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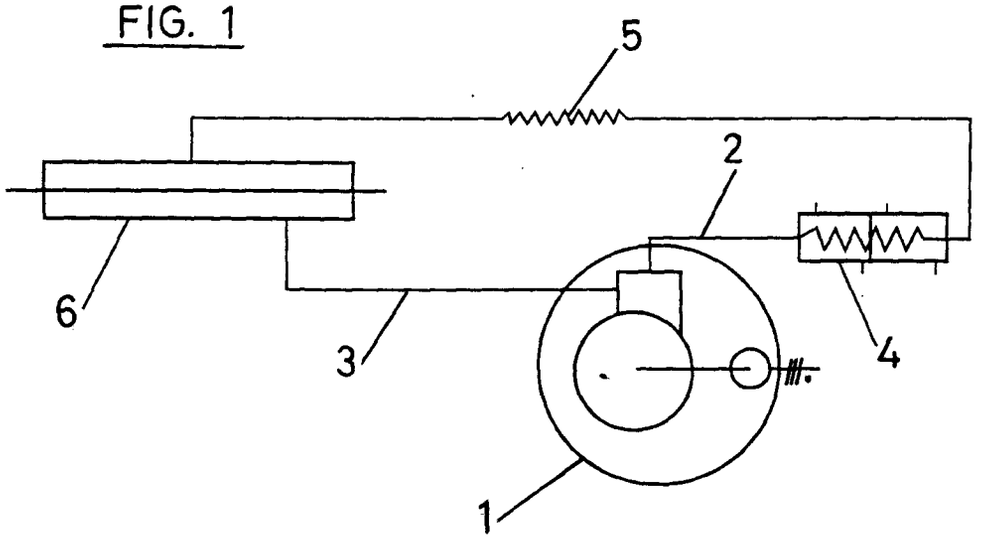
## (54) Air conditioning and hot or cold sanitary water production system

(57) Heating and sanitary hot water production system, using a compressor (1) which propels the coolant at a high temperature towards a high-pressure exchanger (4), which is part of a compartmentalized accumulation boiler, where thermal exchange between the coolant and the water takes place, both for human consumption and heating. The coolant then passes an expansion element (5), finally reaching an evaporation unit (6) where a low pressure exchange takes place and residual heat is transferred to the installation, in order to reheat the coolant before it is again suctioned by the compressor (1).

FIG. 1

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## Description

**[0001]** The present invention relates to an air conditioning and hot or cold sanitary water production system, by accumulation by a thermodynamic system of electrical energy with halogen coolants, of the saturated hydrocarbon type, these coolants being high-pressure coolants with a compression system using a mechanically driven compressor unit, cooling of the circuit carried out either by water or air.

**[0002]** The system allows using cold water production both for consumption or refrigeration, or in its case recovery of air treated for air conditioning.

**[0003]** Both for heating and sanitary hot water production systems, which are generally obtained in a combined way, several solution exist which are based on the use of heating elements which using electrical energy, propane, butane, gas-oil, city-gas, natural gas or another fuel, heat the water in a closed circuit for heating and in an open circuit for producing sanitary hot water.

**[0004]** A less common solution relies on using heat pumps, specifically heat-carrying production units by compression of a coolant in a closed circuit, a solution which has not become widespread as it implies a large energy consumption.

**[0005]** The system proposed by the invention, in a line relatively similar to the heat pumps, solves to a full satisfaction the above problem, obtaining far better operation coefficients which make it competitive with both classical systems using electrical energy as an energy source and with other systems using different fuels, this being achieved by using said electrical energy as the main driving elemment for energy generation, which helps to take advantage of the so-called alternative energy in latent heat of condensation, which next to the energy released by the compression of the coolant employed produces heat exchanges which are used for producing hot water, cold water or otherwise cold air.

**[0006]** More specifically, it is an air conditioning and hot or cold sanitary water production system using any type of energy which may provide sufficient driving couple to generate a compression of a coolant by a compressor element, in such a way that the latent heat and the coolant heat may be used to its intended end.

**[0007]** The hot or cold sanitary water thus obtained is deposited in an accumulation reservoir, from which it is supplied. The same is true for the air-conditioning circuit.

**[0008]** This entire operation is carried out in the high-pressure side, while the low-pressure side is cooled by water or air, this carried heat being used or not, depending on the need for heat recovery set out by the complementary technical instructions of each location.

**[0009]** According to an essential characteristic of the invention, the exchange element is embodied by a compartamentalised high pressure chamber, in which the coolant-water mixed exchange and water storage are performed.

**[0010]** In adition to the above mentioned chamber, the full system consists of a previous compressor element, driven by any form of energy as mentioned before, and after said chamber by a high-pressure expansion refrigerating element, and finally by a coolant expansion battery using a mixed water-coolant exchanger, or otherwise air or any other exchange element in the installation secondary.

**[0011]** According to another characteristic of the invention, between the compressor and the high-pressure exchanger a four-way valve is provided, by which the coolant liquid direction of circulation is controlled, so that it may be reversed throughout the circuit, outside the compressor.

**[0012]** The high-pressure heat exchanger will preferably consist of two independent exchangers placed in parallel to each other.

**[0013]** After the high-pressure heat exchanger there is a second exchanger, an expansion element and a low-pressure exchanger, from which the conduct returns to the compressor intake, through the four way valve. The chambers of the second exchanger mentioned and the low pressure exchanger can be connected to each other, in order to obtain a thermal exchange between the expanded coolant liquid and the liquid arriving from the chamber of the second exchanger.

**[0014]** The conduct segments located before and after the second exchanger include a shut-off valve and are by-passed by an intermediate conduct which also is provided with a shut-off valve.

**[0015]** With the construction described the system may be used for production of sanitary hot water and heating, and by inverting the position of the four-way valve cooling of both high-pressure exchangers is achieved, using the second exchanger as a coolant accumulation deposit. Heat may be also produced on one of the high-pressure exchangers and cold on the other one.

**[0016]** The system constructed in this manner offers several options for production and distribution of heat carriers, specifically the following:

- Direct system, without auxiliary circuits, where the primary circuit evaporator in direct contact with the medium to be heated, cooled or air-conditioned.
- Indirect closed system, of refrigeration with a single auxiliary circuit, whose circulating matter does not come in contact with the medium to be cooled, heated or air-conditioned.
- Indirect open system, of refrigeration with a single auxiliary circuit, whose circulating matter comes in contact with the medium to be cooled, heated or air-conditioned.
- Double indirect closed system, for refrigeration with two auxiliary circuits in series, such that the matter

circulating in the final circuit does not come in contact with the medium to be cooled, heated or air-conditioned.

- Double indirect open system, for refrigeration with two auxiliary circuits in series, such that the matter circulating in the final circuit comes in contact with the medium to be cooled, heated or air-conditioned.

- Ventilated indirect closed system, analogous to the indirect closed system, but where the main circuit deposit is at atmospheric pressure.

- Ventilated indirect open system, similar to the open indirect system, but wth the evaporator located in an open tank or communicated to the atmosphere.

**[0017]** It should also be pointed out that production of both the heat-carrier and the compressor element may be subject to any modification not considered in the above list, without this affecting the essence of the invention.

**[0018]** The characeristics of the invention and the advantages derived from these will be better understood in light of the following description, reffering to the attached drawings, where as non-limiting examples some preffered embodiments are shown.

**[0019]** In the drawings:

**[0020]** Figure 1 is a schematic diagram of a heating and hot sanitary water production system.

**[0021]** Figure 2 is a similar schematic diagram of an air-conditioning and hot or cold sanitary water production system.

**[0022]** The system shown in figure 1 is structured based on a compressor unit (1) which supplies the coolant liquid at a high pressure and temperature, through conduct (2) and suctions at a low temprerature and pressure (as there is a change of state after expansion) through conduct (3).

**[0023]** The energy required to perform the driving motion of the compressor unit may be any fulfilling the working conditions, using electrical energy or any type or fuel for this.

**[0024]** A high-pressure exchanger (4) is executed as an accumulation chamber with two compartments, whichcan carry out exchange of the coolant and the water, both for distribution for human consumption or for haeating.

**[0025]** After chamber (4) is a coolant restrinting element (5), where transmission at a low pressure is performed, for which any conventional restrintor may be used, such as a laminar, machanical or electronic restrintor.

**[0026]** Finally, the circuit closes on an avaporating unit (6) which is intended to perform the exchange at low pressure and where the residual heat of the system is transfered. More specifically, the evaporator unit (8) reheats the coolant before this is suctioned by the compressor unit (1) in order to prevent the coolant from arriving at the compressor in liquid state.

**[0027]** In the installation shown in figure 2, and in the installation described above, there is a compressor (1) from which conduct (2) leaves through which the coolant fluid is supplied at high pressure and temperature, and a conduct (3) through which the coolant fluid enters at a low temperature and pressure.

**[0028]** Conducts 2 and 3 are made to pass a four-way valve labelled (7) which controls the direction of circulation through the system circuit, out od compressor (1), allowing its inversion.

**[0029]** From valve (7) a conduct (8) leaves which splits into two branches (9), each of which passes a high pressure exchager (10 and 11) (equivalent to exchanger (4) of figure 1), from which point branches (9) rejoin in a single conduct (12) where a second exchanger (13) is located, followed by an expansion element (14) (equivalent to the restrintor of figure 1), after which the circuit is provided with a low-pressure thermal exchange unit (15) (equivalent to evaporator (6) of figure 1).

**[0030]** Segments (16 and 17) placed before and after the second exchanger (13) include shut-off valves (18 and 19) and are also interconnected by a bypass or intermediate segment (20) where there is also a shut-off valve(21).

**[0031]** With the described construction, when the system needs to be used to produce heating and sanitary hot water, the coolant fluid at a high temperature and pressure supplied by compressor (1) is taken through valve (7) to exchangers (10 and 11), one of which will produce hot water and the other heating water. When shut -off valve (21) is closed and valves (18 and 19) open, the coolant liquid then passes through the second thermal exchanger (13) where it releases its heat to the fluid contained in the chamber of said exchanger. The coolant fluid then passes through the expansion element (14) from which point the fluid circulates in gaseous state at a low temperature and pressure, then passing through exchanger (15) whose chamber is connected to that of the second exchanger (13), so that the coolant fluid undergoes a preheating and is then carried finally through four-way valve (7) to the compressor (1) intake (3). The exchanger (15) constitutes a low pressure and temperature exchanger where a thermal exchange takes place between the coolant fluid and the water or air preheated in the second exchanger (13).

**[0032]** From low pressure exchanger (15) the coolant liquid may be sent, without preheating, to one of exchangers (10 and 11) so that heat and cold are simultaneously produced in each one.

**[0033]** Valve (7) allows obtaining an inversion of the direction of flow. Cooling of exchangers (10 and 11) is produced and second exchanger (13 ) is used as a deposit for the coolant.

**[0034]** As already mentioned, heat may be produced in one of exchangers (10 and 11) and cold in the other.

**[0035]** Exchanger 10 fulfills a double function: on one

hand it allows improving the refrigerating efficiency and, on the other hand, it acts as a refrigeration accumulator when the circuit is inverted.

**[0036]** The system described is basically applicable at a residential level, both for family homes and office buildings, although its application may be extended to an industrial level.

**[0037]** Exchanger (13) has a double function: improving the refrigerating efficiency and acting as a refrigeration accumulator when the circuit is inverted.

## Claims

1. Air-conditioning and hot or cold sanitary water production system, characterised in that a compressor (1) is involved, which by suctioning the coolant at a low pressure and temperature, sends it at a high temperature towards a high-pressure exchanger (4), which is part of a compartmentalized accumulation chamber, where thermal exchange between the coolant and the water takes place, both for distribution for human consumption and for heating, the coolant then being supplied to a restrintor or expansion element (5) where a drop in pressure occurs, to finally reach an evaporating unit (6) where a low pressure exchange takes place and residual heat of the system is transferred , in order to reheat the coolant before it is again suctioned by compressor (1).

2. System as in claim 1, characterised in that between the compressor and the high-pressure exchanger there is a four-way valve (7), by which the direction of circulation of the coolant fluid is controlled, and in that after the high-pressure exchanger (10-11) there is a second exchanger (13), an expansion element (14) and a low pressure exchanger (15), after which the conduct returns to the intake of the compressor (1) through the four-way valve (7), chambers of the second exchanger (13) and of low pressure exchanger (15) being interconnectable to obtain thermal exchange between the expanded coolant fluid and the fluid arriving from the chamber of the second exchanger (13).

3. System as in claim 2, characterised in that the high-pressure exchanger consists of two independent exchangers arranged in parallel (10-11).

4. System as in claim 2, characterised in that the conduct segments located before and after the second exchanger (13) include shut-off valves (18-19) and are by-passed by a conduct (20) which is also provided with a shut-off valve (21).

FIG. 1

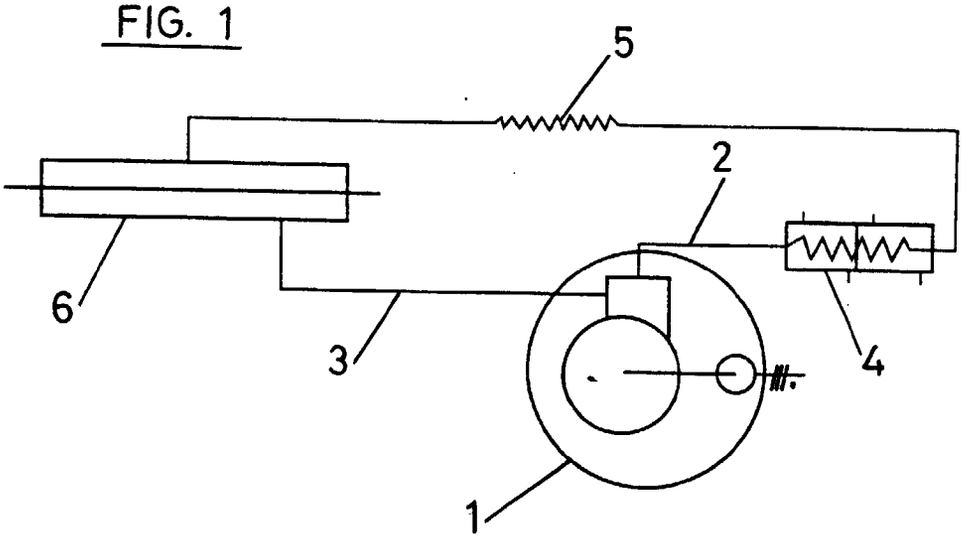

FIG. 2