AIR CONDITIONING INSTALLATION

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ABSTRACT

An air conditioning system for an air-conditioning of spaces comprises a compressor for compressing a refrigerant in a refrigerant circuit, a first heat exchanger for exchanging heat between the refrigerant and a heat reservoir, a plurality of throttles for expanding the refrigerant, a plurality of second heat exchangers for exchanging heat between the refrigerant and a heat transfer fluid in one associated heat transfer fluid circuit each, and a plurality of third heat exchangers which each are arranged in an associated space, for exchanging heat between the heat transfer fluid and indoor air of the associated space. To a second heat exchanger a throttle and a heat transfer fluid circuit with a plurality of third heat exchangers are associated.
AIR CONDITIONING INSTALLATION

[0001] The present invention relates to an air conditioning system for an air-conditioning of spaces of a building, a ship or another vehicle.

[0002] Air-conditioning of hotel rooms or office spaces formerly was usual only in luxurious hotels and in prestigious and high-quality office buildings. Air-conditioning also increasingly is expected in hotels and office buildings of lower categories. For these and other reasons, smaller and smaller spaces have to be air-conditioned. At the same time, buildings are increasingly well insulated, and by outside blinds and other measures, the heat generated by solar radiation is reduced.

[0003] One consequence is that the cooling capacity required for an individual room typically no longer amounts to 2000 W, but only 500 W to 600 W. An indoor unit, on the other hand, typically has a power of 2000 W.

[0004] Another problem consists in that the cooling capacity of a conventional air conditioning system only can be varied within predetermined limits. By an outdoor unit which is formed for a variable refrigerant flow, a cooling capacity between about 120% and about 30% of its nominal power typically can be provided. An even lower cooling capacity at an even lower speed of the compressor generally is not possible, because the refrigerant then loses its properties lubricating the compressor.

[0005] When the cooling capacity picked up by the indoor units decreases below the minimum value of the cooling capacity provided by the outdoor unit, a too high pressure and/or a too high temperature can be obtained in the refrigerant circuit. The air conditioning system thereby can be damaged or destroyed. To avoid this, when the cooling capacity picked up by the indoor units falls below the minimum value, the outdoor unit is operated in a clocked manner or switched on and off at intervals of few minutes. This can effect a corresponding temporal variation of the room temperature and a corresponding loss of convenience.

[0006] Choosing smaller outdoor units generally does not constitute a solution for several reasons. With decreasing nominal power of an outdoor unit, the ratio between the minimum power and the nominal power typically increases, so that the minimum power does not decrease or only to a small extent.

[0007] Furthermore, in air conditioning systems with variable refrigerant flow technically induced limitations exist with regard to the number of the indoor units and with regard to the power of the individual indoor unit.

[0008] JP 55-102842 A describes an air conditioning system with an outdoor unit 11 outside a building. The outdoor unit 11 comprises a compressor 111, a heat exchanger 112 and a throttle 114. An indoor unit 12 is connected with the outdoor unit 11 via pipe conduits 120. In said outdoor unit, cooling capacity is transferred to a water circuit and excess cooling capacity is dissipated by means of a fan 124.

[0009] An object of the present invention consists in creating an improved air conditioning system for an air-conditioning of spaces, which in particular is suitable for generating a low cooling capacity.

[0010] This object is solved by the subject-matter of the independent claims.

[0011] Developments are indicated in the dependent claims.

[0012] Embodiments of the present invention are based on the idea to equip several indoor units of an air conditioning system with their own throttle each and by means of one heat exchanger each transfer the cooling capacity not directly from the refrigerant to indoor air, but to a heat transfer fluid, for example water or brine. By means of several further heat exchangers, the cooling capacity is transferred from the heat transfer fluid to the indoor air of one or more spaces.

[0013] An air conditioning system for an air-conditioning of spaces comprises a compressor for compressing a refrigerant in a refrigerant circuit, a first heat exchanger for exchanging heat between the refrigerant and a heat reservoir, a plurality of throttles for expanding the refrigerant, a plurality of second heat exchangers for exchanging heat between the refrigerant and a heat transfer fluid in one associated heat transfer fluid circuit each, and a plurality of third heat exchangers which each are arranged in an associated space, for exchanging heat between the heat transfer fluid and indoor air of the associated space, wherein a throttle and a heat transfer fluid circuit with a plurality of third heat exchangers are associated to the second heat exchanger.

[0014] The air conditioning system in particular is formed and provided for an air-conditioning or cooling and/or heating of spaces or rooms of one or more buildings or of a ship or another vehicle.

[0015] The first heat exchanger in particular is arranged in direct spatial proximity of the compressor and together with the compressor in particular is arranged in an outdoor unit which is arranged outside the building or at an external border of the building or the ship or the other vehicle. The first heat exchanger in particular is formed and provided for exchanging heat between the refrigerant and ambient air or an atmosphere surrounding the building, the ship or the other vehicle, or for exchanging heat between the refrigerant and ground water or an underground of the building or water in which the ship floats.

[0016] The air conditioning system can include a plurality of second heat exchangers, to each of which a throttle and a separate heat transfer fluid circuit with a plurality of third heat exchangers is associated. Each heat transfer fluid circuit can comprise one or more third heat exchangers. To one space, one or more heat exchangers from the same or from different heat transfer fluid circuits each can be associated.

[0017] The air conditioning system can include further heat exchangers for the direct exchange of heat between the refrigerant and indoor air, for example for an air-conditioning of meeting rooms, halls or other large spaces.

[0018] A throttle in particular each is arranged such that its distance to the associated second heat exchanger is smaller or much smaller than its distance to the first heat exchanger. Distance each refers to the length of the fluid line connecting the throttle with the second heat exchanger or with the first heat exchanger. In particular, a throttle each is arranged directly adjacent to the associated second heat exchanger and in the flow line of the associated heat exchanger or based on the flow direction of the refrigerant upstream of the associated second heat exchanger.

[0019] Interposing the heat transfer fluid circuit between the refrigerant circuit and the indoor air can provide for dimensioning the cooling and/or heating capacity to be provided in individual spaces within distinctly wider limits. In particular, small cooling capacities of only few 100 W can be provided, which are sufficient in small and thermally well insulated rooms of modern hotels or office buildings. Such a reduced cooling capacity can effect a distinct reduction of the...
air movement obtained in an air-conditioned space, which sometimes is perceived as unpleasant draft.

[0020] Refrigerants often are odorless and colorless. When a refrigerant exits from an air conditioning system, it can force out the breathing air in a room and cause choking of persons in the room. This risk can be reduced distinctly, when it no longer is the refrigerant circuit, but only the heat transfer fluid circuit with water, brine or another non-toxic heat transfer fluid liquid under normal conditions that is guided into the individual hotel room or into the individual office space. This can simplify the compliance with regulations of EN 378 concerning maximum refrigerant concentrations in interior spaces.

[0021] In that merely a part of the heat transfer fluid circuit is arranged in the hotel room or in the office space, but the refrigerant circuit is arranged completely outside the hotel room or office space, the noise level also can be lowered distinctly. For example, the noise of a valve switching in the hotel room or in the office space can be avoided completely. The applicant expects a reduction of the noise level from typically at least 30 dB(A) to distinctly smaller values down to about 21 dB(A).

[0022] The heat transfer fluid circuit has its own thermal capacity and its own thermal inertia, which in particular results from the thermal capacity of the heat transfer fluid, the pipe conduits and other parts of the heat transfer fluid circuit. This thermal inertia of the heat transfer fluid circuit can distinctly reduce the temporal variation of the cooling and/or heating capacity in a hotel room or an office space, which is obtained with a clocked operation of the outdoor unit.

[0023] In an air conditioning system with the described features, the number of the air-conditioned spaces can be a multiple of the number of the second heat exchangers and the number of throttles. In the case of a technically induced limitation of the number of throttles and second heat exchangers, which together with a compressor and a first heat exchanger form the refrigerant circuit, a much higher number of spaces hence can be air-conditioned with the air conditioning system described here. Conversely, in the case of a large building the number of compressors and heat exchangers (in particular each combined in an outdoor unit) can be reduced distinctly. Both can distinctly lower the costs for the manufacture, operation and maintenance of the air conditioning system.

[0024] In an air conditioning system as it is described here, in particular the compressor and the first heat exchanger are arranged in an outdoor unit outside a building or a vehicle or at an external border of a building or a vehicle, and one throttle each and an associated heat exchanger are arranged in an indoor unit.

[0025] The indoor unit in particular is arranged inside the building or the ship or the other vehicle, for example in a corridor or aisle or in a staircase. The indoor unit then is connected with the third heat exchangers in individual spaces via pipe conduits. As third heat exchangers, in particular components of so-called chiller systems can be used, which in English-speaking countries are known as fan coils and are offered at low cost and in a wide variety.

[0026] An air conditioning system, as it is described here, in particular furthermore comprises a reservoir for the heat transfer fluid, in order to increase the thermal capacity.

[0027] The reservoir in particular is formed by a tank which is arranged in the vicinity of the associated second heat exchanger. Already with a small volume of e.g. 10 liters the reservoir can distinctly increase the thermal capacity of the heat transfer fluid circuit. In the case of a clocked operation of the compressor, a variation of the cooling capacity in the individual space thereby can be lowered below the perceptibility limit.

[0028] An air conditioning system, as it is described here, in particular furthermore comprises a temperature sensor in the heat transfer fluid circuit.

[0029] The temperature sensor in particular is arranged and formed to detect the temperature of the heat transfer fluid in the flow line of the second heat exchanger. Furthermore, further sensors can be provided for detecting the temperature, the pressure, the flow velocity, the mass flow or other measurement quantities in the flow line of the second heat exchanger or at another point in a heat transfer fluid circuit. The temperature sensor and possibly further sensors for detecting measurement values can support a particularly sensitive control of the air conditioning system.

[0030] In an air conditioning system, as it is described here, in particular no heat exchanger is provided for dissipating cooling or heating capacity of the refrigerant to a medium other than the heat transfer fluid.

[0031] This also distinguishes the air conditioning system in particular from the above-mentioned air conditioning system as described in JP 55-102842 A, in which excess cooling or heating capacity is dissipated. The air conditioning system described here hence provides for a particularly good efficiency or a particularly good performance rating.

[0032] In an air conditioning system, as it is described here, in particular one throttle is controllable.

[0033] The controllable throttle or the controllable throttles each comprise in particular an electronic expansion valve. The controllability of a throttle each provides for controlling the refrigerating capacity at the associated second heat exchanger and hence an adaptation to different values of the cooling capacity picked up at the associated third heat exchangers. The control of the air conditioning system as a whole thereby can be refined and the efficiency or performance rating thereby can be increased.

[0034] In an air conditioning system, as it is described here, an indoor unit is connected with the outdoor unit by means of three fluid lines and formed to withdraw heat from the heat transfer fluid in a cooling mode and to supply heat to the heat transfer fluid in a heating mode.

[0035] Several or all indoor units of the air conditioning system can be connected with the outdoor unit by means of three fluid lines and be formed to each independently withdraw heat from the heat transfer fluid in a cooling mode and to supply heat to the heat transfer fluid in a heating mode. Switching between the cooling mode and the heating mode in particular is effected by controlling a controllable throttle and by selecting one of two possible return lines by means of one or more valves. The valve or valves for selecting one of two return lines can be arranged directly in the indoor unit or in an associated, but separate unit which is connected with the indoor unit via an (in particular short) fluid line.

[0036] In particular in this aspect, too, an air conditioning system with the properties and features described here distinctly differs from the teaching of the above-mentioned JP 55-102842 A, in which switching between a cooling mode and a heating mode is not possible.

[0037] An air conditioning system, as it is described here, in particular is formed for a variable refrigerant volume flow.
By a variable or controllable refrigerant volume flow an adjustment of the total cooling or heating capacity provided by the air conditioning system is possible within a wide range.

In an air conditioning system, as it is described here, in particular a three-phase AC motor with adjustable speed is provided for driving the compressor.

For adjusting the speed of the synchronous or asynchronous three-phase AC motor in particular an inverter is provided, which is formed to provide polyphase current of adjustable frequency and adjustable amplitude of the voltage and/or the current. This provides for a variation of the refrigerant volume flow and the cooling and/or heating capacity provided by the air conditioning system.

An air conditioning system, as it is described here, in particular furthermore comprises a control means for detecting a total demand for cooling or heating capacity and for controlling the compressor between a predetermined minimum capacity and a predetermined maximum capacity, wherein the control means is formed to temporarily switch off the compressor, when the total demand for cooling or heating capacity falls below a predetermined threshold value.

In a separate control unit and/or in the outdoor unit and/or in one or more indoor units, the control means in particular each includes one or more microcontrollers or other electric or electronic analogue or digital circuits for data processing, which by means of electric, optical or other signal lines are coupled with each other, with sensors for detecting temperatures, pressures, volumetric flow rates and other measurement values, and with one or more user interfaces. The control means in particular also is provided and formed for controlling the throttles.

In an air conditioning system with the properties and features described here, temporarily switching off the compressor and hence the cooling and/or heating capacity provided in the refrigerant circuit effects a variation of the cooling or heating capacity in the air-conditioned spaces, which due to the thermal capacity or inertia of the heat transfer fluid circuits can turn out to be distinctly lower than in a conventional air conditioning system.

In the following, various embodiments will be explained in detail with reference to the attached Figures, in which:

FIG. 1 shows a schematic representation of a building with an air conditioning system;

FIG. 2 shows a schematic representation of an air conditioning system;

FIG. 3 shows a schematic representation of a further air conditioning system.

FIG. 1 shows a schematic representation of a building 10 with an outer wall 12 and several spaces 14, 15 of different sizes. The representation in FIG. 1 in particular indicates a ground plan of a storey or floor of the building 10.

The building 10 comprises a large space 14, in particular an entrance area which passes over into a corridor or an aisle between smaller separate spaces. The spaces 15 have different sizes, in particular different floor areas and/or room heights. The spaces 15 furthermore can differ in their functions, in the sizes of the adjacent facade areas, in the quality of the insulation to the outside, in the exposure to solar radiation, and in other properties.

The building 10 includes an air conditioning system which is shown separately in FIGS. 2 and 3 described below and is provided with the reference numeral 20. The air conditioning system comprises an outdoor unit 30 which is attached to the outer wall 12 of the building 10 or can be arranged close to the building 10 and spaced from the same. Furthermore, the air conditioning system comprises a plurality of indoor units 40 which are connected with the outdoor unit 30 by a pipe conduit system. Expressed in other words, the outdoor unit 30 and the indoor units 40 together with the pipe conduits connecting the same form a branched refrigerant circuit 70.

An indoor unit 40 with a plurality of associated room units each arranged in a space 15 forms a heat transfer fluid circuit 90. Expressed in other words, one indoor unit 40 each and several associated room units 50 together with the pipe conduits connecting the same form a heat transfer fluid circuit 90.

In the illustrated example, an indoor unit 40 together with two associated room units 50 each in one of two larger rooms 15 arranged at the bottom left in FIG. 1 forms a heat transfer fluid circuit 90. A further indoor unit 40 together with four room units each in one of four smaller rooms 15 arranged on the right in FIG. 1 forms a further heat transfer fluid circuit 90. In the example shown in FIG. 1 a third indoor unit furthermore is arranged in the large space 14 and provided for its direct air conditioning without use of an associated heat transfer fluid circuit.

The air conditioning system is provided for an air-conditioning of the spaces or rooms 14, 15, in particular for cooling and/or heating the indoor air in the rooms 14, 15. The outdoor unit 30 is provided and formed to provide cooling capacity in the refrigerant circuit 70 or to withdraw heat from a refrigerant in a refrigerant circuit 70 in a cooling mode, and to supply this heat to an environment of the building 10 (in particular at a higher temperature level) by means of a heat exchanger. Alternatively or in addition, the outdoor unit 30 is formed to withdraw heat from the environment of the building 10 in a heating mode and to provide this heat (in particular at a higher temperature level) in the refrigerant circuit 70 or via the refrigerant circuit 70 at the indoor units 40. The outdoor unit 30 and the refrigerant circuit 70 can be formed to provide cooling capacity and heating capacity at the same time. In particular a part of the indoor units 40 is in a cooling mode and another part of the indoor units 40 is in a heating mode.

Each indoor unit 40 is formed to withdraw heat from the associated heat transfer fluid circuit 90 or the large space 14 and supply it to the refrigerant circuit 70 in a cooling mode, or to withdraw heat from the refrigerant circuit 70 and supply it to the associated heat transfer fluid circuit 90 in a heating mode. For this purpose, each indoor unit in particular comprises a heat exchanger for transferring heat between the refrigerant circuit 70 on the one hand and the associated heat transfer fluid circuit 90 or the indoor air of the large space 14 on the other hand.

Each room unit 50 is provided and formed to withdraw heat from the indoor air of the associated space 15 and supply it to the associated heat transfer fluid circuit 90 in the cooling mode, or to withdraw heat from the associated heat transfer fluid circuit 90 and supply it to the indoor air of the associated space 15 in a heating mode. For this purpose, each room unit 50 in particular comprises a heat exchanger for exchanging heat between the heat transfer fluid circuit 90 and the indoor air of the associated space 15.

The air conditioning system can be arranged in a ship or another vehicle rather than in a stationary or mobile building 10. The outdoor unit 30 can be formed to exchange
heat between the refrigerant circuit 70 and water, ground water or another underground of the building rather than to exchange heat between the refrigerant circuit 70 and ambient air. Examples for the configuration of the air conditioning system are described with respect to FIGS. 2 and 3.

[0057] FIG. 2 shows a schematic representation of an air conditioning system 20 which—similar to what has been shown above with reference to FIG. 1—is usable in a stationary or mobile building, a ship or another vehicle. By way of example, the air conditioning system 20 is shown with an outdoor unit 30, a first indoor unit 40 (shown at the top in FIG. 2) to which three room units 50 are associated, and a second indoor unit 40 (shown at the bottom in FIG. 2) to which two room units 50 are associated. The number of the indoor units 40 and the number of the room units associated to each indoor unit 40 can differ distinctly from the representation in FIG. 2.

[0058] For better clarity of the representation in FIG. 2, only one indoor unit 40 and one room unit 50 each are provided with several numerical marks.

[0059] The outdoor unit 30 comprises a compressor 32, which in particular is driven by a three-phase AC motor with adjustable speed not shown in FIG. 2, in order to generate an adjustable refrigerant flow. Furthermore, the outdoor unit 30 comprises a first heat exchanger 34 for transferring heat between a refrigerant and ambient air, water or another medium. The first heat exchanger 34 in particular is provided with an axial fan for circulating ambient air. Furthermore, the outdoor unit 30 comprises a controller 38 for controlling the compressor 32. The controller 38 in addition can be formed to receive signals from sensors for detecting temperatures, pressures, flow rates or other measurement values, which are not shown in FIG. 2, and to control one or more fans of the first heat exchanger 34, valves or other actuators.

[0060] Each indoor unit 40 comprises a controllable throttle valve 42, in particular an electronic expansion valve, a second heat exchanger 44, a circulation pump 45, a reservoir 46, a controller 48 and a temperature sensor 49. By means of fluid lines 71, 72, the throttle 42 and the second heat exchanger of the indoor unit 40 are connected with the compressor 32 and the first heat exchanger 34 of the outdoor unit 30 and together with the same form a refrigerant circuit 70.

[0061] The controller 48 of each indoor unit 40 is connected with the controller 38 of the outdoor unit 30 by means of one or more signal lines 78 for transmitting electric, optical and/or other signals. The signal line 78 in particular is formed as point-to-point connection or as bus which simultaneously couples the controllers 48 of several or all indoor units 40 with the controller 38 of the outdoor unit 30.

[0062] A room unit 50 each comprises a control valve 52, a third heat exchanger 54, a controller 58 and a temperature sensor 59. The control valve 52 and the third heat exchanger 54 of a room unit 50 each are connected with the second heat exchanger 44, the circulation pump 45 and the reservoir 46 of the associated indoor unit 40 by means of heat transfer fluid lines 91, 92 and together with the same form a heat transfer fluid circuit 90.

[0063] The controller 58 of each room unit 50 is coupled with the control valve 52 and the temperature sensor 59 of the room unit 50 and by means of one or more signal lines 98 for transmitting electric, optical or other signals with the controller 48 of the associated indoor unit 40. The signal line 98 in particular is formed as point-to-point connection or as bus for coupling the controller 48 of an indoor unit 40 with the controllers 58 of several or all associated room units 50.

[0064] Other than shown in FIG. 2, the signal lines 78, 98 can extend different from the refrigerant lines 71, 72 or heat transfer fluid lines 91, 92 shown in parallel in FIG. 2 and/or have another topology. In particular, all controllers 38, 48, 58 of the outdoor unit 30, of the indoor units 40 and the room units 50 can be coupled by means of a single unbranched or branched bus or by means of several busses which are split in contrast to the representation in FIG. 5.

[0065] The controllers 38, 48, 58 together form a control means for controlling the air conditioning system 20, in particular the compressor 32, the throttles 42, the circulation pumps 45 and the control valves 52. The controllers 38, 48, 58 in particular are formed to control the air conditioning system 20 in dependence on indoor air temperatures before and/or after the exchange of heat each with a third heat exchanger 54, on temperatures in the refrigerant circuit 70 and in the heat transfer fluid circuits 90, on an outside temperature or a temperature of another heat reservoir with which the first heat exchanger 34 exchanges heat, on setpoints of indoor air temperatures which are detected at user interfaces, and on other parameters.

[0066] When the sum of the cooling capacities provided at all room units 50 falls below a minimum value of the capacity to be provided by the outdoor unit 30, which is specified by properties of the outdoor unit 30, the compressor 32 can be operated in a clocked manner. The compressor 32 is switched on and off periodically or aperiodically. The cooling capacity provided at the second heat exchanger 44 correspondingly varies with time. Due to the inertia or the thermal capacity of the heat transfer fluid circuits 90, this variation of the cooling capacity provided at the second heat exchangers 44 has no or only a weakly perceptible effect on the cooling capacities provided by the room units. The thermal inertia or the thermal capacity of the heat transfer fluid circuits 90 each is increased by the reservoir 46.

[0067] In the schematic representation in FIG. 2, all indoor units 40 are equal and all room units 50 are equal. Other than shown in FIG. 2, the indoor units 40 can differ from each other, for example by differently dimensioned components. Furthermore, the room units 50 can differ from each other, for example by differently dimensioned components.

[0068] FIG. 3 shows a schematic representation of a further air conditioning system 20 which in some features and properties resembles the air conditioning system shown above with reference to FIG. 2. In contrast to FIG. 2, there is only shown a section of the entire air conditioning system 20. Possible continuations of refrigerant lines 71, 72, 73, heat transfer fluid lines 91, 92 and signal lines 78, 98 beyond the illustrated region are indicated by broken lines. In the following in particular those features and properties are shown in which the air conditioning system of FIG. 3 differs from the air conditioning system shown above with reference to FIG. 2.

[0069] In the air conditioning system shown in FIG. 3 the outdoor unit 30 is connected with each indoor unit 40 by means of three refrigerant lines 71, 72, 73. In particular the flow line of the throttle 42 of each indoor unit 40 is connected with the outdoor unit 30 by means of a first refrigerant line 71. The return line of the heat exchanger 44 of each indoor unit 40 is connected with the outdoor unit 30 by means of second refrigerant lines 72, 73.

[0070] Between the return line of the second heat exchanger 44 on the one hand and the second and third refrigerant lines 72, 73 on the other hand a mode switching means
76 each is arranged. The mode switching means 76 can be integrated into the indoor unit 40 or be formed as separate, spaced unit connected with the associated indoor unit 40 by a fluid line. The mode switching means 76 each in particular comprises one or more valves by means of which the return line of the second heat exchanger 44 alternatively is connected with the inlet of a compressor 32 of the outdoor unit 30 (cf. FIG. 2) via the second refrigerant line 72 or via the third refrigerant line 73 and a circulation pump in the outdoor unit 30 with the first refrigerant line 71.

[0071] Via the signal line 78 or in some other way, the mode switching means 76 is connected with the controller 48 of the associated indoor unit 40 and/or with other components 38, 48, 58 (cf. FIG. 2 of the control means). The mode switching means 76 allows switching between a cooling mode and a heating mode. When an indoor unit 40 operates in the cooling mode, heat is transferred from the associated heat transfer fluid circuit 90 to the refrigerant circuit 70. When an indoor unit 40 operates in the heating mode, heat is transferred from the refrigerant circuit 70 to the associated heat transfer fluid circuit 90. Within the air conditioning system 20, one or more indoor units 40 can be in the cooling mode and one or more outdoor units 40 can be in the heating mode at the same time.

LIST OF REFERENCE NUMERALS

10 building
12 outer wall of the building 10
14 space in the building 10
15 space in the building 10
20 air conditioning system
30 outdoor unit of the air conditioning system 20
32 compressor of the outdoor unit 30
34 heat exchanger of the outdoor unit 30
38 controller of the outdoor unit 30
40 indoor unit of the air conditioning system 20
42 throttle of the indoor unit 40
44 heat exchanger of the indoor unit 40
45 circulation pump
46 reservoir of the indoor unit 40
48 controller of the indoor unit 40
49 temperature sensor of the indoor unit 40
50 room unit of the air conditioning system 20
52 control valve of the room unit 50
54 heat exchanger of the room unit 50
58 controller of the room unit 50
59 temperature sensor of the room unit 50
70 refrigerant circuit
71 refrigerant line (high pressure) in the refrigerant circuit 70
72 refrigerant line (low pressure) in the refrigerant circuit 70
73 refrigerant line (low pressure) in the refrigerant circuit 70
76 mode switching means
78 signal line between outdoor unit 30 and indoor unit 40
90 heat transfer fluid circuit
91 heat transfer line in the heat transfer fluid circuit 90
92 heat transfer line in the heat transfer fluid circuit 90
98 signal line between indoor unit 40 and room unit 50

1. An air conditioning system for an air-conditioning of spaces, comprising:
   a compressor for compressing a refrigerant in a refrigerant circuit,
   wherein the air conditioning system is formed for a variable refrigerant volume flow;
   a first heat exchanger for exchanging heat between the refrigerant and a heat reservoir;
   a plurality of throttles for expanding the refrigerant;
   a plurality of second heat exchangers for exchanging heat between the refrigerant and a heat transfer fluid in one associated heat transfer fluid circuit each;
   a reservoir for the heat transfer fluid, to increase the thermal capacity, in each heat transfer fluid circuit;
   a plurality of third heat exchangers which are arranged in one associated space each, for exchanging heat between the heat transfer fluid and indoor air of the associated space;
   wherein a throttle and a heat transfer fluid circuit with a plurality of third heat exchangers are associated to a second heat exchanger;
   and a control means for detecting a total demand for cooling or heating capacity and for controlling the compressor between a predetermined minimum capacity and a predetermined maximum capacity,
   wherein the control means is formed to temporarily switch off the compressor, when the total demand for cooling or heating capacity falls below a predetermined threshold value.

2. The air conditioning system according to claim 1, in which the compressor and the first heat exchanger are arranged in an outdoor unit outside a building or a vehicle or at an external border of a building or a vehicle, and one throttle each and an associated second heat exchanger are arranged in an indoor unit.

3. (canceled)

4. The air conditioning system according to claim 1, furthermore comprising:
   a temperature sensor in the heat transfer fluid circuit.

5. The air conditioning system according to claim 1, in which no heat exchanger is provided for dissipating cooling or heating capacity of the refrigerant to a medium other than the heat transfer fluid.

6. The air conditioning system according to claim 1, in which one throttle is controllable.

7. The air conditioning system according to claim 6, in which an indoor unit is connected with the outdoor unit by means of three fluid lines and formed to withdraw heat from the heat transfer fluid in a cooling mode and supply heat to the heat transfer fluid in a heating mode.

8. (canceled)

9. The air conditioning system according to claim 1, wherein for driving the compressor a three-phase AC motor with adjustable speed is provided.

10. (canceled)

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