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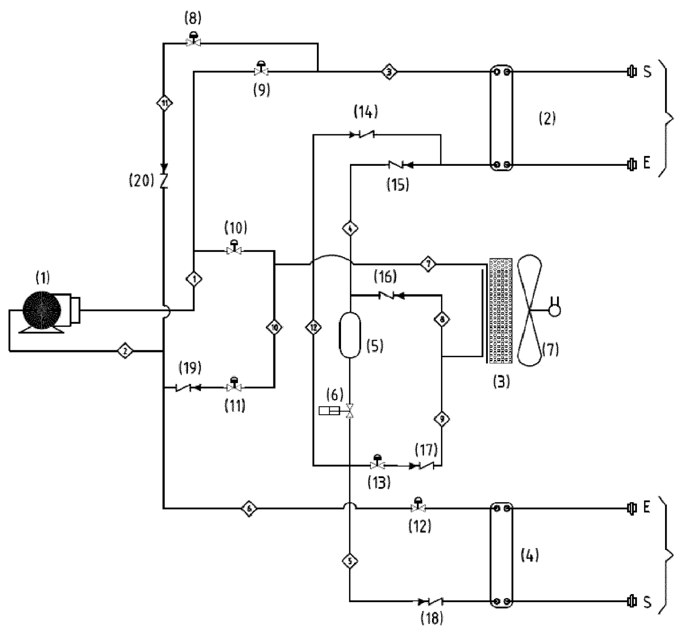
(54) **Refrigeration circuit for an air-conditioning machine.**

(57) Refrigeration circuit for a water-air-water mechanical compression air-conditioning machine that can produce simultaneously or alternately cold water for cooling and hot water for heating, which, under the opening and closing position to take the electro-valves and the constraints-return valves that compose it, can take different operating configurations, called Water-Water, Air, Water Cooling, Air-Water Heating, Efficient Defrosting and Defrosting.

FIGURE 1



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Description

[0001] A new refrigeration circuit for a water-air-water mechanical compression air-conditioning machine which can simultaneously or alternately produce cold water for cooling and hot water for heating.

OBJECT OF THE INVENTION.

[0002] This invention refers to a mechanical compression refrigeration machine which can simultaneously or alternately produce cold water for cooling and hot water for heating.

[0003] This type of refrigeration machine transports heat from a cold point to a hot point. Said points can be understood to be two different zones of a building with simultaneous demands for cooling and heating and in which both processes, cooling and heating, are considered useful. Alternatively, if one of the temperature points has no demand for energy, the machines use a third point or an external, alternative environment to or from which heat is dissipated or extracted.

[0004] In the terminology of the Air-Conditioning Sector, they are known as water-air-water machines when the heat exchange between the two useful points is carried out using water as the transport fluid and air for the exchange with the external point.

PREVIOUS ADVANCES IN THE TECNOLOGICAL STATE OF THE ART.

[0005] The current build technologies for these types of machines can be classified into two groups.

[0006] On one side is the technology of multi-split machines which are based on the continuous control, using electronic expansion valves, of the mass flow of refrigerant between the different heat exchangers (evaporators and condensers). One example of this solution is that presented by the inventors H.J Park, Y.M. Park, and C.S. Lee and assigned to LG Electronics Inc.

[0007] It manages to cover the cooling and/or heating demands, in each of the zones in which the internal exchangers are fitted, via the use of electronic expansion valves and solenoid valves. There is always flow (condensed hot vapour or evaporating biphase mix) circulating through the internal exchangers. One characteristic of this type of system is that the zones' temperatures are very similar to one another, based on that given by conditions of thermal comfort.

[0008] The other side features solutions which resolve the design of the refrigeration circuits by using interior sets of electrovalves which discontinuously (all/nothing) divert the entire mass flow of refrigerant to the various exchangers, based on the required function mode. This is the category into which this invention falls.

[0009] The Italian manufacturer RCGROUP, with its MULTIPLO model, makes the refrigeration circuit using two 3-way electrovalves, two 2-way electrovalves, four anti-return valves and a single expansion valve.

[0010] In turn, CIATESA, in the design of the refrigeration circuit of their AQUAPACK MI product, decided to operate using one 4-way electrovalve, three 2-way electrovalves, two retention valves and three expansion valves.

[0011] The ERACS-Q models of the manufacturer CLIMAVENETTA have a refrigeration circuit which resolves simultaneous or alternate production of hot and cold water with a system which requires two 3-way valves or four 2-way valves, two expansion valves and one retention valve.

[0012] DAIKIN has a product with a system that uses two 3-way valves and that appears in its patent with publication number WO/2004/102086. This patent also includes the method for controlling the pressure of the refrigerant gas in the coil.

[0013] In the designs of RCGROUP, CLIMAVENETTA and DAIKIN, when defrosting the refrigerant-air heat exchanger (coil of finned tubes), which makes it function as a condenser, it is necessary to switch to cold water production mode by using the evaporator. The inconvenience of this is that in wintery conditions it is not always desirable to have the cold water circuit running and, also, its temperature may be low, leading to a subsequent risk of breakage due to freezing from using a brazed plate heat exchanger. This limits the temperature conditions at which the device can function.

[0014] The design used by CIATESA in its AQUAPACK MI product, thanks to the combined use of the 4-way valve and the electrovalves, can carry out defrosting of the coil by making the circuit's evaporator function as the hot water exchanger during the entire defrosting process. This has an energy penalty but it does, however, guarantee efficient defrosting in any temperature conditions, with no risk of freezing.

[0015] Other manufacturers, such as RHOSS, THERMOCOLD and BLUEBOX, also have water-air-water air-conditioning equipment with similar technologies.

[0016] The regulation method for water-air-water equipment is relevant with regards to the reduction and optimisation of the number of changes in the mode of operation. This invention proposes a new control method for these types of machines, based on the management of the majority or main energy demand, via the running and stopping of the compressor and by controlling the minority or auxiliary energy demand, via the action of the electrovalves which divert the flow of refrigerant to the exterior point (ambient air).

EXPLANATION OF THE INVENTION.

[0017] In terms of an explanation, the "New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine" consists of a mechanical compression refrigeration circuit which is built of the following elements or constituent parts: a refrigerant gas compressor, a condenser heat exchanger for the production of hot water, a coil of finned tubes for heat exchange with the exterior air, an evaporator heat exchanger for the production of cold water, a liquid refrigerant accumulator tank, a liquid refrigerant expansion device, a fan for the exchange of heat with the exterior air, an electrovalve for defrosting, an electrovalve for the discharge of gas to the plate condenser, an electrovalve for the discharge of gas to the coil so that it functions as a condenser, an electrovalve for the suction of refrigerant gas from the coil so that it functions as an evaporator, an electrovalve for the suction of refrigerant gas from the plate evaporator, an electrovalve for the entry of expanded refrigerant to the coil so that it functions as an evaporator, an anti-return valve for refrigerant gas going to the condenser plate heat exchanger during defrosting, an anti-return valve for closing the condenser during defrosting, an anti-return valve for liquid refrigerant from the coil, an anti-return valve to avoid inverse flow of refrigerant from the coil to the low pressure zone, an anti-return valve for the plate evaporator, an anti-return valve to avoid inverse flow of refrigerant vapour to the coil and an anti-return valve to avoid inverse flow of refrigerant during defrosting.

[0018] The described refrigeration circuit, in virtue of the open or closed position of the electrovalves and with the restrictions imposed by the anti-return valves, can be used with the following operation configurations:

A configuration called *Water-Water* in which the refrigerant condenses in the condenser heat exchanger, producing hot water, and having expanded in the expansion device, it evaporates in the evaporator heat exchanger, producing cold water.

[0019] There is a second configuration called *Air-Water Cooling* in which the refrigerant condenses in the heat exchanger with the coil of finned tubes for heat exchange with the exterior air, thus letting heat dissipate into the exterior ambient air. Then, having expanded in the expansion device, it evaporates in the evaporator heat exchanger, producing cold water.

[0020] A third configuration is called *Air-Water Heating* and it involves the refrigerant condensing in the condenser heat exchanger, producing hot water. Then, having expanded in the expansion device, it evaporates in the coil of finned tubes, receiving heat from the exterior ambient air.

[0021] A fourth configuration, called *Efficient Defrosting,* is one in which the refrigerant condenses in the heat exchanger with the coil of finned tubes, producing the melting of the frost accumulated on the tubes and fins. Then, having expanded in the expansion device, it evaporates in the evaporator heat exchanger, producing cold water. This configuration is achieved by putting the electrovalves in the same configuration as that used in the *Air-Water Cooling* mode.

[0022] A fifth configuration, called *Defrosting,* is one in which the refrigerant condenses in the heat exchanger with the coil of finned tubes, producing the melting of the frost accumulated on the tubes and fins. Then, having expanded in the expansion device, it evaporates in the heat exchanger which normally functions as a condenser, except for in this configuration which converts it into an evaporator.

[0023] The invention is completed with components such as dehydration filters, pressure switches, pressure collectors, temperature probes, refrigerant filler valves and other elements to be expected in refrigeration circuits. They are located on various sections of tubes which, for the sake of simplicity, are not shown on Figure 1.

DESCRIPTION OF THE DIAGRAMS.

[0024] To complement the description being made and in order to contribute to a better understanding of the characteristics of the invention, in accordance with the examples of its preferred practical embodiment, attached as an integral part of said description are the figures listed below:

Figure 1. - Schematic of the refrigeration circuit which includes the following details:

1. Compressor.
2. Condenser heat exchanger for the production of hot water.
3. Coil of finned tubes for the exchange of heat with exterior air.
4. Evaporator heat exchanger for the production of cold water.
5. Liquid refrigerant accumulator tank.
6. Expansion device.
7. Fan.
8. Electrovalve for defrosting.
9. Electrovalve for the discharge of gas to the plate condenser.
10. Electrovalve for the discharge of gas to the coil.
11. Electrovalve for the suction of vapour from the coil.
12. Electrovalve for the suction of vapour from the plate evaporator.
13. Electrovalve for the entry of vapour into the coil.
14. Anti-return valve going to the condenser during defrosting.
15. Anti-return valve for closing the condenser during defrosting.
16. Anti-return valve for liquid from the coil.
17. Anti-return valve for the coil at low pressure.
18. Anti-return valve for the plate evaporator.
19. Anti-return valve for vapour going from the coil.
20. Anti-return valve for defrosting.

EXAMPLE OF PREFERRED EMBODIMENT

[0025] As an example of preferred embodiment of the "New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine", for a cooling power of 58kW and a heating power of 65kW, the components which constitute the circuit in the invention may be: (1) an R-410A scroll-type refrigerant compressor with an absorbed electrical power of 22kW; (2) a brazed plate condenser heat exchanger for the production of hot water, made with 80 plates; (3) a coil of finned tubes for the exchange of heat with the exterior air, made with 4 rows of tubes with 40 tubes per row and consisting of copper tubes and aluminium fins; (4) a brazed plate evaporator heat exchanger for the production of cold water, made with 80 plates; (5) a 5 litre liquid refrigerant accumulator tank; (6) an expansion device with a thermostatic valve of 7/8 inch nominal diameter and (7) an 800 millimetre, 2kW fan. In terms of electrovalves it has: (8) an electrovalve for defrosting; (9) an electrovalve for the discharge of gas to the plate condenser; (10) an electrovalve for the discharge of gas to the coil; (11) an electrovalve for the suction of vapour from the coil; (12) an electrovalve for the suction of vapour from the plate evaporator and (13) an electrovalve for the entry of vapour into the coil. All of these electrovalves have a nominal diameter of 32 or 40 millimetres. In terms of anti-return valves it has: (14) an anti-return valve going to the condenser during defrosting; (15) an anti-return valve for closing the condenser during defrosting; (16) an anti-return valve for liquid from the coil; (17) an anti-return valve from the coil at low pressure; (18) an anti-return valve for the plate evaporator; (19) an anti-return valve for vapour going from the coil and (20) an anti-return valve for defrosting. All of these anti-return valves have a nominal diameter of 1 1/8".

[0026] As previously mentioned, the refrigeration circuit, in virtue of the open or closed position of the electrovalves and with the restrictions imposed by the anti-return valves, can be used with the various operation configurations which were described above:

In the function mode called *Water-Water,* the refrigerant is compressed by the compressor (1), it exits via line 1 and passes through the electrovalve for the discharge of gas to the plate condenser (9), which is open. The electrovalve for the discharge of gas to the coil (10) is closed. The gaseous refrigerant flows through line 3 and condenses in the condenser heat exchanger for the production of hot water (2), i.e. the condenser, producing hot water. Then the liquid refrigerant flows along line 4, through the anti-return valve for closing the condenser during defrosting (15). At this point it does not flow through the anti-return valve going to the condenser during defrosting (14) as its pressure is greater than that at the outlet of the expansion device (6). After exiting line 4, it accumulates in the liquid refrigerant accumulator tank (5) which it then exits to expand in the expansion device (6). At this point the refrigerant does not flow towards the coil along line 9, as the electrovalve for the entry of vapour into the coil (13) is closed. Instead, it flows along line 5, through the anti-return valve for the plate evaporator (18), reaching the evaporator heat exchanger for the production of cold water (4) where it evaporates to produce cold water. Upon exiting the evaporator heat exchanger for the production of cold water (4), the electrovalve for the suction of vapour from the plate evaporator (12) is open and it is driven along line 6 to line 2 which is that of the intake of the compressor, thus completing the thermodynamic cycle.

[0027] The majority or main energy demand (for cooling or heating) is that which governs the running and stopping cycles of the compressor.

[0028] The minority or auxiliary demand (for heating or cooling) is that which governs the changes of configuration (from *Water-Water* to *Air-Water Cooling* or from *Water-Water* to *Air-Water Heating*).

[0029] If the main demand is for cooling and the auxiliary demand for heating decreases in the hot water circuit, the configuration changes to *Air-Water Cooling.* In this configuration, the electrovalve for the discharge of gas to the plate condenser (9) is closed and the electrovalve for the discharge of gas to the coil (10) is open. The fan (7) is running. The hot, compressed gas accesses the coil of finned tubes for the exchange of heat with the exterior air (3) via line 7 and it condenses. The coil has a greater volume and it slowly starts to accumulate liquid refrigerant which is progressively emptied in from the liquid refrigerant accumulator tank (5). Upon exiting the coil of finned tubes for the exchange of heat with the exterior air (3), the liquid flows along line 8 and passes through the anti-return valve for liquid from the coil (16) and accesses line 4. After passing through the liquid refrigerant accumulator tank (5), it exits to expand in the expansion device (6). At this point, the refrigerant does not flow along line 9 through the anti-return valve from the coil at low pressure (17) as the pressure is lower than that of the coil. Instead, it flows along line 5, through the anti-return valve for the plate evaporator (18), reaching the evaporator heat exchanger for the production of cold water (4) where it evaporates to produce cold water. Upon its exit, the electrovalve for the suction of vapour from the plate evaporator (12) is open and it is driven along line 6 to line 2, which is the intake of the compressor, thus completing the thermodynamic cycle.

[0030] If the main demand is for heating and the auxiliary demand for cooling is reduced in the cold water circuit, the switch is made to the *Air-Water Heating* configuration. In this configuration, the electrovalve for the suction of vapour from the coil (11) is open, connecting line 7 to line 2, via line 10, and therefore connecting the coil of finned tubes for the exchange of heat with the exterior air (3) with the intake of the compressor, therefore meaning it is at low pressure. The fan (7) is running and starting to evaporate the refrigerant which is sucked towards the compressor. The electrovalve for the suction of vapour from the plate evaporator (12) is closed, vapour is not circulating through the evaporator heat exchanger for the production of cold water (4) and therefore cold water is not being produced. The refrigerant compressed by the compressor (1) flows from line 1, through the electrovalve for the discharge of gas to the plate condenser (9), towards the condenser heat exchanger for the production of hot water (2) where it condenses to produce hot water which supplies the main demand. The liquid refrigerant passes through the anti-return valve for closing the condenser during defrosting (15) and reaches line 4. The liquid begins to fill the liquid refrigerant accumulator tank (5) and from there it exits towards the expansion device (6), reaching the coil through the electrovalve for the entry of vapour into the coil (13) and through the anti-return valve from the coil at low pressure (17). In the coil, it evaporates and passes into line 7, then from said line to line 10 and then from the latter to line 2 where the thermodynamic cycle is complete.

[0031] If, after continuous operation in the *Air-Water Heating* configuration, the coil of finned tubes for the exchange of heat with the exterior air (3) is covered in frost and output is reduced, defrost mode is activated.

[0032] In this mode, the first defrosting to take place is of high energy efficiency which avoids the hot water from cooling down. This is called the *Efficient Defrosting* configuration. In this configuration the electrovalves for discharge of gas to the coil (10) and for the suction of vapour from the plate evaporator (12) are open and the electrovalves for the discharge of gas to the plate condenser (9) and for the suction of vapour from the coil (11) are closed.

[0033] This means that the compressor is discharging hot vapour through line 7 to the coil of finned tubes for the exchange of heat with the exterior air (3), producing the defrosting. After the refrigerant passes through the coil, it moves through the anti-return valve for liquid from the coil (16) to accumulate in the liquid refrigerant accumulator tank (5) and then it expands in the expansion device (6). It then flows through line 5 to enter the evaporator plate heat exchanger for the production of cold water (4), which is acting as an evaporator and producing cold water. The refrigerant returns to the compressor (1) via lines 6 and 2.

[0034] The machine's electronic control measures the temperature of the cold water at all times. When it is above a pre-established value, the *Efficient Defrosting* mode is activated. If the temperature drops below this value, the machine control changes the function mode and continues the defrosting in the configuration called *Defrosting.*

[0035] In this configuration, the electrovalve for defrosting (8) installed in line 11 is open and the electrovalve for the suction of vapour from the plate evaporator (12) is closed, connecting the intake of the compressor with the condenser heat exchanger for the production of hot water (2), which in this case is acting as an evaporator. The compressor is discharging hot vapour through line 7 to the coil of finned tubes for the exchange of heat with the exterior air (3), producing the defrosting. After the refrigerant passes through the coil, it passes through the retention valve for liquid from the coil (16) to accumulate in the liquid refrigerant accumulator tank (5) and then it expands in the expansion device (6). It then flows along line 12 and, passing through the anti-return valve going to the condenser during defrosting (14), it returns to the condenser heat exchanger for the production of hot water (2) which in this case is acting as an evaporator, as indicated.

[0036] Therefore, when the machine operates by alternating its function between the *Water-Water* and *Air-Water Cooling* modes, or between the *Water-Water* and *Air-Water Heating* modes, the coil always remains at high or low pressure respectively and the pressure sign of the coil is not inverted, thus avoiding unnecessary movements of its refrigerant. Furthermore, the high pressure zone is always connected to the low pressure zone by a single, unidirectional expansion device, leading to a more uniform transfer of refrigerant when alternating between modes. Lastly, the invention allows an initial, energy efficient defrosting stage, without putting cold water into the heating circuit, and if it is necessary to continue this efficient defrosting, it can use evaporation in the heating circuit. This is an advantage over the existing technology which was described in the state of the art.

[0037] It is deemed unnecessary to make a more extensive description so that any expert in the field may understand the scope of the invention and the advantages deriving from it. The technology it uses, the dimensions of the described elements and their applications will be susceptible to variation, provided that this does not suppose an alteration in the invention's essence.

Claims

1. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine, **characterised by** being composed of: (1) one or two compressors; (2) a condenser heat exchanger for the production of hot water; (3) a coil of finned tubes for the exchange of heat with the exterior air; (4) an evaporator heat exchanger for the production of cold water; (5) a liquid refrigerant accumulator tank; (6) a liquid refrigerant expansion device; (7) a fan for the exchange of heat with the exterior air; (8) an electrovalve for defrosting which connects the condenser with the intake of the compressor, it is installed on line 11 between line 3 and the anti-return valve for defrosting (20); (9) an electrovalve for the discharge of gas to the plate condenser, installed on line 1; (10) an electrovalve for the discharge of gas to the coil, located on line 7; (11) an electrovalve for the suction

of gas from the coil, installed on line 10 between lines 7 and 2; (12) an electrovalve for the suction of vapour from the plate evaporator, installed on line 6; (13) an electrovalve for the entry of vapour to the coil, installed on line 9; (14) an anti-return valve going to the condenser during defrosting, installed on line 12 with said line being a tube which joins the outlet of the condenser heat exchanger for the production of hot water (2) with the outlet of the expansion device (6); (15) an anti-return valve for closing the condenser during defrosting, installed on line 4; (16) an anti-return valve for liquid from the coil, installed on line 8; (17) an anti-return valve for the coil at low pressure, installed on line 9; (18) an anti-return valve for the plate evaporator, installed on line 5; (19) an anti-return valve for vapour going from the coil, installed on line 10; (20) an anti-return valve for defrosting, installed on line 11.

2. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine according to claim 1, **characterised by** having a method of automatic regulation which allows the machine, via the changing of the flow of refrigerant through the refrigeration circuit, to be able to operate with: a first configuration called *Water-Water,* in which the machine produces both hot water and cold water at the same time; a second configuration, called *Air-Water Cooling,* in which the machine produces cold water and hot water alternately; a third configuration, called *Air-Water Heating,* in which the machine produces hot water and cold water alternately; a fourth configuration, called *Efficient Defrosting,* in which the coil is defrosted while cooling power is produced in the cold water circuit; and a fifth configuration, called *Defrosting,* in which the coil is defrosted while cooling power is produced in the hot water circuit.

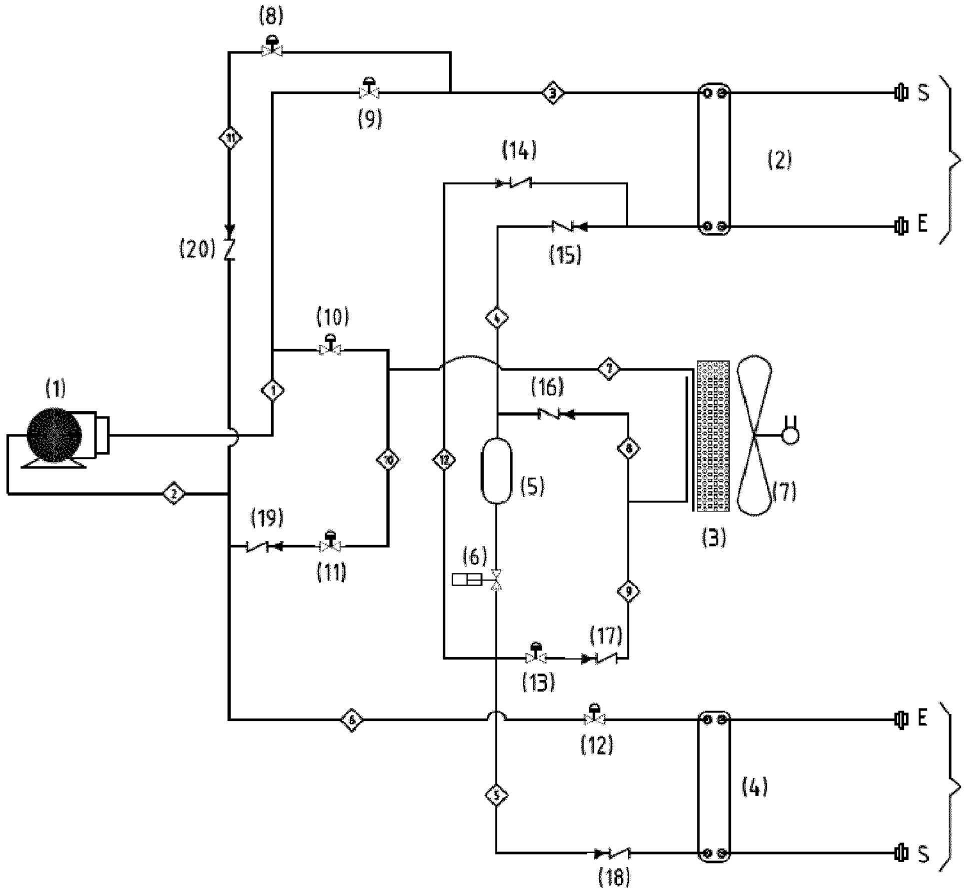
3. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine according to claims 1 and 2, **characterised by** having a method of regulation which, in the *Air-Water Cooling* and *Air-Water Heating* mode configurations, operates to produce a main energy service (cooling or heating) which adapts to the variable energy demand, via the running and stopping of the compressor; and an auxiliary energy service (heating or cooling) which adapts to the variable energy demand, via the changing of the configuration of the open and closed states of its valves, with the main energy service selected manually or automatically, the latter being based on the temperature of the exterior atmosphere.

4. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine according to claims 1, 2 and 3, **characterised by** having a method of regulation which, when said refrigeration circuit is running according to the *Water-Water* configuration with a main demand of cooling and if the auxiliary demand for heating in the hot water circuit decreases, it makes the change to the *Air-Water Cooling* configuration, without stopping the compressor (1), starting the fan (7), opening the electrovalve for the discharge of gas to the coil (10), waiting for a period of between 0 and 15 seconds, then closing the electrovalve for the discharge of gas to the plate condenser (9), waiting for a period of between 0 and 15 seconds, then opening the electrovalve for defrosting (8) for 1 second and reclosing it, leaving the machine running in this new mode for a period of between 0 and 5 minutes. Once this period has elapsed, if it detects an auxiliary demand for hot water again, the machine returns to the *Water-Water* state, running the fan (7) at maximum velocity, opening the electrovalve for the discharge of gas to the plate condenser (9), waiting for a period of between 0 and 15 seconds, then closing the electrovalve for the discharge of gas to the coil (10), waiting for a period of between 0 and 15 seconds, opening the electrovalve for the suction of vapour from the coil (11) for a pulse of 5 seconds to recover the refrigerant gas from the coil of finned tubes for the exchange of heat with the exterior air (3) and then closing it, waiting for a period between 0 and 30 seconds and then stopping the fan (7).

5. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine according to claims 1, 2, 3 and 4, **characterised by** having a method of regulation which, when said refrigeration circuit is running in the *Water-Water* configuration with a main demand of heating and if the auxiliary energy demand for cooling in the cold water circuit decreases, the machine switches to operation in the *Air-Water Heating* configuration, without stopping the compressor (1), first making the fan (7) spin at maximum velocity, opening the electrovalve for the suction of vapour from the coil (11) for a pulse of 1 second and then closing it, then waiting for a period between 0 and 30 seconds, re-opening the electrovalve for the suction of vapour from the coil (11), then waiting for between 0 and 15 seconds, opening the electrovalve for the entry of vapour into the coil (13), waiting for between 0 and 15 seconds, then closing the electrovalve for the suction of vapour from the plate evaporator (12), leaving the machine running in this new mode for a period of between 0 and 5 minutes. Once these minutes have elapsed, if an auxiliary demand for cold water is detected again, the machine returns to the *Water-Water* state, closing the electrovalve for the entry of vapour to the coil (13), waiting for a period of between 0 and 15 seconds, then closing the electrovalve for the suction of vapour from the coil (11), waiting for a period of between 0 and 15 seconds and lastly closing the electrovalve for the suction of vapour from the plate evaporator (12).

6. New refrigeration circuit for a water-air-water mechanical compression air-conditioning machine according to claims 1, 2, 3, 4 and 5, **characterised by** having a method of regulation which, when the machine is running in *Air-Water Heating* mode and if it detects the need to carry out defrosting of the coil of finned tubes for the exchange of heat with the exterior air (3), it switches to the function mode in the *Efficient Defrosting* configuration, without stopping the compressor (1), opening the electrovalve for the suction of vapour from the plate evaporator (12), waiting for a period of between 0 and 15 seconds, then simultaneously closing the electrovalves for the suction of vapour from the coil (11) and for the entry of vapour into the coil (13), waiting for a period between 0 and 30 seconds, opening the electrovalve for the discharge of gas to the coil (10), waiting for a period of between 0 and 15 seconds, closing the electrovalve for the discharge of gas to the plate condenser (9), waiting for a period of between 0 and 15 seconds, opening the electrovalve for defrosting (8) for a pulse of 1 second, closing the electrovalve for defrosting (8), remaining in this configuration until the regulation detects that the coil of finned tubes for the exchange of heat with the exterior air (3) has been defrosted or that a period of between 0 and 20 minutes has elapsed. If during this time the regulation detects that the temperature of the production of cold water is lower than a pre-established value, the defrosting continues according to the *Defrosting* configuration, opening the electrovalve for defrosting (8), waiting for a period of between 0 and 15 seconds, closing the electrovalve for the suction of vapour from the plate evaporator (12), staying in this configuration until the regulation detects that the coil of finned tubes for the exchange of heat with the exterior air (3) has been defrosted or that a period of between 0 and 20 minutes has elapsed.

FIGURE 1



REFERENCES CITED IN THE DESCRIPTION

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