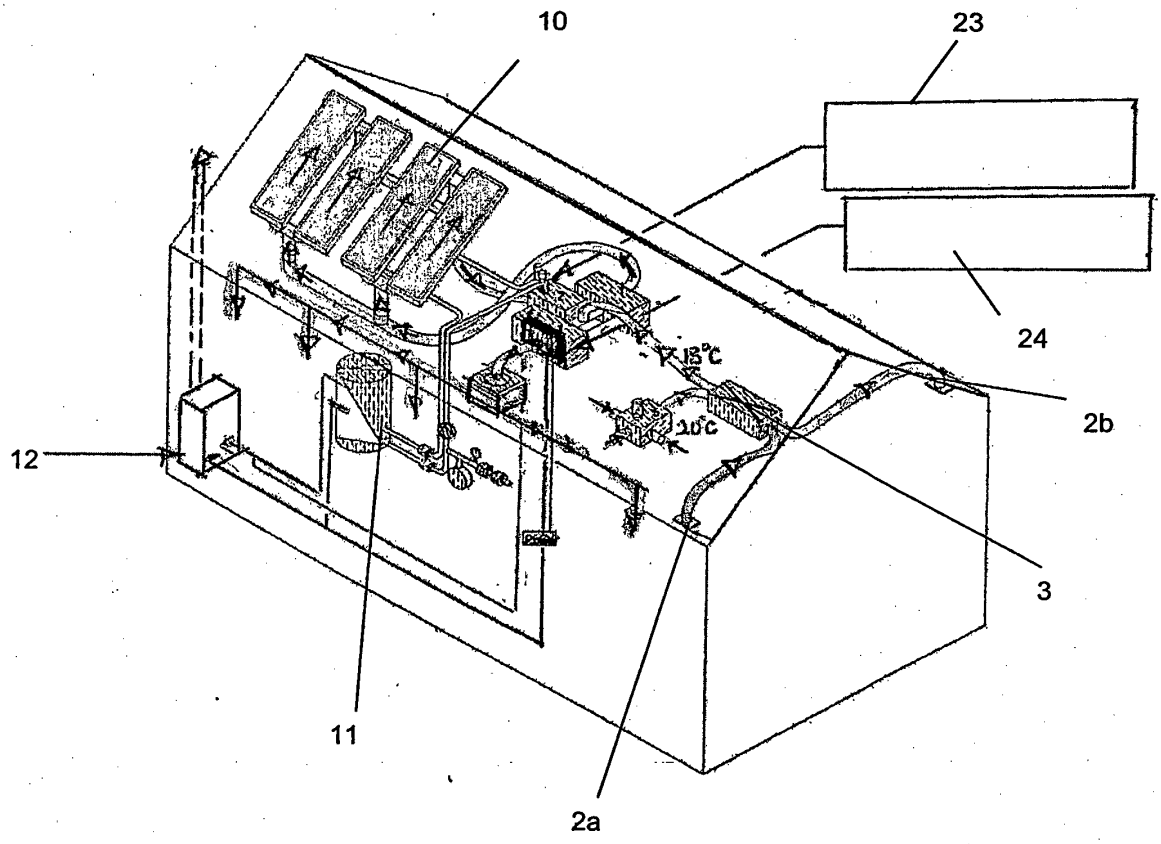


FIGURE 12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6223545 A **[0001]**
- EP 0808441 A **[0002]**