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(54) **Heating cooling unit**

(57) A heating cooling unit, intended for meeting the thermal requirements of a building, comprising a box shaped supporting structure which is intended for being installed on the roof of the building and wherein there are contained: an air treatment station (10) for treating an air flow intended for conditioning one or more main rooms of the building, such station comprising heat exchange means (11,12) suitable for regulating the air flow temperature; a refrigeration circuit (20a,20b,20c), operating according to a vapor compression cycle, which is susceptible of providing a heat load generated by a condensation stage and a cool load generated by an evaporation stage; a first and a second hydraulic circuit (30,40) which are suitable for thermally connecting, through a thermal carrier fluid circulating therein, the refrigeration circuit (20) to the heat exchange means of the air treatment station (10) for regulating the air flow temperature by means of

the heat load and/or the cool load, at least one of the two hydraulic circuits (30,40) being provided with a tank (31,41) for allowing the storage of the thermal carrier fluid, as well as with a delivery header (32,42) and with a return header (33,43) for allowing the thermal carrier fluid to circulate outside the heating cooling unit (1) and to feed conditioning devices located into secondary rooms of the building; - a hot sanitary water production circuit (50) which is thermally connected to one of the two hydraulic circuits for at least partly absorbing the heat load of the refrigeration circuit and is intended for being hydraulically connected to a water distribution network of the building; and a heat integration circuit (60), provided with a boiler (63), which can be thermally connected in parallel to one of the two hydraulic circuits and to the hot sanitary water production circuit (50) for integrating the heat load of the refrigeration circuit (20) in respectively heating the thermal carrier fluid and the sanitary water.

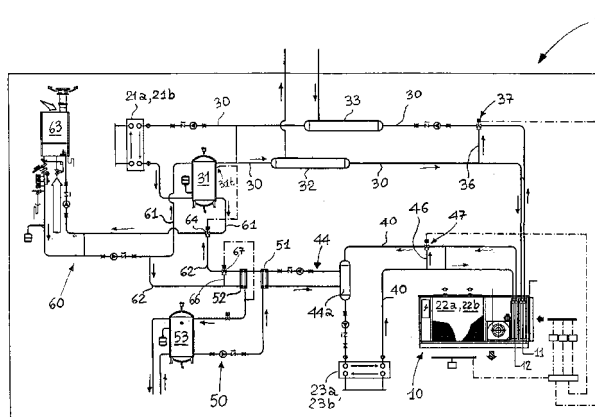


FIG. 1

Description

[0001] The present invention relates to a heating cooling unit.

[0002] The heating cooling unit object of the present invention in general relates to the field of conditioning systems, and more specifically to the field of systems to be installed on the building roofs, commonly called roof top systems. In particular, the unit is suitable for meeting all the heating and cooling requirements normally present in the various rooms of a building for industrial, commercial and/or residential use.

[0003] The thermal requirements of a building, either residential or commercial, essentially consist in heating the rooms in the cold season, in cooling the same in the hot season and in producing hot water for sanitary use.

[0004] In residential buildings, which exhibit quite limited cubic volumes and thermal requirements basically distributed over the whole day, the heating is obtained through a thermo-hydraulic system provided with boiler that also ensures the production of sanitary water, whereas the cooling is obtained separately through a conditioning system, which normally consists of a chiller.

[0005] In industrial or commercial buildings, which on the other hand exhibit much larger cubic volumes and thermal requirements basically concentrated only in some periods of the day, heating and cooling are preferably obtained by a single heating cooling system. Usually, the system is based on a steam compression refrigeration circuit and can operate with cycle reversal as heat pump in the cold season and as chiller in the hot season. In the two different operating modes, the heating cooling unit respectively produces hot water or cold water for heating or cooling the various rooms of the building through localised devices, such as fan coils, or through distributed devices, such as floor or wall systems. On the other hand, the production of hot sanitary water is carried out by a specially provided boiler. A heating cooling unit suitable for alternately operating as heat pump and as a chiller is described, for example, in US patent 5088296.

[0006] In especially large buildings, such as large shopping centres, or in buildings exhibiting one or two main rooms with a large cubic volume and a series of smaller secondary rooms, such as a car dealer building, there is the need of treating high air volumes to ensure suitable conditioning of the entire building. In these cases, the conditioning of the main rooms must be carried out by a special air treatment station with independent heating cooling system, whereas the conditioning of the secondary rooms is carried out by a heating cooling system of smaller dimensions associated to fan coils or to floor systems. This therefore implies the presence of two different heating cooling systems, with increase of the installation and operating costs.

[0007] The heating cooling systems currently available on the market therefore exhibit the disadvantage of being little flexible from the operating point of view and of not allowing an integrated management of the thermal re-

quirements of a building, with consequent disadvantages from the point of view of the overall energy efficiency.

[0008] In this situation, therefore, the object of the present invention is to overcome the disadvantages of the mentioned prior art by providing a heating cooling unit which should allow an integrated management of the thermal requirements of a building or of a group of buildings.

[0009] A further object of the present invention is to provide a heating cooling unit which should allow recovering part of the heat of condensation for pre-heating hot sanitary water.

[0010] A further object of the present invention is to provide a heating cooling unit which should allow concurrently meeting cooling and heating requirements.

[0011] A further object of the present invention is to provide a heating cooling unit which should be constructively easy to make and operatively totally reliable.

[0012] The technical features of the invention, according to the above objects, are clearly found in the contents of the annexed claims and the advantages of the same shall appear more clearly from the following detailed description, made with reference to the annexed drawings, which show a purely exemplifying and non-limiting embodiment thereof, wherein:

[0013] - Figure 1 shows a diagram of the heating cooling unit according to the present invention, in accordance with a first and a second plant configuration;

[0014] - Figure 2 shows the diagram of a refrigeration circuit used in the heating cooling unit of Figure 1 made in accordance with the first plant configuration;

[0015] - Figure 3 shows the diagram of a refrigeration circuit used in the heating cooling unit of Figure 1 made in accordance with the second plant configuration;

[0016] - Figure 4 shows the diagram of the heating cooling unit according to the present invention made in accordance with a third plant configuration; and

[0017] - Figure 5 shows the diagram of a refrigeration circuit used in the heating cooling unit shown in Figure 4.

[0018] With reference to the annexed Figures, reference numeral 1 globally denotes the heating cooling unit according to the invention. The heating cooling unit 1 is suitable for meeting all the heating and cooling requirements present in the different rooms of a building for commercial and/or residential use.

[0019] In particular, the heating cooling unit 1 is capable of concurrently meeting both the thermal requirements of rooms with large cubic volumes by generating conditioned air flows, and the thermal requirements of rooms with low cubic volume by feeding localised thermal devices, such as fan coils, or distributed devices, such as floor or wall systems. Unit 1 further allows the production of hot water for sanitary use through a recovery of the energy that is dissipated during the operation of unit 1 itself.

[0020] The heating cooling unit 1 is a roof top system, that is, intended to be installed on the roof of a building. To this end, unit 1 is provided with a supporting structure

(not shown in the figures) with a box shape, having an aluminium frame, a steel base and multilayer thermal insulation panels, inside which there are arranged all the operating elements of the same heating cooling unit 1.

[0021] With reference to Figures 1, 3 and 5, the operating elements of the heating cooling unit 1 are: an air treatment station 10; a refrigeration circuit 20a, 20b, or 20c for producing a heat load and a cool load; a first and a second hydraulic circuit 30 and 40 suitable for thermally connecting the air treatment station 10 and the refrigeration circuit; a hot sanitary water production circuit 50; and a heat integration circuit 60.

[0022] The air treatment station 10 is suitable for generating an air flow for conditioning the main rooms of the building. To this end, station 10 is provided with special connections for the ducts conveying the air flow to the various rooms. Station 10 is capable of ensuring all the treatments normally envisaged for an air flow, that is, cooling, heating, filtering, dehumidification and humidification. In particular, it is provided with heat exchange means 11 and 12 which are suitable for regulating the temperature of said air flow and are thermally connected to the refrigeration circuit through the two hydraulic circuits 30 and 40.

[0023] Advantageously, such heat exchange means comprise a main heat exchanger 11 and a secondary heat exchanger 12, which is located downstream of the main one 11 relative to the air flow moving direction. Both exchangers 11 and 12 are of the finned battery type.

[0024] The refrigeration circuit 20a, 20b, or 20c operates according to a steam compression cycle and is susceptible of generating a heat load for meeting the heating requirements and a cool load for meeting the cooling requirements. As explained hereinafter, the refrigeration circuit may be sided by the heat integration circuit 60 to meet especially high heating requirements and/or to produce hot sanitary water. Typically, this can happen in the cold season when especially low external temperatures can impair the refrigeration circuit.

[0025] Steam compression refrigeration cycle herein means a refrigeration cycle intended for transferring heat from a cold source to a hot source continuously treating a refrigerating fluid through an evaporation stage, a compression stage, a condensation stage and finally, a lamination stage. Such cycle is carried out in a closed circuit provided with an evaporator, a compressor, a condenser, and lamination means, connected to one another in series.

[0026] The refrigeration circuit 20a, 20b, or 20c, which shall be described in more detail hereinafter, uses as refrigerating fluid (coolant), for example, R407C or R410 (or any other "ecological" refrigerating fluid) and is provided with a first and a third heat exchanger 21a, b, c and 23a, b, c (preferably of the plate type) for exchanging heat respectively with the two hydraulic circuits 30 and 40, and is provided with a second heat exchanger 22a, b, c (preferably of the finned battery type) for exchanging heat directly with the external environment.

[0027] Operatively, in some plant configurations, the refrigeration circuit is structured for operating without cycle reversal, whereas in other configurations, the refrigeration circuit is structured for operating with cycle reversal. Cycle reversal means the possibility of operating the refrigeration circuit alternately as a chiller in the hot season for carrying out a heat transfer from the building to the external environment, and as a heat pump in the cold season for carrying out, instead, a heat transfer from the external environment to the building.

[0028] The first and the second hydraulic circuit 30 and 40 are suitable for thermally connecting, by a thermal carrier fluid circulating therein (preferably water), the refrigeration circuit 20a, 20b, or 20c with the heat exchange means 11 and 12 of the air treatment station 10. These two circuits 30 and 40 allow transferring the heat load and/or the cool load generated by the refrigeration circuit to the air flow that is treated in the air treatment station 10 so as to regulate the temperature of the latter. As shall be explained in more detail hereinafter, the thermal carrier fluid circulating in the two hydraulic circuits 30 and 40 can be cold or hot according to the operating conditions of unit 1.

[0029] Concurrently with the thermal conditioning of the air flow, the two hydraulic circuits 30 and 40 can feed the thermal carrier fluid circulating therein to external conditioning devices (fan coils, floor or wall systems) located in the secondary rooms of the building. To this end, as can be seen in Figures 1, 3 and 5, at least one between the two hydraulic circuits 30 and 40 is provided with a tank 31, 41 for allowing the storage of the thermal carrier fluid, with a delivery header 32, 42 for allowing the fluid bleeding and with a return header 33, 43 for allowing the return of the fluid itself into the circuit.

[0030] The hot sanitary water production circuit 50 is intended for being hydraulically connected to a water distribution network of the building and is thermally connected to one of the two hydraulic circuits 30 and 40. This circuit 50 allows partly or fully absorbing the heat load generated by the refrigeration circuit 20 in all the operating situations wherein such load is not used for conditioning the rooms and would therefore be alternatively dissipated in the environment outside the building.

[0031] Here and in the following description, "total", "complete" or "integral transfer" of the heat load means the transfer of the heat load share available for the exchange, excluding (of course) that absorbed by all the unavoidable energy dissipations.

[0032] Advantageously, the hot sanitary water production circuit 50 comprises a pre-heating exchanger 51 and a heating exchanger 52 connected to each other in series. These two exchangers 51 and 52 preferably are of the plate type for dimension and weight reasons. Circuit 50 can be further provided with a third tank 53 for the storage of the hot sanitary water produced.

[0033] The heat integration circuit 60 is provided with a boiler 63 and is thermally connected, through two parallel branches, respectively to one of the two hydraulic

circuits 30 and 40 and to the hot sanitary water production circuit 50. This circuit 60 allows integrating the heat load of the refrigeration circuit 20a, 20b, or 20c in heating respectively the sanitary water and the thermal carrier fluid circulating in the two hydraulic circuits 30 and 40. Preferably, boiler 63 is of the condensation type (high efficiency) and is provided with a gas burner. The features of a condensation boiler are well known to a man skilled in the art and therefore shall not be described in detail.

[0034] Advantageously, the plant structure of the heating cooling unit 1 can be suitably calibrated on the specific thermal requirements of a building by choosing among different configurations the one that most suits the specific case.

[0035] Normally, a commercial and/or residential building exhibits thermal requirements quite even in all the rooms thereof, that is, heating requirements in the cold season and cooling requirements in the hot season. In especially large and complex buildings, however, climatic situations may occur which, in the same period of the year, lead some rooms of the building to have heating requirements and other rooms to have, on the other hands, cooling requirements. This frequently happens during the intermediate seasons, when even minimal differences in the sun exposure between one room and the other can cause even considerable temperature variations. For this type of buildings, the heating cooling unit 1 according to the invention can be structured with plant configurations capable of meeting at the same time both heating requirements and cooling requirements. In these cases, the heating cooling unit 1 is more complex to the detriment of the weight and dimensions thereof. For buildings that over the year exhibit substantially even thermal requirements in all the rooms and that do not need concurrent cooling and heating capabilities, the heating cooling unit 1 can instead be structured with less complex plant configurations, which are characterised by smaller dimensions and lower weights.

[0036] In accordance with a first plant configuration, illustrated in Figures 1 and 2, the heating cooling unit 1 is structured for meeting cooling requirements or heating requirements. As will appear more clearly from the following description, in this first configuration unit 1 can produce hot sanitary water by actuating a partial recovery of the heat load generated by the refrigeration circuit 20a. Such recovery can only be carried out when unit 1 is operating in cooling mode.

[0037] In this first configuration, the refrigeration circuit 20a, illustrated in detail in Figure 2, is structured for operating with cycle reversal, that is, for operating in chiller mode or in heat pump mode, and to this end it is provided with a four way valve 24a for managing the coolant circulation. Circuit 20a comprises one or more compressors 25a arranged in parallel, lamination means 26a, a first 21a and a second heat exchanger 22a, susceptible of alternately operating as condenser and as evaporator, and a third exchanger 23a susceptible of operating as desuperheater. The first exchanger 21a and the third ex-

changer 23a are both of the plate type and are thermally connected respectively to the first and the second hydraulic circuit 30 and 40. The second exchanger 22a is of the finned battery type and is installed in the air treatment station 10.

[0038] In this first plant configuration, as explained hereinafter, the third exchanger 23a is located downstream of compressors 25a and is suitable for transferring only a part of the heat load to the second hydraulic circuit 40, cooling the coolant without condensing it, that is, operating in desuperheating mode. For this reason, the third exchanger 23a has a size, and therefore a weight and overall dimensions, smaller than those of the first exchanger 21a.

[0039] For clarity, the description of the refrigeration circuit 20a shall be completed after describing the remaining operating elements of the heating cooling unit 1 and the interconnections thereof.

[0040] The transfer of the heat load or of the cool load from the refrigeration circuit 20a to the air treatment station 10 and to the external conditioning devices is carried out by the first hydraulic circuit 30, which as already said is thermally connected to the first exchanger 21a of the refrigeration circuit 20a. The transfer of the heat load from the refrigeration circuit 20a to the air flow for post-heating and/or to the hot sanitary water for the pre-heating is instead carried out by the second hydraulic circuit 40, which as already said is thermally connected to the third exchanger 23a of the refrigeration circuit 20a.

[0041] More in detail, the first hydraulic circuit 30 thermally connects the first heat exchanger 21a of the refrigeration circuit 20a to the main exchanger 11 of the air treatment station 10 for heating or cooling the air flow according to whether the first heat exchanger 21a operates as condenser or as evaporator. The first hydraulic circuit 30 can also feed the above conditioning devices external to unit 1 and to this end it is provided with a first tank 31 for the storage of the thermal carrier fluid, as well as a first delivery header 32 and a first return header 33 for the thermal carrier fluid circulation outside the heating cooling unit 1. Preferably, the first tank 31 is located downstream of the first heat exchanger 21a.

[0042] Advantageously, the air flow conditioning for the main rooms of the building can be carried out as an alternative to the feeding of the conditioning devices installed in the secondary rooms. To this end, the first circuit 30 is provided with a first by-pass 36 for excluding the main exchanger 11 of the air treatment station 10 from the circulation. The opening the first by-pass 36 is regulated by a second three way valve 37 based on the temperature values that the air flow exhibits in input to and output from the air treatment station 10. It is understood that the second three way valve 37 can be used for regulating the inflow of thermal carrier fluid to the main exchanger 11 by a flow rate modulation.

[0043] The second hydraulic circuit 40 thermally connects the third exchanger 23a of the refrigeration circuit 20a, which operates as desuperheater, respectively to

the secondary exchanger 12 of the air treatment station 10 for post-heating the air flow and to the pre-heating exchanger 51 of the hot sanitary water production circuit 50 for pre-heating the sanitary water.

[0044] Operatively, in this first configuration, as will be clarified hereinafter, the post-heating of the air flow and the pre-heating of the sanitary water can only be carried out when the refrigeration circuit 20a operates in the chiller mode, that is, when the first exchanger 21a operates as evaporator.

[0045] As can be seen in Figure 1, the second hydraulic circuit 40 is thermally connected to the pre-heating exchanger 51 through a closed circuit 44 which develops in parallel from a specially provided header 44a.

[0046] In consideration of the reduced heat load recovered by the desuperheater 23a, the post-heating of the air flow is preferably carried out as an alternative to the heat recovery for the production of hot sanitary water. To this end, the second circuit 40 is provided with a second by-pass 46 for excluding the secondary exchanger 12 of the air treatment station 10 from the circulation. The opening of the second by-pass 46 is regulated by a third three way valve 47 based on the temperature values that the air flow exhibits in input to and output from the air treatment station 10. It is understood that the third three way valve 47 can be used for regulating the inflow of thermal carrier fluid to the secondary exchanger 12 by a flow rate modulation.

[0047] The heat integration circuit 60 uses water as circulating fluid and is hydraulically connected to the first tank 31 of the first hydraulic circuit 30 by a first branch 61 and to the heating exchanger 52 of the hot sanitary water production circuit 50 by a second branch 62. The latter is connected in parallel to the first branch 61.

[0048] Operatively, the inflow of hot water coming from boiler 63 into the first branch 61 can be carried out as an alternative to the inflow into the second branch 62 and is regulated by a first three way valve 64 which is located at the point where the first and the second branch 61 and 62 join into the main circuit 60. It is understood that the inflow of hot water into the first branch 61 can be regulated by the first three way valve 64 so that is concurrent to the inflow into the second branch 62.

[0049] When the refrigeration circuit 20a operates as chiller, typically in the hot season, the thermal carrier fluid circulating into the first hydraulic circuit 30 is cold and the hot water coming from boiler 63 must never flow into the first branch 61 towards the first tank 31. In this case, the heat integration circuit 60 can intervene only to integrate the pre-heating of the sanitary water carried out by the second hydraulic circuit 40. The first three way valve 64 is therefore regulated so that the hot water coming from boiler 63 flows only into the second branch 62, towards the heating exchanger 52 of the hot sanitary water production circuit 50.

[0050] When the refrigeration circuit 20a operates as heat pump, typically in the cold season, the thermal carrier fluid circulating into the first hydraulic circuit 30 is hot

and the hot water coming from boiler 63 can flow also into the first branch 61. In this case, the heat integration circuit 60 can intervene both to integrate the pre-heating of the sanitary water and to integrate the heating of the thermal carrier fluid of the first hydraulic circuit 30.

[0051] The heating of the thermal carrier fluid of the first hydraulic circuit 30 has priority over the heating of the sanitary water. The opening of the first three way valve 64 is controlled by a temperature sensor 31t which is installed on the first tank 31 of the first circuit 30 and is suitable for sensing the temperature of the thermal carrier fluid contained into tank 31. The first three way valve 64 allows the inflow of hot water into the second branch 62 towards the heating exchanger 52 only when sensor 31t senses a temperature of the thermal carrier fluid contained in tank 31 exceeding a predetermined threshold value. The latter is set so that the thermal carrier fluid may ensure the heating of the air flow into the air treatment unit 10 and a suitable thermal feeding of the external conditioning devices.

[0052] Advantageously, the second branch 62 of the heat integration circuit 60 is provided with a third by-pass 66 for excluding the heating exchanger 52 from the circulation. The opening of the third by-pass 66 is regulated by a fourth three way valve 67 based on the temperature value that the hot sanitary water exhibits in output from the heating exchanger 52. In some operating situations, in fact, it can happen that the heat load recovered into the third exchanger 23a and transferred to the sanitary water into the pre-heating exchanger 51 is sufficient for bringing the sanitary water to a temperature value equal to or higher than 45°C and the heat integration of boiler 63 therefore is not necessary. It is understood that the fourth three way valve 67 can be used for regulating the inflow of hot water coming from the boiler to the heating exchanger 52 by a flow rate modulation.

[0053] The opening of the above four three way valves 37, 47, 64 and 67 is coordinated by a logical control unit according to a predetermined operating logic based on the thermal requirements of the various building rooms.

[0054] As already said, the refrigeration circuit 20a is structured for operating with cycle reversal and to this end, it is provided with a four way valve 24a. This valve connects four circuit lines to one another: a first line 28a which represents the delivery line of compressors 25a and wherein there is inserted the third exchanger (desuperheater) 23a; a second line 28b wherein there is inserted the second exchanger 22a; a third line 28c which represents the return line to compressors 25a; a fourth line 28d wherein there is inserted the first exchanger 21a. The first exchanger 21a is connected to the second exchanger 22a by a fifth line 28e consisting of a first and a second branch 28e' and 28e'' parallel to one another which join back the second exchanger 22a. A third branch 28e''', which connects to the second exchanger 22a by a distributor 29, branches from the second branch 28e''. Access to the third branch 28e''' is regulated by a first and a second solenoid valve 541 and 542 respectively

inserted at the inlet of the third branch 28e''' and into the second branch 28e". The lamination means 26a consist of a first thermostatic valve 26a', which is inserted into the second branch 28e" and allows the coolant flow only towards the first exchanger 21a, and of a second thermostatic valve 26a'', which is inserted into the third branch 28e''' and allows the coolant flow only towards distributor 29. There are provided a first and a second nonreturn valve 110 and 120, respectively inserted into the first branch 28e' and in the portion of the fifth line 28e which is comprised between the second exchanger 22a and the convergence point of the two branches 28e' and 28e".

[0055] Operatively, when the refrigeration circuit 20a operates as chiller, typically in the hot season, the first exchanger 21a operates as evaporator and transfers the cool load (evaporation heat) to the thermal carrier fluid of the first hydraulic circuit 30, whereas the second exchanger 22a operates as condenser and dissipates the heat load (heat of condensation) to the external environment. In this operating mode, the third exchanger (desuperheater) 23a is upstream of the second exchanger 22a and can recover about 20% of the heat load transferring it to the thermal carrier fluid circulating into the second hydraulic circuit 40. The residual 80% of the heat load, on the other hand, is dissipated to the environment through the second exchanger 22a.

[0056] More in detail, in the chiller mode, the four way valve 24a is regulated so that the coolant in output from the third exchanger (desuperheater) 23a proceeds towards the second exchanger 22a along the second line 28b. After flowing through the second exchanger 22a, the coolant gets into the second branch in parallel 28e" (deviated by the first nonreturn valve 110). The first solenoid valve 541 is closed, whereas the second one 542 is open. The coolant flows through the first thermostatic valve 26a' to reach the first exchanger 21a. From the latter, following the fourth line 28d, the coolant reaches the four way valve 24a and then returns to compressors 25a following the third line 28c.

[0057] When the refrigeration circuit 20a operates as heat pump, typically in the cold season, the first exchanger 21a operates as condenser and transfers the heat load to the thermal carrier fluid of the first hydraulic circuit 30, whereas the second exchanger 22a operates as evaporator and transfers the cool load to the external environment. In this operating mode, the third exchanger (desuperheater) 23a is upstream of the first exchanger 21a. In this case, the heat load is used for heating the rooms and therefore cannot be used for producing hot sanitary water. The third exchanger 23a is thus deactivated, interrupting the circulation of the thermal carrier fluid into the second hydraulic circuit 40.

[0058] More in detail, in the heat pump mode, the four way valve 24a is regulated so that the coolant in output from the third exchanger 23a (deactivated) proceeds towards the first exchanger 21a along the fourth line 28d. After flowing through the first exchanger 21a, the coolant

gets into the first branch in parallel 28e' (deviated by the first thermostatic valve 26a') and proceeds through the second branch 28e" (deviated by the second nonreturn valve 120). The second solenoid valve 542 is closed, whereas the first one 541 is open. The coolant flows through the third branch 28e''' flowing through the second thermostatic valve 26a'' and then enters into the second exchanger 22a through distributor 29. From the second exchanger 22a, following the second line 28d, the coolant reaches the four way valve 24a and then returns to compressors 25a following the third line 28c.

[0059] In accordance with a second plant configuration, illustrated in Figures 1 and 3, the heating cooling unit 1 is structured for meeting only cooling requirements or only heating requirements, similarly to what envisaged in the first configuration. However, in this second configuration, unlike the first one, unit 1 can fully recover the heat load generated by the refrigeration circuit and, above all, it can carry out such recovery both when it is operating in heating (heat pump operating mode) and when it is operating in cooling (chiller operating mode).

[0060] From a plant point of view, the second configuration differs from the first one only in the refrigeration circuit, which is globally denoted with reference numeral 20b. The remaining operating elements, on the other hand, are totally similar to those envisaged in the first configuration and are illustrated in the same Figure 1. The description of this second configuration shall therefore focus on the refrigeration circuit 20b and shall highlight only the differences existing between the two configurations from an operating point of view. Elements in common between the two configurations shall therefore be referred to with the same alphanumerical references.

[0061] The refrigeration circuit 20b of this second configuration, illustrated in detail in Figure 3, is suitable for operating with cycle reversal, that is, as chiller or as heat pump, and to this end, similarly to the first configuration, it is provided with a four way valve 24a. Circuit 20b comprises one or more compressors 25a arranged in parallel, lamination means 26a, a first 21b and a second heat exchanger 22b, susceptible of alternately operating as condenser and as evaporator, and a third exchanger 23b which is susceptible of operating as condenser as an alternative to the first or second exchanger 21b and 22b. The first exchanger and the third exchanger 21b and 22b are both of the plate type and are thermally connected respectively to the first and the second hydraulic circuit 30 and 40. The second exchanger 22b preferably is of the finned battery type and is installed in the air treatment station 10.

[0062] In this second configuration, unlike the first one, the third exchanger 23b must not carry out the desuperheating of the coolant only, but the complete condensing thereof, and therefore has a suitable size, with dimensions and weight comparable to those of the first exchanger 21b. As a consequence, also the refrigeration circuit 20b is structured differently from that of the first configuration and comprises a parallel line 200 wherein

there is inserted the third exchanger 23b. In this way, the third exchanger 23b can operate as an alternative to the other two exchangers 21b and 22b or it can be excluded from the circulation. As for the rest, the refrigeration circuit 20b is substantially identical to the refrigeration circuit 20a of the first configuration and therefore, in the following description the same alphanumerical references shall be used for the elements in common.

[0063] More in detail, the parallel line 200 branches from the first line 28a of circuit 20b in a point comprised between compressors 25a and the four way valve 24a and reconnects to the circuit at the first branch 28e' of the above fifth line 28e, downstream of the second exchanger 22b. The coolant deviation towards the parallel line 200 or towards the four way valve 24a is regulated by a third and a fourth solenoid valve 310 and 320 respectively inserted at the input of the parallel line 200 and of the four way valve 24b. The parallel line 200 is further provided, at the final end thereof, with a third non-return valve 130 which is inserted downstream of the third exchanger 23b.

[0064] Operatively, when the refrigeration circuit 20b of this second configuration operates as chiller, typically in the hot season, the first exchanger 21b operates as evaporator and transfers the cool load (evaporation heat) to the thermal carrier fluid of the first hydraulic circuit 30. The second and the third exchanger 22b and 23b both operate as condensers, alternating each other. When the second exchanger 22b is activated, the heat load (heat of condensation) is dissipated to the external environment, whereas when the third exchanger 23b is activated, the heat load is integrally transferred to the thermal carrier fluid circulating into the second hydraulic circuit 40. In this last case, the third exchanger 23b can recover all the heat load for pre-heating the hot sanitary water and/or post-heating the air flow treated into the air treatment station 10.

[0065] In this second plant configuration, as already said before, the third exchanger 23b substantially has the same size as the first exchanger 21b to carry out a complete recovery of the heat load. As a consequence, the pre-heating of the sanitary water can be carried out also concurrently to the post-heating of the air flow.

[0066] More in detail, in the chiller mode, if the condensation occurs into the second exchanger 22b without recovery of the heat load (heat of condensation), the coolant in output from compressors 25a finds the third solenoid valve 310 closed and the fourth one 320 open and is therefore deviated towards the four way valve 24a. The latter is regulated so that the coolant proceeds towards the second exchanger 22b along the second line 28b. After dissipating the heat load to the external environment in this second exchanger 22b, the coolant gets into the second branch in parallel 28e". The first solenoid valve 541 is closed, whereas the second one 542 is open. The coolant flows through the first thermostatic valve 26a' and reaches the first exchanger 21b. From the latter, following the fourth line 28d, the coolant reaches the four

way valve 24a and then returns to compressors 25a following the third line 28c.

[0067] If the condensation is carried out into the third exchanger 23b, with complete recovery of the heat load, the coolant in output from compressors 25a finds the first solenoid valve 310 open and the second one 320 closed and is therefore deviated into the parallel line 200. After yielding the heat load to the thermal carrier fluid of the second hydraulic circuit 40 into the third exchanger 23b, the coolant flows into the first branch in parallel 28e' and then flows into the second branch in parallel 28e" (deviated by the first and the third nonreturn valve 110 and 130) to flow towards the first thermostatic valve 26a' and towards the first exchanger 21b.

[0068] Operatively, when the refrigeration circuit 20b operates as heat pump, typically in the cold season, the first exchanger 21b operates as condenser and transfers the heat load to the thermal carrier fluid of the first hydraulic circuit 30, whereas the second exchanger 22b operates as evaporator and transfers the cool load to the external environment. In this operating mode, the third exchanger 23b still operates as condenser, but as an alternative to the first exchanger 21b.

[0069] Also in this second configuration, similarly to the first one, the heating of the thermal carrier fluid of the first hydraulic circuit 30 has priority over the heating of the sanitary water. Thus, the coolant condensation can move from the first exchanger 21b to the third exchanger 23b when the temperature of the thermal carrier fluid, which is contained into the first tank 31 of the first hydraulic circuit 30, exceeds the above threshold temperature i.e when the thermal carrier fluid has such temperature as to ensure the heating of the air flow into the air treatment station 10 and a suitable thermal feeding of the external conditioning devices.

[0070] More in detail, in the heat pump mode, if the condensation occurs into the first exchanger 21b (heating of the air flow and feeding of the external conditioning devices), the coolant in output from compressors 25a finds the third solenoid valve 310 closed and the fourth one 320 open and is therefore deviated towards the four way valve 24a. The latter is regulated so that the coolant proceeds towards the first exchanger 21b along the fourth line 28d. After yielding the heat load (heat of condensation) to the thermal carrier fluid of the first hydraulic circuit 30 in this first exchanger 21b, the coolant gets into the first branch in parallel 28e" (deviated by the first thermostatic valve 26a') and proceeds through the second branch 28e" (deviated by the third and the second non-return valve 130 and 120). The second solenoid valve 542 is closed, whereas the first one 541 is open. The coolant flows through the third branch 28e'" flowing through the second thermostatic valve 26a" and then enters into the second exchanger 22b through distributor 29. From the second exchanger 22a, following the second line 28b, the coolant reaches the four way valve 24a and then returns to compressors 25a following the third line 28c.

[0071] If the condensation is carried out into the third exchanger 23b (pre-heating of sanitary water), the coolant in output from compressors 25a finds the first solenoid valve 310 open and the second one 320 closed and is therefore deviated into the parallel line 200. After yielding the heat load (heat of condensation) to the thermal carrier fluid of the second hydraulic circuit 40 into the third exchanger 23b, the coolant flows into the first branch in parallel 28e', flows into the second branch in parallel 28e" (deviated by the first and the second nonreturn valve 110 and 120) and then into the third branch 28e'" to flow towards the first thermostatic valve 26a" and the second exchanger 22b.

[0072] In accordance with a third plant configuration, illustrated in Figures 4 and 5, the heating cooling unit 1 is capable of concurrently meeting cooling requirements and heating requirements of a building, totally recovering the heat load generated by the refrigeration circuit 20c in any operating situation.

[0073] In particular, the heating cooling unit 1 according to this third configuration offers the highest operating flexibility. In fact, it can operate at the same time for cooling and for heating, or for cooling only and heating only. The production of hot sanitary water with recovery of the heat load can take place in all the three operating modes.

[0074] In this third configuration, the refrigeration circuit 20c, illustrated in detail in Figure 5, unlike the other two configurations, operates without cycle reversal. The refrigeration circuit 20c comprises one or more compressors 25a arranged in parallel, lamination means 26a, a first and a third heat exchanger 21c and 23c, susceptible of respectively operating only as evaporator and only as condenser, and a second exchanger 22c which is susceptible of operating as evaporator or as condenser as an alternative respectively to the first and the third exchanger 21c and 23c. Similarly to the second configuration, the third exchanger 23c has a size suitable for carrying out the coolant condensation. The second exchanger 22c is of the finned battery type and is installed in the air treatment station 10. In particular, the lamination means 26a comprise a first and a second thermostatic valve 26a' and 26a".

[0075] For clarity, the description of the refrigeration circuit 20c shall be completed after describing the remaining operating elements of the heating cooling unit 1 and the interconnections thereof.

[0076] In this third configuration, the first hydraulic circuit 30 is devoted only for transferring the cool load from the refrigeration circuit 20c to the air flow and/or to the external conditioning devices and therefore operates in cooling mode only. Therefore, the thermal carrier fluid circulating into the first hydraulic circuit 30 can only be cold.

[0077] The second hydraulic circuit 40 is devoted only for transferring the heat load from the refrigeration circuit 20c to the air flow and/or to the external conditioning devices and therefore operates in heating mode only. The second hydraulic circuit 40 can also transfer the heat load

to the sanitary water for pre-heating it. Therefore, in this third configuration, the thermal carrier fluid circulating into the second hydraulic circuit 40 can only be hot.

[0078] More in detail, the first hydraulic circuit 30 thermally connects the first exchanger 21c (evaporator) of the refrigeration circuit 20c to the main exchanger 11 of the air treatment station 10 for allowing the air flow cooling. Similarly to the other two configurations, the first hydraulic circuit 30 is provided with a first tank 31 for allowing the storage of the thermal carrier fluid, as well as with a first delivery header 32 and with a first return header 33 for allowing the circulation of the cold thermal carrier fluid outside the heating cooling unit 1.

[0079] In this third plant configuration, similarly to what envisaged in the other two configurations, the second hydraulic circuit 40 thermally connects the third exchanger 23c (condenser) of the refrigeration circuit 20c respectively to the secondary exchanger 12 of the air treatment station 10 for allowing the post-heating of the air flow and to the pre-heating exchanger 51 of the hot sanitary water production circuit 50 for allowing the pre-heating of the sanitary water.

[0080] Unlike what envisaged in the other two configurations, the second circuit 40 is provided with a second tank 41 for allowing the storage of the thermal carrier fluid, as well as with a second delivery header 42 and with a second return header 43 for allowing the circulation of the hot thermal carrier fluid outside the heating cooling unit 1.

[0081] In addition, the second hydraulic circuit 40 can thermally connect the third exchanger 23c of the refrigeration circuit 20c to the main exchanger 11 of the air treatment station 10 for allowing the air flow heating. The air flow heating must be carried out in the main exchanger 11 of the air treatment station 10, since it is provided with a larger heat exchange surface than the secondary exchanger 12.

[0082] To this end, the second hydraulic circuit 40 is hydraulically connected to the first hydraulic circuit 30 by means of a delivery by-pass 45a and by means of a return by-pass 45b, respectively upstream and downstream of the main exchanger 11 of the air treatment station 10. Access to the delivery by-pass 45a and to the return by-pass 45b is respectively regulated by a first three way valve 451 and by a second three way valve 452. When the thermal carrier fluid of the second hydraulic circuit 40 flows towards the main exchanger 11 of the air treatment station 10, the first hydraulic circuit 30 must be deactivated and the cool load is yielded to the environment into the second heat exchanger 22b.

[0083] Operatively, when there is the need of generating a hot air flow for heating the main rooms of the building, typically only in the cold season, normally in a building there are no cooling requirements to meet. Therefore, the deactivation of the first hydraulic circuit 30 is in any case envisaged and as a consequence, there are no operating interferences between the two hydraulic circuits 30 and 40.

[0084] In this third plant configuration, similarly to what envisaged in the other two, the air flow conditioning for the main rooms of the building can be carried out also as an alternative to the feeding of the conditioning devices installed in the secondary rooms.

[0085] To this end, the first circuit 30 is provided with a first by-pass 36 for excluding the main exchanger 11 of the air treatment station 10 from the circulation. The opening the first by-pass 36 is regulated by a third three way valve 37 based on the temperature values that the air flow exhibits in input to and output from the air treatment station 10. Similarly, the second circuit 40 is provided with a second by-pass 46 for excluding the secondary exchanger 12 of the air treatment station 10 from the circulation. The opening the second by-pass 46 is regulated by a fourth three way valve 47 based on the temperature values that the air flow exhibits in input to and output from the air treatment station 10.

[0086] It is understood that the third and the fourth three way valve 37 and 47 can be used for regulating the inflow of thermal carrier fluid to the main exchanger 11 and to the secondary exchanger 12 by a flow rate modulation.

[0087] In this third configuration, in consideration of the fact that the hot circuit is not the first hydraulic circuit 30 anymore, but the second one 40, the heat integration circuit 60 is hydraulically connected by a first branch 61 to the second tank 41 of the second hydraulic circuit 40, and not to the first tank 31 of the first circuit 30 anymore.

[0088] Similarly to what envisaged in the other two configurations, the heat integration circuit 60 is further hydraulically connected to the heating exchanger 52 of the hot sanitary water production circuit 50 by a second branch 62, which is connected in parallel to the first one. Access to the second branch 62 is regulated by a fifth three way valve 455 located at the inlet of the second branch 62 itself.

[0089] The opening of the above five three way valves 451, 452, 37, 47 and 455 is coordinated by a logical control unit according to a predetermined operating logic based on the thermal requirements of the various building rooms.

[0090] As already said above, in this third configuration the refrigeration circuit 20c is structured for operating without cycle reversal.

[0091] As can be seen in Figure 5, the refrigeration circuit 20c consists of a main loop 400, wherein there are inserted in series the first exchanger 21c (evaporator), compressors 25a, the third exchanger 23c (condenser) and the first thermostatic valve 26a', and of a secondary loop 500, which can be excluded from the circulation and wherein there are inserted the second heat exchanger 22c (condenser or evaporator) and the second thermostatic valve 26a".

[0092] More in detail, the secondary loop 500 comprises a first branch 510, which develops in parallel to the main loop 400 downstream of the third exchanger 23c, a by-pass 520, which connects the first branch 510 di-

rectly to the compressor intake, and a second branch 530, which is connected to the second exchanger 22c by a distributor 29 and which allows excluding the first thermostatic valve 26a' and the first exchanger 21c from the circulation. The second thermostatic valve 26a" is inserted in this second branch 530.

[0093] Operatively, access to the first branch 510 is regulated by a first solenoid valve 511 inserted just after the inlet of the first branch 510 and by a second solenoid valve 512 inserted in the main loop 400.

[0094] The first branch 510 is provided with a nonreturn valve 513 arranged in the proximity of the point at which the first branch 510 reconnects to the main loop 400. Access to by-pass 520 is regulated by a third solenoid valve 521 inserted in the by-pass itself. Access to the second branch 530 is regulated by a fourth solenoid valve 531, which is inserted just after the inlet of the second branch, and by a fifth solenoid valve 541, which is inserted in the main loop upstream of the first thermostatic valve 26a'.

[0095] When the heating cooling unit 1 must concurrently operate in heating and in cooling, the coolant circulates only in the main loop 400. The secondary loop 500 is excluded from the circulation and the second exchanger 22c is deactivated. This operating mode occurs not only in the intermediates seasons, when there may be rooms in the building with opposite thermal requirements, but also in the hot season, when even if the thermal requirements of all the rooms in a building are even, in any case there may be the need of producing hot sanitary water and thus the possibility of recovering the heat load with a pre-heating, or the need of regulating the temperature of the conditioned air flow with a post-heating.

[0096] When the heating cooling unit 1 must operate in cooling mode only, for example during the hot season, and it is not possible to use the heat load in any way, the third heat exchanger 23c is deactivated interrupting the circulation of the thermal carrier fluid in the second hydraulic circuit 40. The heat load (heat of condensation) is dissipated to the external environment through the second exchanger 22c.

[0097] More in detail, the coolant in output from compressors 25a flows through the third exchanger 23c (deactivated). The first solenoid valve 511 is open, whereas the second solenoid valve 512 is closed, so that the coolant flows into the first branch 510 of the secondary loop 500. After dissipating the heat load to the environment through the second exchanger 22c, the coolant returns into the main loop 500 for flowing towards the first thermostatic valve 26a' and the first exchanger 21c (evaporator). The third and the fourth solenoid valve 521 and 531 are closed and access to by-pass 520 and to the second branch 520 of the secondary loop 500 is therefore prevented.

[0098] When the heating cooling unit 1 operates in heating only, for example during the cold season, the cool load cannot be used and must be yielded to the external environment. In this case, the first heat exchang-

er 21c is excluded from the circulation and the evaporation stage of the refrigeration cycle is carried out in the second heat exchanger 22c.

[0099] More in detail, the coolant in output from compressors 25a yields the heat load to the thermal carrier fluid of the second hydraulic circuit 30 into the third exchanger 23c (condenser). The first solenoid valve 511 is closed, whereas the second solenoid valve 512 is open. The coolant continues to flow into the main loop 400 until it meets with the second branch 530 of the secondary loop 500. The fourth solenoid valve 531 is open, whereas the fifth solenoid valve 541 is closed. The coolant can thus flow through the second thermostatic valve 26a" and get into the second exchanger 22c (evaporator) thanks to distributor 29. The coolant flows through the by-pass 520 and then returns to compressors 25a.

[0100] As already seen, in the first configuration the heating cooling unit 1 cannot concurrently meet heating and cooling requirements of the building rooms. Moreover, the heat load recovery for the production of hot sanitary water is partial and limited to some special operating situations. However, unit 1 is less complex and heavy and is easier to install on a building roof. In fact, the third heat exchanger 23a has a reduced size with reduction of the overall dimensions and of the weight and the second circuit is not provided with tank and with the two headers for feeding the conditioning devices external to unit 1.

[0101] In the second configuration, similarly to the first one, the heating cooling unit 1 cannot concurrently meet heating and cooling requirements of the building rooms, but the heat load recovery for the production of hot sanitary water is total and can be carried out in a greater number of operating situations. However, unit 1 is slightly more complex and heavy, in particular due to the fact that the third heat exchanger 23b has a larger size for allowing a total recovery of the heat load and the refrigeration circuit 20b consequently is more complex.

[0102] In the third configuration, the heating cooling unit 1 can meet any thermal requirements with the possibility of recovering the heat load in any operating situation. However, unit 1 is more complex from a plant point of view, but especially heavier than the other two configurations. This can make its installation more difficult. In fact, both hydraulic circuits are provided with tank and with the two headers for feeding the conditioning devices external to unit 1.

[0103] The invention thus conceived thus achieves the intended purposes.

[0104] Of course, in the practical embodiment thereof, it may take shapes and configurations differing from that illustrated above without departing in any case from the present scope of protection.

[0105] Moreover, all the parts may be replaced by technically equivalent ones and the sizes, shapes and materials used may be whatever according to the requirements.

Claims

1. A heating cooling unit, intended for meeting the thermal requirements of a building, comprising a box shaped supporting structure which is intended for being installed on the roof of said building and wherein there are contained:

- an air treatment station (10) for treating an air flow intended for conditioning one or more main rooms of said building, said plant (10) comprising heat exchange means (11; 12) suitable for regulating the temperature of said air flow;
- a refrigeration circuit (20a; 20b; 20c), operating according to a steam compression cycle, which is subject to providing a heat load generated by a condensation stage and a cool load generated by an evaporation stage;
- a first (30) and a second hydraulic circuit (40) which are suitable for thermally connecting, through a thermal carrier fluid circulating therein, said refrigeration circuit (20) with the heat exchange means (11; 12) of said air treatment station (10) for regulating the temperature of said air flow by means of the heat load and/or by means of the cool load provided by said refrigeration circuit (20), at least one between said two hydraulic circuits (30; 40) being provided with a tank (31; 41) for allowing the storage of said thermal carrier fluid, as well as with a delivery header (32; 42) and with a return header (33; 43) for allowing said thermal carrier fluid to circulate outside said heating cooling unit (1) and to feed conditioning devices located into secondary rooms of said building;
- a hot sanitary water production circuit (50) which is thermally connected to one of said two hydraulic circuits (30; 40) for absorbing at least partly the heat load of said refrigeration circuit (20a; 20b; 20c) and is intended for being hydraulically connected to a water distribution network of said building; and
- a heat integration circuit (60), provided with a boiler (63), which can be thermally connected in parallel to one of said two hydraulic circuits (30; 40) and to said hot sanitary water production circuit (50) for integrating the heat load of said refrigeration circuit (20) in heating respectively said thermal carrier fluid and said sanitary water.

2. A heating cooling unit according to claim 1, wherein the heat exchange means (11; 12) of said air treatment station (10) comprise a main heat exchanger (11) and a secondary heat exchanger (12) located downstream of the main one (11) relative to the moving direction of said air flow, and wherein said hot sanitary water production circuit (50) comprises a pre-heating exchanger (51) and a heating exchanger

(52) connected to each other in series.

3. A heating cooling unit according to claim 2, wherein:

- said refrigeration circuit (20a) is suitable for operating with cycle reversal and comprises a four way valve (24a), at least one compressor (25a), lamination means (26a), a first (21a) and a second heat exchanger (22a), susceptible of alternately operating as condenser and as evaporator, and a third heat exchanger (23a) which is located downstream of said at least one compressor (25a) and is susceptible of operating as desuperheater;
- said first hydraulic circuit (30) is susceptible of thermally connecting the first heat exchanger (21a) of said refrigeration circuit (20a) to the main exchanger (11) of said air treatment station (10) for heating or cooling said air flow according to whether said first heat exchanger (21a) operates as condenser or as evaporator, said first circuit (30) being provided with a first tank (31), as well as with a first delivery header (32) and with a first return header (33);
- said second hydraulic circuit (40) is susceptible of thermally connecting the third heat exchanger (23a) of said refrigeration circuit (20a) respectively to the secondary exchanger (12) of said air treatment station (10) for post-heating said air flow and to the pre-heating exchanger (51) of said hot sanitary water production circuit (50) for pre-heating the sanitary water; and
- said heat integration circuit (60) is hydraulically connected to the first tank (31) of said first hydraulic circuit (30) by a first branch (61) and to the heating exchanger (52) of said hot sanitary water production circuit (50) by a second branch (62), connected in parallel to the first one.

4. A heating cooling unit according to claim 3, wherein said third heat exchanger (23a) is activated when said first exchanger (21a) operates as evaporator and said second exchanger (22a) operates as condenser.

5. A heating cooling unit according to claim 2, wherein:

- said refrigeration circuit (20b) is suitable for operating with cycle reversal and comprises a four way valve (24a), at least one compressor (25a), lamination means (26a), a first (21b) and a second heat exchanger (22b) susceptible of alternately operating as condenser and as evaporator, and a third exchanger (23b), which is susceptible of operating as condenser as an alternative to said first (21b) or said second exchanger (22b);
- said first hydraulic circuit (30) is susceptible of

thermally connecting the first heat exchanger (21b) of said refrigeration circuit (20b) to the main exchanger (11) of said air treatment station (10) for heating or cooling said air flow according to whether said first heat exchanger (21b) operates as condenser or as evaporator, said first circuit (30) being provided with a first tank (31), as well as with a first delivery header (32) and with a first return header (33);

- said second hydraulic circuit (40) is susceptible of thermally connecting the third exchanger (23b) of said refrigeration circuit (20b) respectively to the secondary exchanger (12) of said air treatment station (10) for post-heating said air flow and to the pre-heating exchanger (51) of said hot sanitary water production circuit (50) for pre-heating the sanitary water; and

- said heat integration circuit (60) is hydraulically connected to the first tank (31) of said first hydraulic circuit (30) by a first branch (61) and to the heating exchanger (52) of said hot sanitary water production circuit (50) by a second branch (62), connected in parallel to the first one.

6. A heating cooling unit according to claim 3 or 5, wherein said second hydraulic circuit (40) is provided with a header (44a) and is thermally connected to said pre-heating exchanger (51) through a parallel circuit (44) which develops from said header (44a).

7. A heating cooling unit according to claim 3 or 5, wherein said first tank (31) of said first hydraulic circuit (30) is located downstream of said first heat exchanger (21a; 21b).

8. A heating cooling unit according to claim 3 or 5, wherein the first tank (31) of said first hydraulic circuit (30) is provided with a temperature sensor (31t) suitable for evaluating the temperature of the thermal carrier fluid contained in said first tank (31) and wherein said heat integration circuit (60) uses water as circulating fluid and is provided with a first three way valve (64) which regulates access of said circulating fluid coming from said boiler (63) alternately to said first branch (61) and to said second branch (62), the opening of said first three way valve (64) being controlled based on the temperature value measured by said sensor (31t).

9. A heating cooling unit according to claim 2, wherein:

- said refrigeration circuit (20c) comprises at least one compressor (25a), lamination means (26a), a first (21c) and a third exchanger (23c), which are susceptible of respectively operating as evaporator and as condenser, and a second heat exchanger (22c) which is susceptible of operating as evaporator or as condenser as an al-

ternative respectively to said first (21c) and said third exchanger (23c);

- said first hydraulic circuit (30) is susceptible of thermally connecting the first exchanger (21c) of said refrigeration circuit (20c) to the main exchanger (11) of said air treatment station (10) for cooling said air flow, said first circuit (30) being provided with a first tank (31), as well as with a first delivery header (32) and with a first return header (33);

- said second hydraulic circuit (40) is provided with a second tank (41), as well as with a second delivery header (42) and with a second return header (43), and is susceptible of thermally connecting the third exchanger (23c) of said refrigeration circuit (20c) respectively to the secondary exchanger (12) of said air treatment station (10) for post-heating said air flow and to the pre-heating exchanger (51) of said hot sanitary water production circuit (50) for pre-heating the sanitary water, said second hydraulic circuit (40) being susceptible of hydraulically connecting to said first hydraulic circuit (30) by means of a delivery by-pass (45a) and by means of a return by-pass (45b) for thermally connecting the third exchanger (23c) of said refrigeration circuit (20c) to the main exchanger (12) of said air treatment station (10) so as to heat said air flow;

- said heat integration circuit (60) is hydraulically connected to the second tank (41) of said second hydraulic circuit (40) by means of a first branch (61) and to the heating exchanger (52) of said hot sanitary water production circuit (50) by means of a second branch (62), connected in parallel to the first one.

10. A heating cooling unit according to claim 9, wherein said second hydraulic circuit (40) is thermally connected to said pre-heating exchanger (51) through a parallel circuit (44) which develops from said second tank (41).
11. A heating cooling unit according to claim 3, 5 or 9, wherein the second heat exchanger (22a; 22b; 22c) of said refrigeration circuit (20a; 20b; 20c) is a finned battery heat exchanger and is installed in said air treatment station (10) for exchanging heat with the external air of said building.
12. A heating cooling unit according to claim 3, 5 or 9, wherein the first (21a; 21b; 21c) and the third heat exchanger (23a; 23b; 23c) of said refrigeration circuit (20a; 20b; 20c) are plate-type heat exchangers.
13. A heating cooling unit according to any one of the previous claims, wherein said hot sanitary water production circuit (50) is provided with a third tank (53) for the storage of said hot sanitary water.

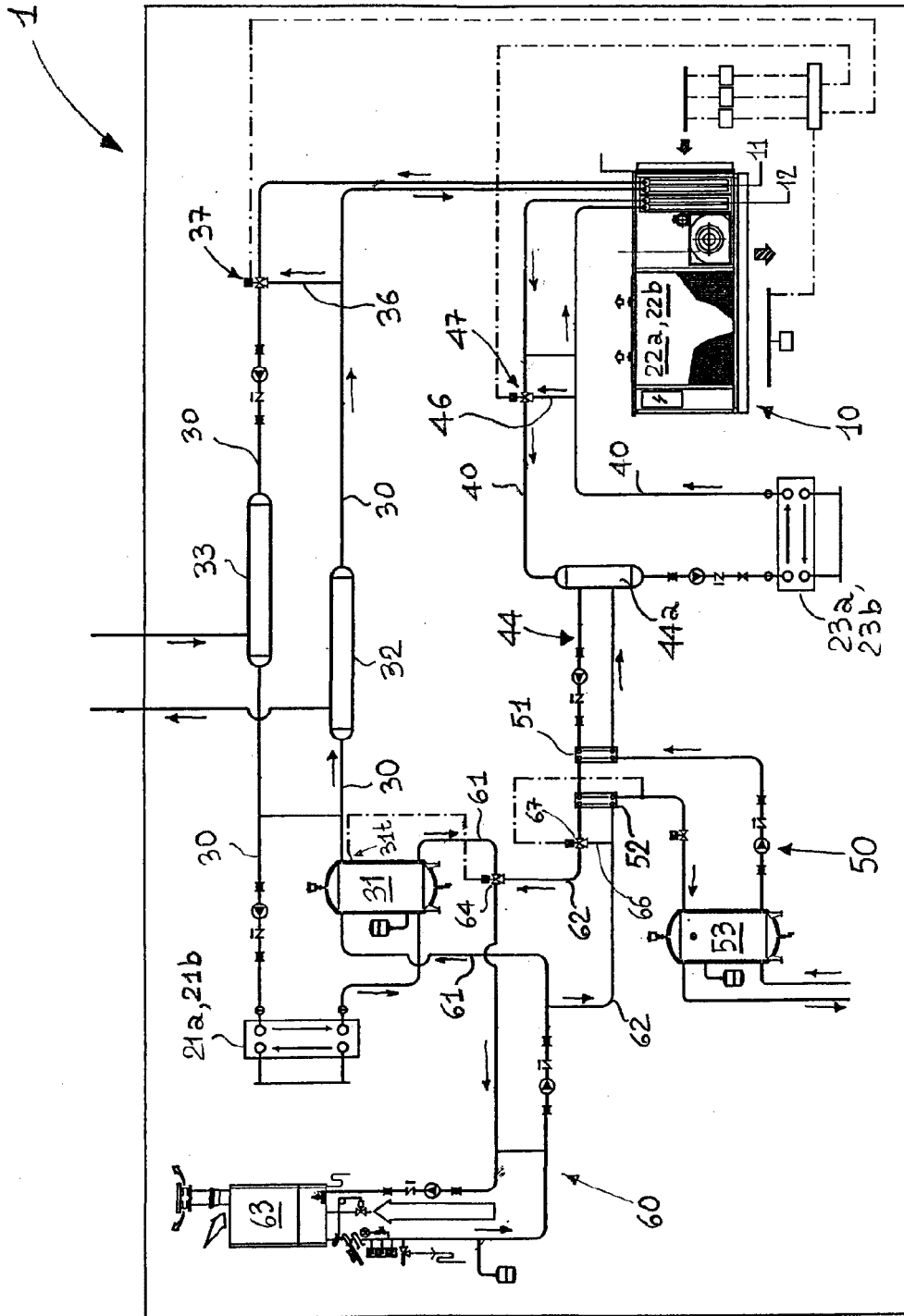


FIG. 1

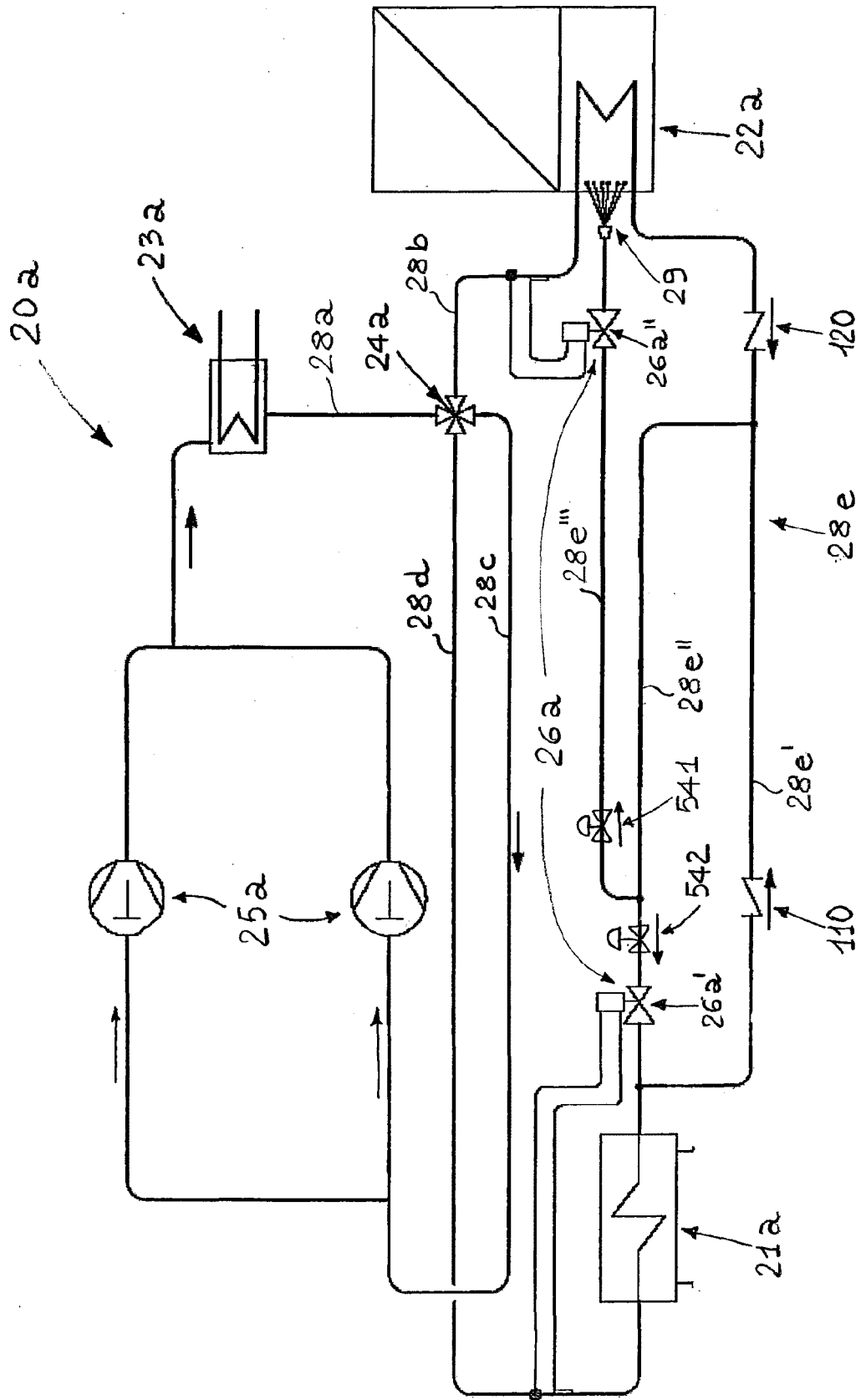
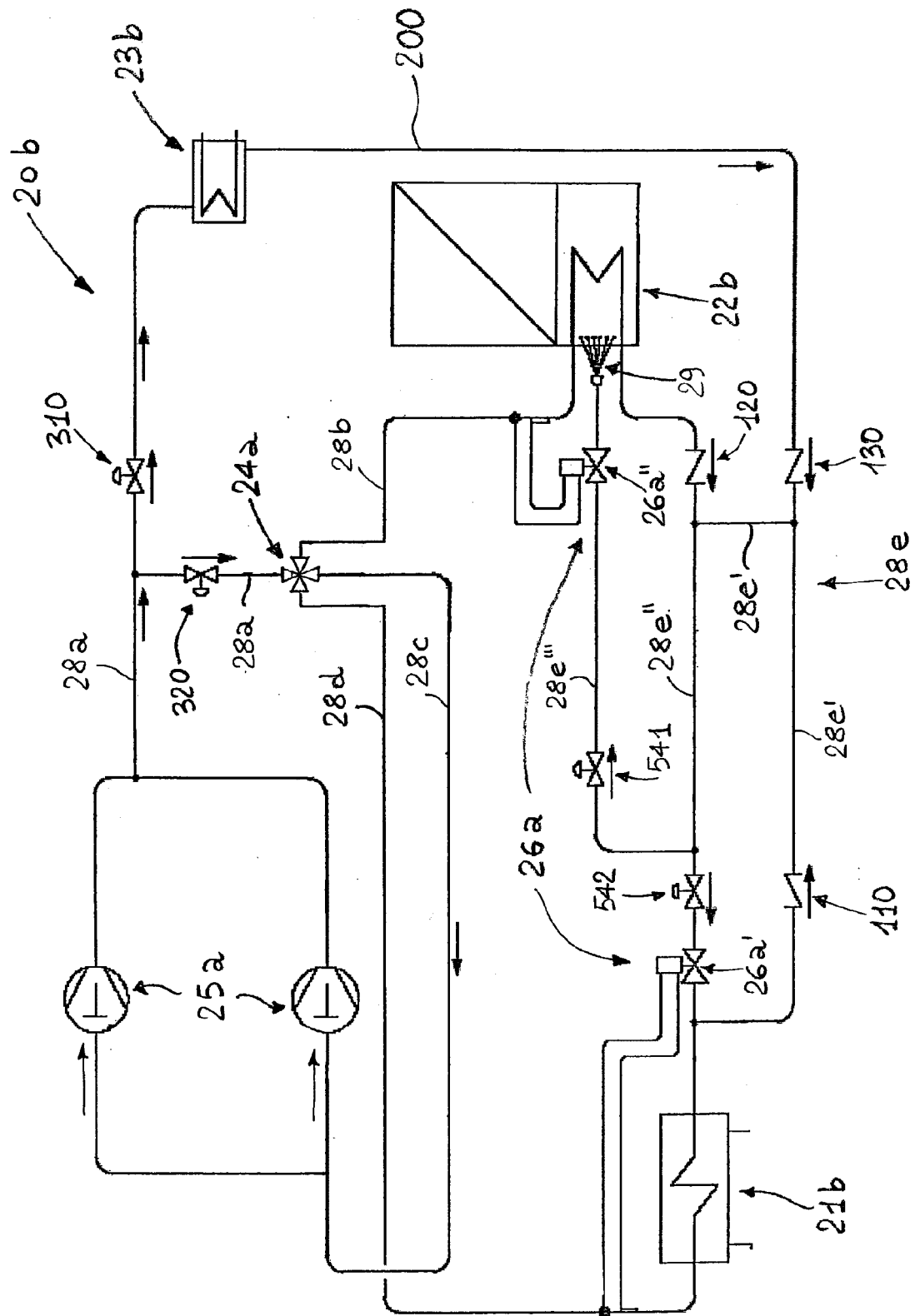


FIG. 2



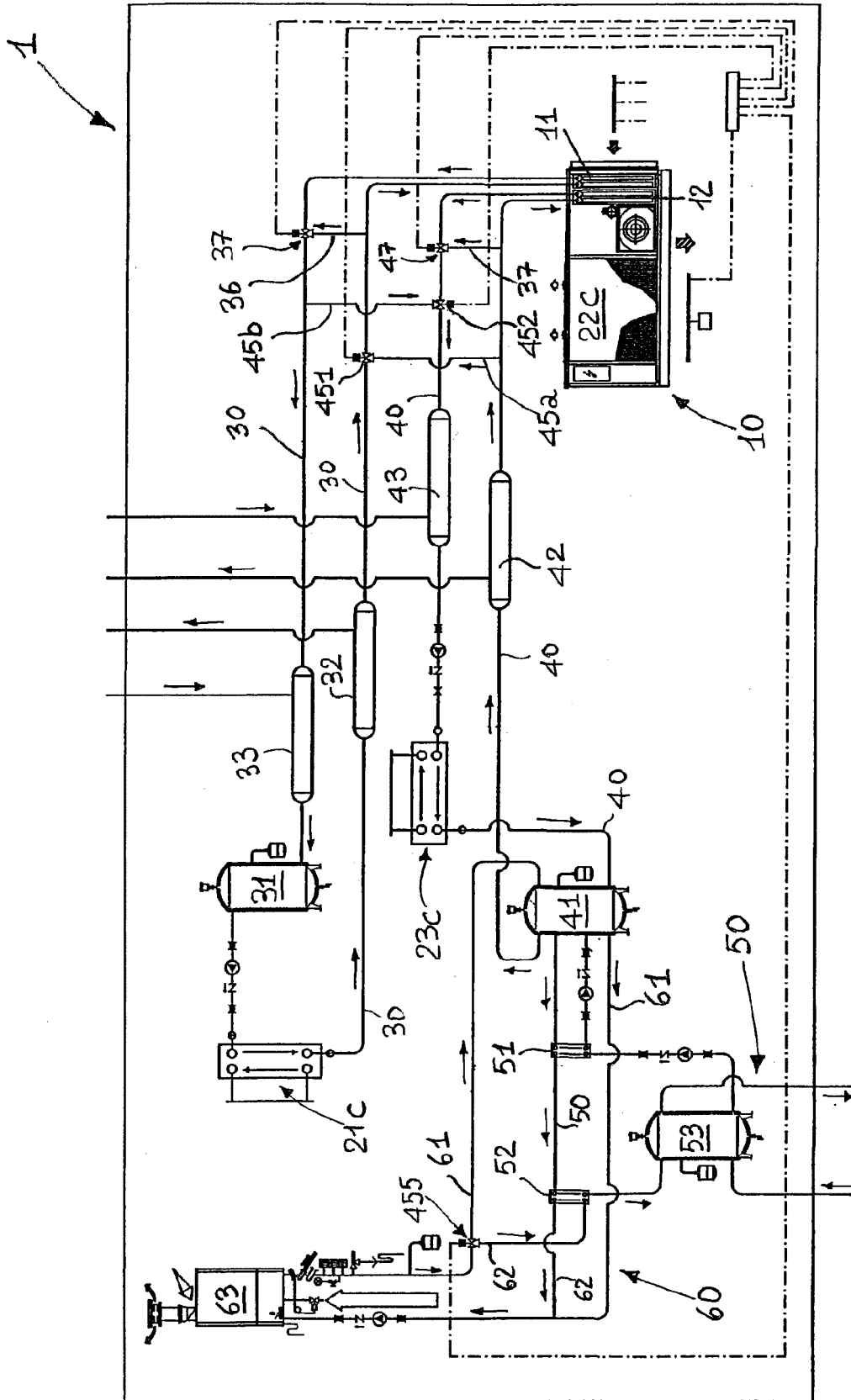


FIG. 4

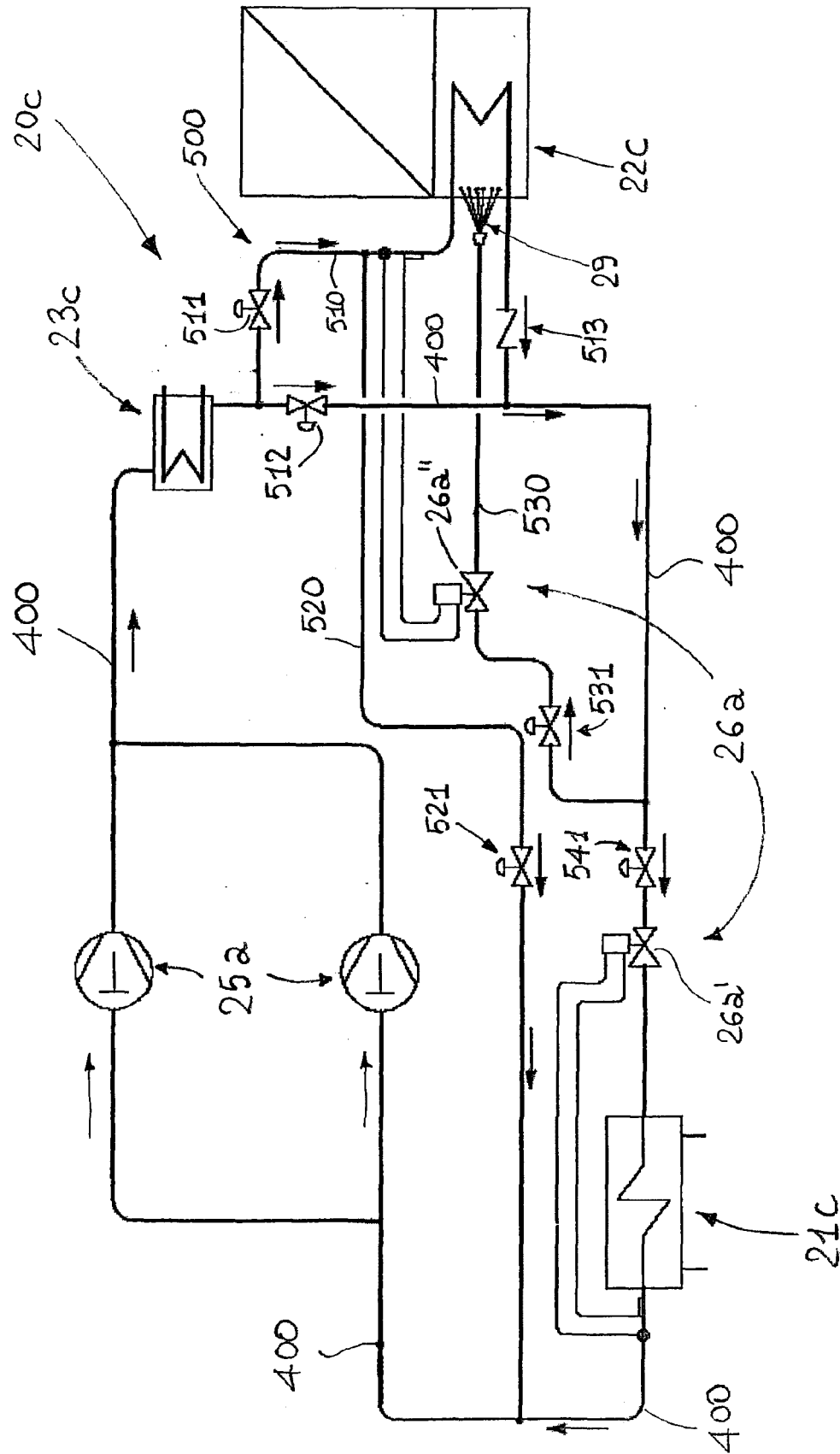


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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