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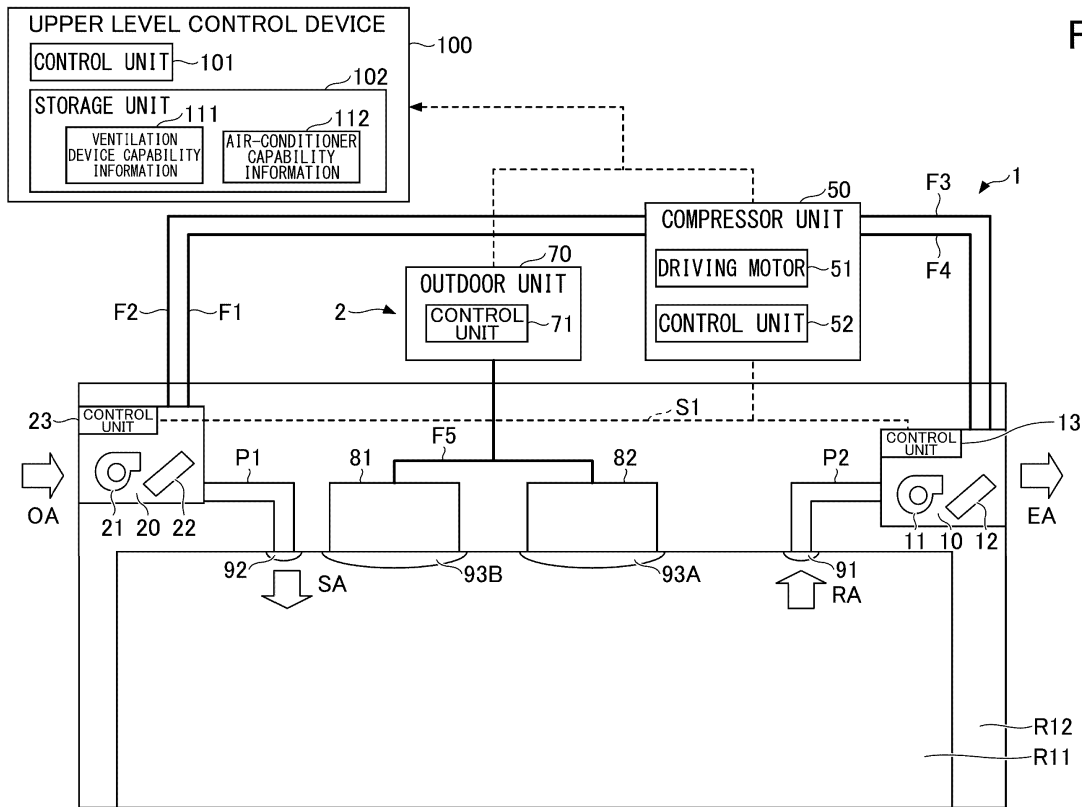
(54) **AIR-CONDITIONING SYSTEM AND AIR-CONDITIONING CONTROL DEVICE**

(57) The air-conditioning system according to an embodiment is provided with a ventilation device, an air-conditioner, and a control unit for controlling the ventilation device and the air-conditioner, wherein the control unit stores a first capability indicating a heat load that can be output corresponding to the power consumption of the ventilation device and a second capability indicating a

heat load that can be output corresponding to the power consumption of the air conditioner, acquires the temperature of an indoor space, and sets the ventilation device and the air conditioner to share the first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space according to the first capability and the second capability.

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FIG.1



Description

Technical Field

5 **[0001]** The present disclosure relates to an air-conditioning system and air-conditioning control apparatus.

Background Art

10 **[0002]** Conventionally, it has been known that a ventilation device that exchanges air between outdoors and indoors and that exchanges heat between indoors and outdoors by using a plurality of heat exchangers, and an air-conditioner that performs a cooling operation or a heating operation indoors, are installed in the same space (see Patent Document 1).

Citation List

15 Patent Document

[0003] [Patent Document 1] WO 2018/182022

Summary of Invention

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Technical Problem

[0004] In the air-conditioning system described in Patent Document 1, a technique for making adjustments to reduce the sum of the power consumption of the ventilation device and the power consumption of the air-conditioner, is proposed.

25 **[0005]** An object of the present disclosure is to implement efficient control of air-conditioning.

Solution to Problem

30 **[0006]** The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;

a first heat exchanger configured to function as a condenser or an evaporator;

35 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;

a second heat exchanger configured to function as a condenser or an evaporator;

a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and

40 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

45 a third heat exchanger configured to function as a condenser or an evaporator; and

an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

50 a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power consumption of the ventilation device and a second capability indicating a heat load that can be output by the

55 air-conditioner according to power consumption of the air-conditioner,

acquires a temperature of the indoor space, and

makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first

capability and the second capability.

[0007] According to the air-conditioning system, the first heat load can be appropriately shared between the ventilation device and the air-conditioner, so that the energy consumption efficiency can be improved.

[0008] In the above air-conditioning system,

the ventilation device is provided in plurality,

the air-conditioner is provided in plurality, and

the control unit makes a setting to cause the plurality of ventilation devices and the plurality of air-conditioners to share the first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first capability and the second capability.

[0009] According to the above air-conditioning system, the first heat load can be appropriately shared among the plurality of ventilation devices and the plurality of air-conditioners, thereby improving energy consumption efficiency.

[0010] In the above air-conditioning system, the control unit causes the first heat exchanger to function as a condenser or an evaporator to adjust a temperature of air supplied to the indoor space, in a case where a part of the first heat load is set as a share assigned to the ventilation device.

[0011] According to the air-conditioning system, the energy consumption efficiency can be improved by having the first heat exchanger of the ventilation device which shares the first heat load perform heat exchange.

[0012] In the above air-conditioning system,

the control unit stores, as the first capability, a first minimum heat load determined as a minimum value that can be set based on the power consumption of the ventilation device out of the heat load that can be output by the ventilation device, and stores, as the second capability, a second minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit implements control such that the ventilation device repeats operating by a capability corresponding to a minimum heat load and stopping to operate, and makes a setting such that the air-conditioner stops operating, in a case where the first heat load is less than the first minimum heat load and the first heat load is less than the second minimum heat load.

[0013] According to the air-conditioning system, the energy consumption efficiency can be improved by having the ventilation device be prioritized to exchange heat.

[0014] In the above air-conditioning system, the control unit sets an operation time of the ventilation device to perform processing corresponding to the first heat load per unit time, in a case where the first heat load is less than a minimum heat load according to the first capability and the first heat load is less than a minimum heat load according to the second capability.

[0015] According to the air-conditioning system, the operation time corresponding to the first heat load can be set, and, therefore, the energy consumption efficiency can be improved.

[0016] In the above air-conditioning system,

the ventilation device is provided in plurality,

the air-conditioner is provided in plurality, and

the control unit holds in advance, as the first capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the ventilation device out of the heat load that can be output by the ventilation device, and holds in advance, as the second capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit makes a setting to cause at least one of the plurality of ventilation devices to stop operating, and to cause other ones of the plurality of ventilation devices to operate according to a capability corresponding to the first heat load, in a case where the first heat load is less than a sum of the minimum heat loads according to the first capability of the plurality of ventilation devices, and the first heat load is less than a sum of the minimum heat loads according to the second capability of the plurality of air-conditioners.

[0017] According to the air-conditioning system, the energy consumption efficiency can be improved by operating the number of the ventilation devices corresponding to the first heat load.

[0018] In the above air-conditioning system,

the control unit holds in advance, as the second capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit causes the air-conditioner to maintain an operation of processing the minimum heat load of the second capability.

[0019] In the above air-conditioning system, when the second heat exchanger is functioning as a condenser, an input target temperature is higher than a temperature of air of the outdoors, and the target temperature is lower than the temperature of air in the indoor space, the control unit reduces driving of the compressor, sets an amount of air that can be supplied from the first air flow path to be a maximum value that can be set, and sets an amount of air that can be exhausted from the second air flow path to be a maximum value that can be set.

[0020] According to the air-conditioning system, energy consumption efficiency can be improved by controlling the temperature with the outdoor air.

[0021] In the above air-conditioning system, the control unit adds a heat load generated in the indoor space to a heat load generated by ventilation between the indoor space and the outdoors, and acquires a result of the addition as the first heat load.

[0022] In the above air-conditioning system, the control unit

acquires a temperature or a humidity of first air that has passed through the first heat exchanger via the first air flow path, and acquires a temperature or a humidity of second air in the indoor space, determines whether the temperature or the humidity of the first air and the temperature or the humidity of the second air satisfy a predetermined criterion, and reduces a capability of processing a heat load by the ventilation device and increases a capability of processing a heat load by the air conditioner as compared to before determining whether the predetermined criterion is satisfied, when the control unit determines that the predetermined criterion is not satisfied.

[0023] In the above air-conditioning system, the control unit adds a heat load corresponding to control of reducing a temperature generated in a first area in the indoor space to a heat load corresponding to control of raising a temperature generated in a second area in the indoor space, and acquires a result of the addition as the first heat load.

[0024] According to the air-conditioning system, the energy consumption efficiency can be improved by adjusting the temperature considering the entire area.

[0025] In the above air-conditioning system,

the control unit causes the first heat exchanger to function as the evaporator and causes the second heat exchanger to function as the condenser when the first heat load is determined to be a cooling load, and the control unit causes the first heat exchanger to function as the condenser and causes the second heat exchanger to function as the evaporator when the first heat load is determined to be a heating load.

[0026] In the above air-conditioning system,

the ventilation device is provided in plurality, the control unit sets a share of the first heat load to be assigned to the ventilation device including the second heat exchanger for taking in air from an area with low temperature among the plurality of ventilation devices, to be larger than a share of the first heat load to be assigned to other ones of the plurality of ventilation devices, when the first heat load is determined to be a cooling load, and the control unit sets a share of the first heat load to be assigned to the ventilation device including the second heat exchanger for taking in air from an area with high temperature among the plurality of ventilation devices, to be larger than a share of the first heat load to be assigned to other ones of the plurality of ventilation devices, when the first heat load is determined to be a heating load.

[0027] According to the air-conditioning system, the efficiency of heat exchange can be improved to improve the efficiency of energy consumption.

[0028] In the above air-conditioning system,

the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space.

[0029] In the above air-conditioning system, the control unit adds a humidification amount or a dehumidification amount required for a first area in the indoor space to a humidification amount or a dehumidification amount required for a second area in the indoor space, and performs temperature control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner based on a result of the addition.

[0030] In the above air-conditioning system, when input of a target humidity in the indoor space is received, the control unit performs humidity control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner such that an average humidity in the indoor space becomes the target humidity, based on a relative humidity distribution in the indoor space.

[0031] In the above air-conditioning system,

the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and includes a first air volume adjustment mechanism configured to adjust an air volume for each of the air supply ports, the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space, and includes a second air volume adjustment mechanism configured to adjust an air volume for each of the exhaust ports, and the control unit controls, for each of the air supply ports, the first air volume adjustment mechanism of the corresponding supply port, and the control unit controls, for each of the exhaust ports, the second air volume adjustment mechanism of the corresponding exhaust port.

[0032] In the above air-conditioning system,

the ventilation device is provided in each of a first area of the indoor space and a second area in the indoor space, and the control unit acquires a target humidification amount indicating a humidification amount required for the indoor space, and when humidifying the indoor space with the target humidification amount, the control unit compares a temperature of air in the first area in the indoor space with a temperature of air in the second area in the indoor space, and allocates a larger humidification amount for an area with a higher temperature among the first area and the second area than a humidification amount to be allocated to an area with a lower temperature among the first area and the second area.

[0033] According to the air-conditioning system, condensation can be prevented by distributing the humidification amount in the high temperature area to be more than the humidification amount in the low temperature area.

[0034] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
a first heat exchanger configured to function as a condenser or an evaporator;
a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
a second heat exchanger configured to function as a condenser or an evaporator;
a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and
a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit adds a humidification amount or a dehumidification amount required for a first area in the indoor space to a humidification amount or a dehumidification amount required for a second area in the indoor space, and performs temperature control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner based on a result of the addition.

[0035] According to the air-conditioning system, energy consumption efficiency can be improved by performing temperature control according to the addition result of adding the dehumidification amount and the humidification amount

of a plurality of areas.

[0036] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein when input of a target humidity in the indoor space is received, the control unit performs humidity control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner such that an average humidity in the indoor space becomes the target humidity, based on a relative humidity distribution in the indoor space.

[0037] According to the air-conditioning system, it is possible to improve energy consumption efficiency by controlling humidity in consideration of humidity distribution.

[0038] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and includes a first air volume adjustment mechanism configured to adjust an air volume for each of the air supply ports, the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space, and includes a second air volume adjustment mechanism configured to adjust an air volume for each of the exhaust ports, and the control unit controls, for each of the air supply ports, the first air volume adjustment mechanism of the corresponding supply port, and the control unit controls, for each of the exhaust ports, the second air volume adjustment

mechanism of the corresponding exhaust port.

[0039] According to the air-conditioning system, by adjusting the air volume by the first air volume adjustment mechanism and the second air amount adjustment mechanism, the temperature can be adjusted in detail in the living room space, and the comfort can be improved.

[0040] The above air-conditioning system further includes:

a plurality of detecting units configured to detect a temperature of air in the indoor space, wherein the control unit controls an air volume supplied by the first air volume adjustment mechanism corresponding to the air supply port provided near an area in the indoor space having a large difference between a temperature indicated by a temperature distribution in the indoor space based on detection results of the plurality of detecting units and a target temperature received as input, to be greater than an air volume supplied by another first air volume adjustment mechanism, or

the control unit controls an air volume taken in by the second air volume adjustment mechanism corresponding to the exhaust port provided near an area in the indoor space having a large difference between a temperature indicated by a temperature distribution in the indoor space based on detection results of the plurality of detecting units and a target temperature received as input, to be greater than an air volume taken in by another second air volume adjustment mechanism.

[0041] In the above air-conditioning system,

the control unit stores first position information indicating a position of each of the air supply ports and second position information indicating a position of each of the exhaust ports, and

the control unit controls the first air volume adjustment mechanism and the second air volume adjustment mechanism based on the position of the air supply port indicated by the first position information and the position of the air supply port indicated by the second position information.

[0042] The above air-conditioning system further includes:

a wireless receiver installed at at least one of the air supply port or the exhaust port; and a detector configured to detect a temperature or a humidity, the detector being capable of performing wireless communication with the wireless receiver, wherein the control unit identifies a position of the detector based on a signal strength of the detector acquired from the wireless receiver, and the first position information or the second position information, and the control unit controls the first air volume adjustment mechanism at the air supply port existing near the position of the detector or controls the second air volume adjustment mechanism of the exhaust port existing near the position of the detector, based on a detection result of the detector.

[0043] According to the air-conditioning system, by adjusting the air volume by the first airflow adjustment mechanism and the second airflow adjustment mechanism, the temperature or humidity can be adjusted in detail to improve comfort.

[0044] The above air-conditioning system further includes:

a third air flow path configured to transport air from a first opening provided near the air supply port in a fifth area in the indoor space to a second opening provided in a sixth area in the indoor space, wherein the control unit controls an amount of air flowing in the third air flow path.

[0045] According to the air-conditioning system, by having air flow through the third air flow path, temperature adjustment is facilitated and comfort can be improved.

[0046] The above air-conditioning system further includes:

a heat transfer apparatus including:

a second compressor;

a fourth heat exchanger configured to function as a condenser or an evaporator, the fourth heat exchanger being provided in a seventh area in the indoor space;

a fifth heat exchanger configured to function as a condenser or an evaporator, the fifth heat exchanger being provided in an eighth area in the indoor space; and

a second refrigerant circuit in which a refrigerant flows, the second refrigerant circuit being connected to the

second compressor, the fourth heat exchanger, and the fifth heat exchanger by a refrigerant pipe, wherein

the control unit causes the fourth heat exchanger to function as one of a condenser or an evaporator and causes the fifth heat exchanger to function as another one of a condenser or an evaporator.

[0047] The above air-conditioning system further includes:

a ventilation mechanism configured to exhaust air from the indoor space to the outdoors, wherein the control unit adjusts an amount of air exhausted and an amount of air exhausted by the ventilation device, based on an amount of air exhausted by the ventilation mechanism.

[0048] According to the air-conditioning system, by adjusting the amount of air supplied and the amount of air exhausted in consideration of the exhaust mechanism, the pressure change in the indoor space can be prevented to improve comfort.

[0049] In the above air-conditioning system,

the plurality of air supply ports are provided in an indoor space different from the indoor space in which the plurality of exhaust ports are provided, and when an amount of air taken in from at least one exhaust port of the plurality of exhaust ports changes, the control unit adjusts an amount of air taken in by another exhaust port of the plurality of exhaust ports by using the second air volume adjustment mechanism, such that a sum of amounts of air supplied from the plurality of air supply ports and a sum of amounts of air taken in from the plurality of exhaust ports substantially match each other.

[0050] According to the air-conditioning system, the air pressure in the indoor space can be stably maintained by stabilizing the amount of air taken in from the plurality of exhaust ports.

[0051] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
a first heat exchanger configured to function as a condenser or an evaporator;
a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
a second heat exchanger configured to function as a condenser or an evaporator;
a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the first heat exchanger is configured to reduce an evaporation temperature of a refrigerant flowing through the first heat exchanger, and when a target temperature and a target humidity are set, and the first heat exchanger is functioning as an evaporator, the control unit implements control to dehumidify air flowing in a state where the evaporation temperature in the first heat exchanger is reduced to reach the target humidity, and controls the temperature by the air-conditioner to reach the target temperature.

[0052] According to the air-conditioning system, air reaching a target temperature and a target humidity is taken in, thereby improving comfort.

[0053] In the air-conditioning system, when the target temperature and the target humidity are set, and the first heat exchanger is functioning as an evaporator, when performing heat exchange on the air flowing in a state where the evaporation temperature in the first heat exchanger is reduced, the control unit implements control such that the air

supplied to the indoor space after being subjected to heat exchange in the second heat exchanger maintains a temperature corresponding to the target humidity on a curve of 100% relative humidity in an air diagram.

[0054] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe, and

a control unit configured to control the ventilation device, wherein
 when the ventilation device performs a humidification operation, the control unit performs temperature control based on a temperature set for air that has undergone heat exchange by the first heat exchanger such that a target temperature and a target humidity set in advance are reached, according to isenthalpic change when water is supplied to the air that has undergone the heat exchange by the first heat exchanger.

[0055] According to the air-conditioning system, air reaching a target temperature and a target humidity is taken in, thereby improving comfort.

[0056] The present disclosure provides an air-conditioning system including:

a first air-conditioner including:

a first heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in an indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the first heat exchanger, and exhaust the air that has undergone heat exchange by the first heat exchanger to the indoor space,

a second air-conditioner including:

a second heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the second heat exchanger, and exhaust the air that has undergone heat exchange by the second heat exchanger to the indoor space, and

a control unit configured to control the first air-conditioner and the second air-conditioner, wherein the control unit

stores, in a storage unit, a first air-conditioning capability including a first minimum heat load determined as a minimum value of a heat load that can be output by the first air-conditioner, and a second air-conditioning capability including a second minimum heat load determined as a minimum value of a heat load that can be output by the second air-conditioner,
 acquires a temperature in the indoor space, and
 makes a setting to cause the second air-conditioner to process a first heat load, in a case where power consumption by the second air-conditioner for processing the second minimum heat load is lower than power consumption by the first air-conditioner for processing the first minimum heat load, and the first heat load required to be adjusted in the indoor space that is calculated based on the temperature of the indoor space is lower than the first minimum heat load.

[0057] According to the air-conditioning system, energy efficiency can be improved by using an air-conditioner having low power consumption.

[0058] In the air-conditioning system,

the first air-conditioning capability stored in the storage unit includes a first maximum heat load determined as a maximum value of a heat load that can be output by the first air-conditioner,
 the second air-conditioning capability stored in the storage unit includes a second maximum heat load determined as a maximum value of a heat load that can be output by the second air-conditioner, and
 when the second maximum heat load is lower than the first maximum heat load, and the first heat load calculated based on the temperature of the indoor space is higher than the first minimum heat load and the first heat load is lower than the second maximum heat load, the control unit causes an air-conditioner, among the first air-conditioner and the second air-conditioner, that requires a lower power consumption for processing the first heat load, to process the first heat load.

[0059] The above air-conditioning system further includes:

a first casing configured to accommodate at least a part of the first heat exchanger and the first air flow path; and
 a second casing configured to accommodate at least a part of the second heat exchanger and the second air flow path, wherein
 the first casing and the second casing are separable.

[0060] The above air-conditioning system further includes:

a third air volume adjustment mechanism configured to adjust an air volume of the air taken in from the outdoors and flowing to the indoor space from the first heat exchanger through the first air flow path; and
 a fourth air volume adjustment mechanism configured to adjust an air volume of the air that passes through the second air flow path from the indoor space and flows to the outdoors from the second heat exchanger, wherein
 the control unit sets an air volume of air supplied by the third air volume adjustment mechanism and an air volume of air taken in by the fourth air volume adjustment mechanism to be different from each other, based on an air volume of air supplied or exhausted by another device.

[0061] According to the air-conditioning system, it is possible to improve comfort by adjusting the amount of air exhausted and the amount of air taken in the entire indoor space.

[0062] In the air-conditioning system,

the ventilation device is provided in plurality, and
 the air-conditioning system further includes, for each of the plurality of ventilation devices:

a third air volume adjustment mechanism configured to adjust an air volume of the air taken in from the outdoors and flowing to the indoor space from the first heat exchanger through the first air flow path, and
 a fourth air volume adjustment mechanism configured to adjust an air volume of the air that passes through the second air flow path from the indoor space and flows to the outdoors from the second heat exchanger, and
 wherein

the control unit sets an air volume of air supplied by the third air volume adjustment mechanism and an air volume of air taken in by the fourth air volume adjustment mechanism in the indoor space, to be substantially the same.

[0063] According to the air-conditioning system, it is possible to improve comfort by preventing negative pressure in the indoor space.

[0064] The above air-conditioning system includes:

a ventilation device including:

a compressor used when performing a heat collection ventilation operation;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken
in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat
exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
the control unit acquires a temperature of the indoor space, and
when a first heat load required to be adjusted in the indoor space calculated based on the temperature of the indoor
space is a cooling load, and when a temperature of air in the outdoors is lower than a predetermined temperature,
the control unit reduces driving of the compressor, and sets at least one of an air direction or an air volume of air
supplied from the first air flow path such that air in the indoor space is replaced by air in the outdoors by the ventilation
device.

[0065] According to the air-conditioning system, it is possible to improve comfort by adjusting the air flow path so as
to be appropriate.

[0066] The above air-conditioning system further includes:

a plurality of air supply ports configured to supply air to the indoor space by the first air flow path; and
a plurality of exhaust ports configured to return air from the indoor space by the second air flow path, wherein
when the first heat load required to be adjusted in the indoor space calculated based on the temperature of the
indoor space is a cooling load, and when a temperature of air in the outdoors is lower than a predetermined tem-
perature, air is supplied by the plurality of air supply ports arranged on a first direction side in the indoor space and
air is exhausted by the plurality of exhaust ports arranged on a second direction side that is an opposite direction
to the first direction side in the indoor space.

[0067] According to the air-conditioning system, it is possible to improve comfort by preventing the air flow path from
being shortened when ventilating.

[0068] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
a first heat exchanger configured to function as a condenser or an evaporator;
a first air volume adjustment mechanism configured to pass air taken in from outdoors through the first heat
exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
a first casing configured to accommodate the first heat exchanger and the first air volume adjustment mechanism;
a second heat exchanger configured to function as a condenser or an evaporator;
a second air volume adjustment mechanism configured to pass air taken in from the indoor space through the
second heat exchanger and then supply the air that has passed through the second heat exchanger to the
outdoors;
a second casing configured to accommodate the second heat exchanger and the second air volume adjustment
mechanism; and
a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the
first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken
in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat
exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power

consumption of the ventilation device and a second capability indicating a heat load that can be output by the air-conditioner according to power consumption of the air-conditioner, acquires a temperature of the indoor space, and makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first capability and the second capability, and wherein

the first casing and the second casing are provided at different heights.

[0069] According to the air-conditioning system, the first casing and the second casing are provided at different heights, and, therefore, an air flow can be formed in the height direction and controlled so that the temperature distribution is substantially uniform, thereby improving comfort.

[0070] The present disclosure provides an air-conditioning system including:

a ventilation device including:

a compressor;
a first heat exchanger configured to function as a condenser or an evaporator;
a first air volume adjustment mechanism configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
a first casing configured to accommodate the first heat exchanger and the first air volume adjustment mechanism;
a second heat exchanger configured to function as a condenser or an evaporator;
a second air volume adjustment mechanism configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors;
a second casing configured to accommodate the second heat exchanger and the second air volume adjustment mechanism; and
a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power consumption of the ventilation device and a second capability indicating a heat load that can be output by the air-conditioner according to power consumption of the air-conditioner, acquires a temperature of the indoor space, and makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first capability and the second capability, and wherein

the first casing further includes a first switching mechanism configured to switch an air intake destination between the outdoors and the indoor space, and the second casing further includes a second switching mechanism configured to switch an air exhaust destination between the outdoors and the indoor space.

[0071] According to the air-conditioning system, the first switching mechanism and the second switching mechanism can switch between ventilation and indoor circulation according to the situation of an indoor space, thereby improving energy saving.

[0072] The present disclosure provides an air-conditioning control apparatus including:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 5 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 10 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

15 a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

20 a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit

generates a plurality of pieces of operation instruction information for controlling the air-conditioner and the ventilation device to control air-conditioning in the indoor space in which the air-conditioner and the ventilation
 25 device are installed,

acquires an amount correlated with an air-conditioning load in the indoor space,
 calculates, for each piece of the operation instruction information, an energy amount in a case where processing
 is performed according to the operation instruction information of the air-conditioning load in the indoor space
 based on the amount correlated with the air-conditioning load in the indoor space,
 30 stores the calculated energy amount in association with each piece of the operation instruction information in a storage unit, and

outputs the operation instruction information associated with the energy amount satisfying a predetermined condition to the air-conditioner or the ventilation device as an operation instruction.

35 **[0073]** According to the air-conditioning control device, it is possible to improve energy consumption efficiency by giving an operation instruction with suitable operation instruction information among a plurality of pieces of operation instruction information.

[0074] In the above air-conditioning control apparatus, the predetermined condition is a condition to collect cold heat from exhaust heat (a high-temperature refrigerant flows through exhaust path heat exchange) when a total heat balance
 40 in the indoor space is a temperature rise, and to collect warm heat from exhaust heat when the total heat balance in the indoor space is a temperature fall.

[0075] In the above air-conditioning control apparatus, the amount correlated with the air-conditioning load in the indoor space includes an amount relating to an air volume to be ventilated by the ventilation device.

45 Brief Description of Drawings

[0076]

[FIG. 1] FIG. 1 is a diagram illustrating a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to the first embodiment.

[FIG. 2] FIG. 2 is a diagram illustrating a correspondence relationship between power consumption in ventilation device capability information and a heat load (also referred to as an air-conditioning load) that can be supported according to the first embodiment.

[FIG. 3] FIG. 3 is a diagram illustrating an example of a sharing method by the control unit according to the first
 55 embodiment.

[FIG. 4] FIG. 4 is a diagram illustrating an example of a sharing method by the control unit according to the first embodiment.

[FIG. 5] FIG. 5 is a diagram illustrating an example of a sharing method by the control unit according to the first

embodiment.

[FIG. 6] FIG. 6 is a diagram illustrating an arrangement example of a ventilation device, an air-conditioner, and an upper level control device according to the modified example 1 of the first embodiment.

[FIG. 7] FIG. 7 illustrates a heat load detected for each area in the living room space.

[FIG. 8] FIG. 8 illustrates an example of an area to be processed by the ventilation device and an area to be processed by the air-conditioner according to the third embodiment.

[FIG. 9] FIG. 9 illustrates an example of an area to be processed by the ventilation device and an area to be processed by the two air-conditioners according to the third embodiment.

[FIG. 10] FIG. 10 is a diagram illustrating an example of an area to be processed by two ventilation devices and an area to be processed by an air-conditioner according to a third embodiment.

[FIG. 11] FIG. 11 is a flowchart illustrating a processing procedure performed by the upper level control device according to the third embodiment.

[FIG. 12] FIG. 12 is a diagram illustrating an arrangement of a group of devices including an upper level control device according to a fifth embodiment.

[FIG. 13] FIG. 13 is a diagram illustrating an arrangement of a group of devices in a living room space according to a fifth embodiment.

[FIG. 14] FIG. 14 is a diagram illustrating an arrangement of a group of devices in a living room space according to a modified example of the fifth embodiment.

[FIG. 15] FIG. 15 is a diagram illustrating an arrangement of a group of devices in a living room space according to a modified example 2 of the fifth embodiment.

[FIG. 16] FIG. 16 is a diagram illustrating an arrangement of a group of devices in a living room space according to a modified example 5 of the fifth embodiment.

[FIG. 17] FIG. 17 is a diagram illustrating an arrangement example of an upper level control device and two air-conditioners according to the sixth embodiment.

[FIG. 18] FIG. 18 illustrates a correspondence relationship between the power consumption in the two pieces of air-conditioner capability information and the air-conditioning capability (heat load that can be supported).

[FIG. 19] FIG. 19 is an air diagram illustrating the transition until the target temperature and target humidity are reached by controlling the ventilation device and the air-conditioner according to the seventh embodiment.

[FIG. 20] FIG. 20 is an air diagram illustrating the transition until the target temperature and target humidity are reached by controlling the ventilation device and the air-conditioner according to the eighth embodiment.

[FIG. 21] FIG. 21 illustrates an exemplary configuration of an upper level control device, an air supply unit, an exhaust unit, and a compressor unit according to the ninth embodiment.

[FIG. 22] FIG. 22 is a diagram illustrating an exemplary configuration of an upper level control device according to the tenth embodiment.

[FIG. 23] FIG. 23 illustrates a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to the eleventh embodiment.

[FIG. 24] FIG. 24 illustrates a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to a modified example of the eleventh embodiment.

[FIG. 25] FIG. 25 illustrates a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to the twelfth embodiment.

[FIG. 26] FIG. 26 illustrates an example of switching of an air supply damper and an exhaust damper according to the twelfth embodiment.

[FIG. 27] FIG. 27 illustrates an example of switching of an air supply damper and an exhaust damper according to the twelfth embodiment.

[FIG. 28] FIG. 28 illustrates an example of switching of an air supply damper and an exhaust damper according to the twelfth embodiment.

[FIG. 29] FIG. 29 is a diagram illustrating an arrangement of a group of devices including an upper level control device according to a thirteenth embodiment.

Description of Embodiments

[0077] Hereinafter, an air-conditioning system according to the present embodiment will be described with reference to the drawings. Note that the following embodiments are essentially preferred examples and the embodiments are not intended to limit the scope of the present disclosure, the application, or the use thereof.

(First embodiment)

[0078] FIG. 1 is a diagram illustrating a configuration example of a ventilation device, an air-conditioner, and an upper

level control device according to the first embodiment. In the example illustrated in FIG. 1, an air-conditioning system includes a ventilation device 1, an air-conditioner 2, and an upper level control device 100 for air-conditioning an indoor space.

[0079] In the present embodiment, as an example of an indoor space, an example having a living room space R11 and a ceiling space R12 will be described. However, the indoor space is not limited to the living room space R11 and the ceiling space R12, and may be a space inside a building, for example, a space under the floor.

[0080] An air supply unit 20 is arranged on the ceiling between the outside air inlet of the building wall and the indoor air supply air outlet, and an exhaust unit 10 is arranged on the ceiling between the indoor exhaust intake port and the outside air exhaust port of the building wall. Thus, the laying duct can be shortened to reduce pressure loss.

[0081] The living room space R11 is, for example, a living room inside an office or a house. The ceiling space R12 is an adjacent space above the living room space R11. The ceiling space R12 exists above the living room space R11, and, therefore, warm air tends to be collected in the ceiling space R12.

[0082] The air-conditioner 2 includes an outdoor unit 70 and two air-conditioning indoor units 81 and 82. In the present embodiment, the number of air-conditioning indoor units is not limited to two units, but may be one unit or three units or more.

[0083] The air-conditioner 2 performs a vapor compression type refrigeration cycle to cool and heat the living room space R11. The air-conditioner 2 according to the present embodiment can both cool and heat the living room space R11. However, the present embodiment is not limited to an air-conditioner capable of both cooling and heating, and may be a device capable of only cooling, for example.

[0084] The space between the outdoor unit 70 and the two air-conditioning indoor units 81 and 82 is connected by a connection pipe F5. The connection pipe F5 includes a liquid refrigerant connection pipe and a gas refrigerant connection pipe (not illustrated). Accordingly, a refrigerant circuit in which a refrigerant circulates between the outdoor unit 70 and the two air-conditioning indoor units 81 and 82 is formed. When refrigerant circulates in the refrigerant circuit, a vapor compression type refrigeration cycle is performed in the air-conditioner 2.

[0085] The outdoor unit 70 is arranged outdoors. The outdoor unit 70 is provided with a control unit 71 together with a heat exchanger (not illustrated), and the air in which the heat is exchanged with the refrigerant flowing through the heat exchanger is discharged outdoors.

[0086] The control unit 71 controls the entire air-conditioner 2. The control unit 71 transmits and receives information with the upper level control device 100. The control unit 71 performs various kinds of control in response to a control signal from the upper level control device 100.

[0087] The air-conditioning indoor units 81 and 82 are provided with a heat exchanger (example of a third heat exchanger), and the air-conditioning indoor units 81 and 82 take in the air in the living room space R11, and exchange the heat in the air with the refrigerant flowing through the heat exchanger, and blow the heat exchanged air into the living room space R11. In the present embodiment, the air-conditioning indoor units 81 and 82 are ceiling-installed types installed on the ceiling of the living room space R11. In particular, the air-conditioning indoor units 81 and 82 of the present embodiment are ceiling-embedded type air-conditioning indoor units, and air in which heat has been exchanged is blown out from exhaust ports 93A and 93B. Although an example in which the exhaust ports 93A and 93B are provided on the ceiling will be described in the present embodiment, the positions at which the exhaust ports 93A and 93B are provided are not particularly limited. The air-conditioning indoor units 81 and 82 are not limited to the ceiling-embedded type, and may be a ceiling-suspended type. The air-conditioning indoor units 81 and 82 may be other than the ceiling installed type, such as a wall mounted type or a floor mounted type.

[0088] The ventilation device 1 includes the exhaust unit 10, the air supply unit 20, a compressor unit 50, refrigerant circuits F1, F2, F3, and F4, an air supply path P1, and a return air path P2.

[0089] The ventilation device 1 supplies the air captured from outdoors to the living room space R11 and exhausts the air captured from the indoor space (including the living room space R11) to the outside. Thus, the ventilation device 1 implements the replacement of the air in the living room space R11.

[0090] Furthermore, the ventilation device 1 according to the present embodiment exchanges heat between the exhaust unit 10 and the air supply unit 20 to reduce the temperature difference between the temperature of the air taken in from the outside and the temperature of the living room space R11.

[0091] The air supply path P1 (an example of the first air flow path) is a flow path for supplying air taken in from the outside to the living room space R11 from the air supply port 92 after passing the air supply unit 20 having the first heat exchanger 22. Although the present embodiment will describe an example in which the air supply port 92 is provided on the ceiling, the position at which the air supply port 92 is provided is not particularly limited.

[0092] The return air flow path P2 (an example of the second air flow path) is a flow passage for exhausting air (return air) taken in from the exhaust port 91 of the living room space R11 to the outside after passing through the exhaust unit 10 having the second heat exchanger 12. Although the present embodiment will describe an example in which the exhaust port 91 is provided on the ceiling, the position at which the exhaust port 91 is provided is not particularly limited.

[0093] The refrigerant circuits F1, F2, F3, and F4 are circuits in which the compressor unit 50, the first heat exchanger

22 of the air supply unit 20, and the second heat exchanger 12 of the exhaust unit 10 are connected by refrigerant pipe, and the refrigerant flows in these refrigerant circuits.

[0094] The control unit 52 of the compressor unit 50, the control unit 23 of the air supply unit 20, and the control unit 13 of the exhaust unit 10 are connected by a signal line S1 indicated by a dotted line in FIG. 1. Thus, information can be transmitted and received between the control unit 52 of the compressor unit 50, the control unit 23 of the air supply unit 20, and the control unit 13 of the exhaust unit 10.

[0095] The compressor unit 50 is provided with a driving motor 51 and a control unit 52, and controls circulation of the refrigerant in the refrigerant circuits F1, F2, F3, and F4 by compressing any one of the refrigerants in the refrigerant circuits F1, F2, F3, and F4. For example, when the second heat exchanger 12 in the exhaust unit 10 functions as an evaporator, the compressor unit 50 compresses the refrigerant in the refrigerant circuit F2 to circulate the refrigerant in the refrigerant circuits F1, F2, F3, and F4.

[0096] The driving motor 51 is a motor for rotating (driving) the compressor for compressing the refrigerant.

[0097] The control unit 52 controls the configuration in the compressor unit 50. For example, the control unit 52 outputs an instruction for rotating (driving) the compressor to the driving motor 51.

[0098] Further, the control unit 52 of the compressor unit 50 transmits the status of the ventilation device 1 received from the control unit 23 of the air supply unit 20 and the control unit 13 of the exhaust unit 10 to the upper level control device 100. Accordingly, the upper level control device 100 can implement control according to the status of the ventilation device 1.

[0099] The air supply unit 20 includes a fan 21, a first heat exchanger 22, a control unit 23, and a temperature detecting unit 24, and takes in the outside air (OA), and supplies air (SA) to the living room space R11.

[0100] The fan 21 functions to supply air (SA) to the living room space R11 from the outside air (OA) that is taken in.

[0101] The first heat exchanger 22 functions as a condenser or an evaporator.

[0102] The temperature detecting unit 24 detects the surface temperature of the first heat exchanger 22 and the temperature of the refrigerant flowing through the first heat exchanger 22.

[0103] Further, the temperature detecting unit 24 may detect the outdoor temperature and humidity through a sensor (not illustrated) provided near the intake port of air from the outdoors. The temperature detecting unit 24 may detect the temperature and humidity of air in the living room space R11 through a sensor (not illustrated) provided near the air supply port 92.

[0104] The control unit 23 controls the configuration inside the air supply unit 20. The control unit 23 performs various kinds of control according to the detection result by the temperature detecting unit 24. For example, the control unit 23 adjusts the function of the first heat exchanger 22 as a condenser or an evaporator according to the detection result by the temperature detecting unit 24.

[0105] The control unit 23 transmits the detection result by the temperature detecting unit 24 or the like in the air supply unit 20 to the control unit 52 of the compressor unit 50. The control unit 52 of the compressor unit 50 may transmit the detection result to the upper level control device 100 or may transmit the current status recognized based on the detection result to the upper level control device 100.

[0106] The exhaust unit 10 is provided with a fan 11, a second heat exchanger 12, a control unit 13, and a temperature detecting unit 14, takes in return air (RA) of the living room space R11, and exhausts (EA) the taken in air to the outside.

[0107] The fan 11 functions to exhaust (EA) the return air (RA) taken in from the living room space R11 to the outside.

[0108] The second heat exchanger 12 functions as a condenser or an evaporator.

[0109] The temperature detecting unit 14 detects the outdoor air temperature, the surface temperature of the second heat exchanger 12, and the temperature of the refrigerant flowing through the second heat exchanger 12.

[0110] Further, the temperature detecting unit 14 may detect the temperature and humidity of air in the living room space R11 through a sensor (not illustrated) provided near the exhaust port 91.

[0111] The control unit 13 controls the configuration of the inside of the exhaust unit 10. The control unit 13 performs various kinds of control according to the detection result by the temperature detecting unit 14. For example, the control unit 13 adjusts the function of the second heat exchanger 12 as a condenser or an evaporator according to the detection result of the temperature detecting unit 14.

[0112] The control unit 13 transmits the detection result of the temperature detecting unit 14 or the like in the exhaust unit 10 to the control unit 52 of the compressor unit 50. The control unit 52 of the compressor unit 50 may transmit the detection result to the upper level control device 100 or may transmit the current status recognized based on the detection result to the upper level control device 100.

[0113] The upper level control device 100 includes a control unit 101 and a storage unit 102, and performs various kinds of control to coordinate the operation of the ventilation device 1 and the operation of the air-conditioner 2.

[0114] The storage unit 102 stores ventilation device capability information 111 and air-conditioner capability information 112. The storage unit 102 is, for example, a non-volatile storage medium capable of reading and writing information.

[0115] The ventilation device capability information 111 is capability information (an example of the first capability) indicating the correlation of the heat load that can be output corresponding to the power consumption of the ventilation

device 1 as a performance curve. The ventilation device capability information 111 may be specified in accordance with the temperature and humidity in the room and the amount of air to be ventilated.

[0116] The ventilation device capability information 111 includes the minimum heat load L1_min that can be set based on the power consumption of the ventilation device 1 out of the heat loads that the ventilation device 1 can output, and the ventilation device capability information 111 includes the maximum heat load L1_max that the ventilation device 1 can set out of the heat loads that the ventilation device 1 can output.

[0117] The air-conditioner capability information 112 is capability information (example of the second capability) that indicates the correlation of the heat loads that can be output corresponding to the power consumption of the air-conditioner 2 as a performance curve. Further, the air-conditioner capability information 112 may be specified in accordance with a settable air volume.

[0118] The air-conditioner capability information 112 includes the minimum heat load L2_min which can be set based on the power consumption of the air-conditioner 2 out of the heat loads which can be output by the air-conditioner 2, and the air-conditioner capability information 112 includes the maximum heat load L2_max which can be set by the air-conditioner 2 out of the heat loads which can be output by the ventilation device 1.

[0119] FIG. 2 is a diagram illustrating the correspondence relationship between the power consumption in the air-conditioner capability information 112 and the heat load (also referred to as the air-conditioning load) that can be supported. A line 1201 indicates the heat load that the air-conditioner can support in accordance with the power consumption. As illustrated by the line 1201, the higher the power consumption, the higher the heat load (air-conditioning load) that can be supported. However, as indicated by a line 1202, even if the air-conditioning load becomes lower than a predetermined value, the power consumption does not decrease. Therefore, in the air-conditioner capability information 112, the heat load at which the power consumption does not decrease even if the heat load is further decreased, is set as the minimum heat load L2_min that can be set. The maximum heat load L2_max that can be set for the air-conditioner is also set.

[0120] In the present embodiment, an example in which the ventilation device capability information 111 and the air-conditioner capability information 112 are stored in advance will be described, but the correspondence between the power consumption and the heat load may be stored in any form, in a table form, or as an approximate expression.

[0121] The control unit 101 acquires the detection result of the temperature detecting unit 24 of the air supply unit 20 and the detection result of the temperature detecting unit 14 of the exhaust unit 10 via the control unit 52 of the compressor unit 50. Accordingly, the control unit 101 can acquire the temperature in the living room space R11, the temperature outside, and the like. Further, the control unit 101 may acquire the temperature, etc., detected by the remote controller for operating the air-conditioner 2 via the control unit 71 of the outdoor unit 70.

[0122] The control unit 101 calculates a heat load target value ACL (example of the first heat load) determined as a control target in the living room space R11 based on the temperature, etc., of the living room space R11. As a calculation method, for example, the calculation may be performed by formula (1).

$$\text{Heat load target value ACL [W]} = \alpha(T_{\text{out}} - T_{\text{in}}) + \beta + (V_e + V_d) \times (H_{\text{out}} - H_{\text{in}}) + (C_p B \times V_b + C_p A \times V) \times (T_{\text{in}} - T_{\text{set}}) \quad (1)$$

[0123] Among the parameters illustrated in formula (1), the indoor temperature T_{in} , the outdoor temperature T_{out} , the indoor air enthalpy H_{in} , and the indoor air enthalpy H_{out} are values that can be calculated from the detection results of the temperature detecting unit 14 or 24. The target temperature T_{set} is the target temperature set by the user with a remote controller of the air-conditioner 2.

[0124] Among the parameters indicated in formula (1), the building heat capacity $C_p B$, the building capacity V_b , the air heat capacity $C_p A$, the volume V of air, the forced ventilation amount V_e , and the draft ventilation amount V_d may be predetermined values or values obtained by a predetermined learning result.

[0125] The parameter α is determined according to the embodiment. The parameter β is determined according to one or more of the device heat generation amount, the lighting internal heat generation amount, the human internal heat generation amount, etc., set in the living room space R11.

[0126] Then, the control unit 101 makes settings so that the ventilation device 1 and the air-conditioner 2 share the calculated heat load target value ACL in accordance with the ventilation device capability information 111 and the air-conditioning capability information 112.

[0127] That is, in formula (1), $\alpha(T_{\text{out}} - T_{\text{in}}) + (V_e + V_d) \times (H_{\text{out}} - H_{\text{in}})$ is the heat load generated by ventilation between the living room space R11 and the outdoors, and $\beta + (C_p B \times V_b + C_p A \times V) \times (T_{\text{in}} - T_{\text{set}})$ is the heat load generated in the living room space R11. That is, the control unit 101 according to the present embodiment calculates the heat load target value ACL by adding the heat load generated by ventilation between the living room space R11 and the outdoors and the heat load generated in the living room space R11. In the present embodiment, power consumption can be reduced by appropriately sharing the sum of the heat load of the living room space R11 and the heat load generated by

ventilation.

[0128] When making a setting to assign a share of a part of the heat load target value ACL with respect to the ventilation device 1, the control unit 101 adjusts the temperature of the air supply in the living room space R11 by making the first heat exchanger 22 function as a condenser or an evaporator.

[0129] For example, the control unit 101 instructs the rotation speed of the compressor to the control unit 52 of the compressor unit 50 so that the measured value of the air temperature detected after passing through the first heat exchanger 22 becomes the target temperature Tset. At this time, feedback control may be performed so that the measured value that changes according to the time will follow the target temperature Tset.

[0130] Then, the control unit 101 identifies the remaining heat load obtained by subtracting the heat load required for the measured value of the ventilation device 1 to reach the target temperature Tset from the heat load target value ACL, as the heat load to be processed by the air-conditioner 2. Then, the control unit 101 calculates the operation condition necessary for processing the identified heat load by the air-conditioner 2, and instructs the air-conditioner 2 to satisfy the identified operation condition.

[0131] Thus, the heat load target value ACL can be shared by the ventilation device 1 and the air-conditioner 2.

[0132] In the present embodiment, various sharing methods may be used in addition to the above sharing method.

[0133] When the heat load target value ACL is lower than the minimum heat load L1_min of the ventilation device 1 stored in the ventilation device capability information 111 and the heat load target value ACL is lower than the minimum heat load L2_min of the air-conditioner 2 stored in the air-conditioner capability information 112, the control unit 101 stops the operation of the air-conditioner 2. Then, the control unit 101 controls the ventilation device 1 to repeat operating according to the capability corresponding to the minimum heat load and stopping the operation.

[0134] Further, the control unit 101 sets the operation time and the stop time per unit time so that the average value of the heat load processed in the unit time corresponds to the heat load target value ACL. Specifically, the control unit 101 sets the operation time and the stop time so that the heat load target value ACL = the minimum heat load L1_min $\times$ (operation time/(operation time + stop time)). Thus, the optimal control to satisfy the heat load target value ACL can be implemented.

[0135] That is, in the present embodiment, by alternately repeating operating and stopping the operation, it is possible to implement the control to reach the heat load target value ACL. The fans 11 and 21 of the ventilation device 1 are constantly operated to maintain the ventilation of the living room space R11. The aforementioned control can reduce the low-load operation of the air-conditioner 2, thereby reducing power consumption.

[0136] The control unit 101 according to the present embodiment may cause the heat load to be shared according to the following operation patterns. In the example illustrated in FIGS. 3 to 5, a case in which the heat load processing efficiency of the ventilation device 1 is higher than that of the air-conditioner 2 (a case in which the power consumption is small when the same load is processed) will be described.

[0137] FIG. 3 is a diagram illustrating an example of a sharing method by the control unit 101. As illustrated in FIG. 3, when it is determined that the heat load target value ACL (1303) is greater than or equal to the sum of the minimum heat load L2_min (1301) of the air-conditioner 2 and the maximum heat load L1_max (1302) of the ventilation device 1, the maximum heat load L1_max (1302) is assigned to the ventilation device 1, and the difference (1304) obtained by subtracting the maximum heat load L1_max of the ventilation device 1 from the heat load target value ACL is assigned to the air-conditioner 2.

[0138] FIG. 4 is a diagram illustrating an example of a sharing method by the control unit 101. As illustrated in FIG. 4, when it is determined that the heat load target value ACL (1402) is lower than the maximum heat load L1_max (1401) of the ventilation device 1 and greater than or equal to the minimum heat load L1_min (1403) of the ventilation device 1, the entire heat load 1404 corresponding to the heat load target value ACL (1402) is assigned to the ventilation device 1.

[0139] FIG. 5 is a diagram illustrating an example of the sharing method by the control unit 101. As illustrated in FIG. 5, when it is determined that the heat load target value ACL (1503) is lower than the sum of the maximum heat load L1_max (1502) of the ventilation device 1 and the minimum heat load L2_min (1501) of the air-conditioner 2, and is greater than or equal to the maximum heat load L1_max (1504) of the ventilation device 1, the minimum heat load L2_min is assigned to the air-conditioner 2, and the difference (1505) obtained by subtracting the minimum heat load L2_min from the heat load target value ACL to the air-conditioner 2 is assigned to the ventilation device 1.

[0140] In the examples illustrated in FIGS. 3 to 5, a large share of the load processing is assigned to the ventilation device 1, thereby improving the load efficiency.

[0141] When assigning the heat load to the air-conditioner 2 because the heat load target value ACL (1503) is larger than the maximum heat load L1_max of the ventilation device 1, etc., the control unit 101 maintains the operation corresponding to the minimum heat load L2_min with respect to the air-conditioner 2. Accordingly, frequent thermal start and stop of the air-conditioner 2 can be prevented at the time of performing a cooperative operation.

[0142] In the present embodiment, after the operation control is started by having the heat load target value ACL shared between the ventilation device 1 and the air-conditioner 2, the ratio of sharing may be changed according to the change of the status. For example, when the cooling operation is carried out by the ventilation device 1, the air cooled

by the first heat exchanger 22 cools the air in the room where the first heat exchanger 22 is installed via the first heat exchanger 22, and condensation may occur on the surface of the air supply unit 20. In such a case, a part of the share of the ventilation device 1 is adjusted to be assigned to the air-conditioner 2.

[0143] The control unit 101 receives the air temperature measured by the sensor unit provided downstream of the first heat exchanger 22, from the air supply unit 20 via the control unit 52 of the compressor unit 50.

[0144] The control unit 101 receives the temperature and humidity data of the living room space R11 from the control unit 71 of the outdoor unit 70. The temperature and humidity data of the living room space R11 is, for example, the data detected by the remote control of the air-conditioner 2.

[0145] The control unit 101 calculates the condensation temperature based on the temperature and humidity data of the living room space R11.

[0146] The control unit 101 determines whether the temperature of the air downstream of the first heat exchanger 22 from the air supply unit 20 is greater than or equal to the condensation temperature (an example of a predetermined standard).

[0147] When the control unit 101 determines that the temperature of the air downstream of the first heat exchanger 22 is lower than the condensation temperature (an example of a predetermined standard) (when the control unit 101 determines that the temperature does not meet a predetermined standard), the control unit 101 reassigns the share so as to reduce the processing capability of the heat load of the ventilation device 1 and increase the processing capability of the heat load of the air-conditioner 2 compared with before the determination.

[0148] In the present embodiment, when the control unit 101 of the upper level control device 100 performs the control described above, the heat load can be appropriately shared between the ventilation device and the air-conditioner, thereby improving energy consumption efficiency.

(Modified example 1 of first embodiment)

[0149] In the above-described embodiment, an example in which one air supply port and one exhaust port are provided for each of the air supply unit 20 and the exhaust unit 10 has been described. However, the present embodiment is not limited to the above-described configuration. Therefore, in the modified example 1 of the first embodiment, an example in which a plurality of exhaust ports are provided for each of the air supply unit 20 and the exhaust unit 10 will be described.

[0150] FIG. 6 is a diagram illustrating an arrangement example of a ventilation device, an air-conditioner, and an upper level control device according to the present modified example. In the example illustrated in FIG. 6, the same reference numerals are assigned to the configurations similar to those of the above-described embodiment, and descriptions thereof will be omitted.

[0151] In present modified example, in the air-conditioner 2A, three air-conditioning indoor units 81, 82, and 83 are provided in the outdoor unit 70. The control of the air-conditioner 2A is the same as that of the air-conditioner 2 of the above-described embodiment. The air-conditioner 2A and the three air-conditioning indoor units 81, 82, and 83 are connected by a connection pipe F101.

[0152] The ventilation device 1A is provided with the compressor unit 50, the exhaust unit 10, and the air supply unit 20. The compressor unit 50, the exhaust unit 10, and the air supply unit 20 are connected by the connection pipe F102.

[0153] The exhaust unit 10 is connected to a plurality of exhaust ports 93A to 93D via an exhaust duct P102 (an example of a second air flow path).

[0154] The air supply unit 20 is connected to a plurality of air supply ports 92A to 92D via an air supply duct P101 (an example of a first air flow path).

[0155] Accordingly, a plurality of air supply ports 92A to 92D and exhaust ports 93A to 93D are arranged in the living room space R51, and, therefore, air can circulate in the living room space R51, thereby improving ventilation efficiency.

[0156] Further, an opening/closing damper (not illustrated) (an example of the first air volume adjustment mechanism) may be provided in the supply duct P101 for each branch flow path separated by the air supply ports 92A to 92D. The opening/closing damper adjusts the amount of air supplied to each air supply port 92A to 92D in accordance with control from the control unit 23 of the air supply unit 20, for example.

[0157] Similarly, an opening/closing damper (not illustrated) (an example of the first air volume adjustment mechanism) may be provided in the exhaust duct P102 for each branch channel separated by each exhaust port 93A to 93D. The opening/closing damper adjusts the amount of air returned to each exhaust port 93A to 93D in accordance with control from the control unit 13 of the exhaust unit 10, for example.

[0158] For example, the upper level control device 100 can finely adjust the amount of air blown out by outputting a control signal indicating the opening/closing of the opening/closing damper provided at each of the air supply ports 92A to 92D or the exhaust ports 93A to 93D with respect to the control unit 23 of the air supply unit 20 and the control unit 13 of the exhaust unit 10 in accordance with the temperature distribution, humidity distribution, or ventilation status in the living room space R51, thereby improving the comfort in the living room space R51 and reducing the power consumption.

[0159] Further, although an example in which the opening/closing damper is provided for each of the air supply ports 92A to 92D and the exhaust ports 93A to 93D has been described in the present modified example, an air volume adjustment mechanism other than the opening/closing damper may be provided. For example, an air flow fan which can adjust the air volume may be installed for each of the air supply ports 92A to 92D and the exhaust ports 93A to 93D.

(Second embodiment)

[0160] In the first embodiment, an example in which one ventilation device 1 and one air-conditioner 2 are provided has been described. However, the above-described embodiment is not limited to an example in which one ventilation device 1 and one air-conditioner 2 are provided. Therefore, in the second embodiment, an example in which a plurality of ventilation devices 1 and a plurality of air-conditioners 2 are provided will be described. Otherwise, the contents are the same as the above embodiment and descriptions will be omitted.

[0161] In the present embodiment, the number of ventilation devices 1 is plural (for example, two units). The number of air-conditioners 2 is plural (for example, two units).

[0162] Similarly to the above-described embodiment, the control unit 101 sets the load target value that needs to be adjusted in the living room space R11 calculated based on the temperature of the living room space R11, to be shared among the plurality of ventilation devices 1 and the plurality of air-conditioners 2.

[0163] The control unit 101 calculates the total power consumption W_{total} by using the following formula (2).

$$W_{total} = \sum_{i=1}^{n1} W_{o_i} + \sum_{i=1}^{n2} W_{a_i} \quad \dots (2)$$

[0164] Among the variables indicated in formula (2), $n1$ is the number of ventilation devices 1 and $n2$ is the number of air-conditioners 2. It is assumed that the power consumption W_{o_i} of the ventilation device 1 (power consumption of the i -th ventilation device 1) = Function1(V_s , V_r , T_{set} , T_s , T_r , L_{fo_i}), and the power consumption W_{a_i} of the air-conditioner 2 (power consumption of the i -th air-conditioner 2) = Function2(T_{set} , T_s , T_r , L_{fa_i}). Note that Function1 and Function2 are defined as functions for calculating power consumption according to the embodiment.

[0165] The parameters indicated in formula (2) are the air volume V_s supplied at the ventilation device 1, the air volume V_r exhausted by the ventilation device 1, the outdoor temperature T_s , the temperature T_r of the living room space R11, and the target temperature T_{set} . The ventilation device load factor is calculated as $L_{fo_i} = C_{fo_i}/C_{o_{max}}$ [W] and the air-conditioner load factor is calculated as $L_{fa_i} = C_{fa_i}/C_{a_{max}}$ [W].

[0166] The ventilation device capacity C_{fo_i} indicates the share of heat load assigned to the i -th ventilation device 1, and the air-conditioner capacity C_{fa_i} indicates the share of heat load assigned to the i -th air-conditioner 2.

[0167] It is assumed that $C_{o_{max}}$ [W] is the maximum capability of the ventilation device 1 (maximum settable heat load), and $C_{a_{max}}$ [W] is the maximum capability of the air-conditioner 2 (maximum settable heat load).

[0168] Further, the ventilation device capacity $C_{fo_i} >$ the minimum capacity of the ventilation device (minimum settable heat load) $C_{o_{min}}$ [W], and the air-conditioner capacity $C_{fa_i} >$ the minimum capacity of the air-conditioner (minimum settable heat load) $C_{a_{min}}$ [W] need to be satisfied.

[0169] The maximum capacity of the ventilation device 1 (maximum settable heat load) $C_{o_{max}}$ [W], the maximum capacity of the air-conditioner 2 (maximum settable heat load) $C_{a_{max}}$ [W], the minimum capacity of the ventilation device (minimum settable heat load) $C_{o_{min}}$ [W], and the minimum capacity of the air-conditioner (minimum settable heat load) $C_{a_{min}}$ [W] may be previously stored in the storage unit as the ventilation device capability information 111 and the air-conditioner capability information 112, or may be calculated based on a learning result.

[0170] The control unit 101 calculates a ventilation device load factor L_{fo} and an air-conditioner load factor L_{fa} by which the total power consumption W_{total} is minimized. In doing so, the condition of the following formula (3) is satisfied. Thus, the sharing by the ventilation device 1 and the air-conditioner 2 is identified.

[0171] The relationship between the heat load target value ACL and the ventilation device capacity C_{fo_i} of the ventilation device 1 (ventilation device capacity of the i -th ventilation device 1) and the air-conditioner capacity C_{fa_i} of the air-conditioner (air-conditioner capacity of the i -th air-conditioner 2) can be expressed by formula (3). According to the above calculation, the heat load target value ACL is shared by the ventilation device 1 and the air-conditioner 2 according to the ventilation device load factor L_{fo_i} and the air-conditioner load factor L_{fa_i} .

$$ACL = \sum_{i=1}^{n1} C_{fo_i} + \sum_{i=1}^{n2} C_{fa_i} \quad \dots (3)$$

[0172] Further, the control unit 101 stops the operation of the plurality of air-conditioners 2 when the heat load target value ACL (an example of the first heat load) [W] calculated by the above formula (1) is lower than the total value of the minimum capacity Comin [W] of the plurality of (e.g., two units) ventilation devices 1 installed in the present embodiment and the total value of the minimum capacity Camin [W] of the plurality of (e.g., two units) air-conditioners 2 installed in the present embodiment.

[0173] Then, the control unit 101 stops a part (e.g., one unit) of the plurality of ventilation devices 1 and operates the other ventilation devices 1 (e.g., one unit). If the heat load target value ACL > the minimum capacity per ventilation device Comin [W], the control unit 101 can achieve the target by instructing only one ventilation device 1 to operate by the heat load corresponding to the heat load target value ACL.

[0174] The fans 11 and 21 of the ventilation device 1 are constantly maintained in operation.

[0175] In the case where the heat load target value ACL < the minimum capacity per ventilation device Comin [W], similarly to the first embodiment, the control unit 101 instructs one ventilation device 1 to repeat operating and stopping the operation with the minimum capacity so as to correspond to the heat load target value ACL. Thus, low-load operation of the air-conditioner 2 can be avoided.

[0176] Further, when the living room space is large, the heat load may be different depending on the area. FIG. 7 illustrates the detected heat load for each area. In the example illustrated in FIG. 7, two ventilation devices 1A and 1B and two air-conditioners 2A and 2B are provided. The upper level control device 100 controls the two ventilation devices 1A and 1B and the two air-conditioners 2A and 2B.

[0177] The ventilation device 1A includes a compressor unit 50A, an air supply unit 20A, and an exhaust unit 10A. The ventilation device 1B includes a compressor unit 50B, an air supply unit 20B, and an exhaust unit 10B.

[0178] The air-conditioner 2A includes an outdoor unit 70A and an air-conditioning indoor unit 81A. The air-conditioner 2B includes an outdoor unit 70B and an air-conditioning indoor unit 81B.

[0179] In the example illustrated in FIG. 7, in the living room space R101, a cooling load (a heat load that needs to be removed by control that lowers the temperature in order to reach the target temperature) is generated in the area R101A, and a heating load (a heat load that needs to be applied by control that raises the temperature in order to reach the target temperature) is generated in the area R101B.

[0180] In such a case, when cooling is performed by the ventilation device 1A and the air-conditioner 2A existing in the area R101A, and heating is performed by the ventilation device 1B and the air-conditioner 2B existing in the area R101B, power consumption becomes large.

[0181] Therefore, the control unit 101 according to the present embodiment adds all the heat load target values (for example, the cooling load in area R101A and the heating load in area R101B) arising in each area of the living room space R101, and shares the total heat load target value among the two ventilation devices 1A and 1B, and the two air-conditioners 2A and 2B.

[0182] Thus, even when the cooling load and the heating load are mixed in the same air-conditioning zone (for example, the living room space R101), the efficiency of power consumption is improved by sharing the heat load based on the sum of the cooling load and the heating load.

[0183] Further, the control of the ventilation devices 1A and 1B is made different depending on whether the total heat load target value is the cooling load or the heating load.

[0184] That is, the control unit 101 according to the present embodiment causes the first heat exchanger 22 of the air supply units 20A and 20B of the plurality of ventilation devices 1A and 1B to function as an evaporator and causes the second heat exchanger 12 of the exhaust units 10A and 10B of the plurality of ventilation devices 1A and 1B to function as a condenser, when the total heat load target value is a cooling load.

[0185] On the other hand, the control unit 101 according to the present embodiment causes the first heat exchanger 22 of the air supply units 20A and 20B of the plurality of ventilation devices 1A and 1B to function as a condenser and causes the second heat exchanger 12 of the exhaust units 10A and 10B of the plurality of ventilation devices 1A and 1B to function as an evaporator, when the total heat load target value is a heating load.

[0186] Further, the control unit 101 assigns a different share of heat load according to the positions where the ventilation devices 1A and 1B are installed.

[0187] When it is determined that the total heat load target value (an example of the first heat load) is the cooling load, the control unit 101 sets the load share of the ventilation device including the second heat exchanger which takes in air from the low temperature area to be larger than the load share of the other ventilation device, among the plurality of ventilation devices 1A and 1B.

[0188] In the example illustrated in FIG. 7, the heat load share of the ventilation device 1B provided in the heating load area R101B (the area that needs to be heated, that is, the area where the temperature is low) is made larger than that of the ventilation device 1A. That is, the temperature of the air to be exhausted is low, and, therefore, the heat radiation efficiency can be increased.

[0189] When it is determined that the total heat load target value (an example of the first heat load) is a heating load, the control unit 101 sets the load share of the ventilation device 1A including the second heat exchanger which takes

in air from the high temperature area to be larger than the load share of the other ventilation device 1B, among the plurality of ventilation devices 1A, 1B.

[0190] In the example illustrated in FIG. 7, the heat load share assigned to the ventilation device 1A provided in the cooling load area R101A (the area that needs cooling, that is, the area with high temperature) is made larger than that of the ventilation device 1B. That is, the temperature of the exhaust air is high, and, therefore, the heat radiation efficiency can be increased.

(Third embodiment)

[0191] In addition to the embodiments described above, there exist other arrangements of ventilation devices and air-conditioners. Therefore, in the third embodiment, various arrangements of ventilation devices and air-conditioners will be described. In the third embodiment, the upper level control device 100, the ventilation device 1B, and the air-conditioner 2B are installed. The internal configurations of the upper level control device 100, the ventilation device, and the air-conditioner are the same as those in the above embodiment, and descriptions thereof will be omitted.

[0192] FIG. 8 is a diagram illustrating an example of the area to be processed by the ventilation device 1B and the areas to be processed by the air-conditioner 2B according to the third embodiment. In the example illustrated in FIG. 8, the living room space R201 is divided into 16 areas of 4×4 .

[0193] For the ventilation device 1B, the area R211 corresponding to the living room space R201 is the area to be processed, and for the air-conditioner 2B, the 16 areas R211A to R211P corresponding to the living room space R201 are the areas to be processed.

[0194] FIG. 9 illustrates an example of the areas to be processed by the ventilation device 1B and the areas to be processed by the two air-conditioners 2B. For the ventilation device 1B, the area R211 corresponding to the living room space R201 is the area to be processed. One of the two air-conditioners 2B has eight areas R211A to R211H as the areas to be processed, and the other has eight areas R211I to R211P as the areas to be processed.

[0195] FIG. 10 illustrates an example of the areas to be processed of the two ventilation devices 1B and the areas to be processed of the air-conditioner 2B.

[0196] One of the two ventilation devices 1B has the area R211Q as the area to be processed, and the other has the area R211R as the area to be processed. The air-conditioner 2B has the 16 areas R211A to R211P as the areas to be processed.

[0197] With regard to the correspondence relationship of the areas to be processed to be processed between the ventilation device 1B and the air-conditioner 2B illustrated in FIGS. 8 to 10, the user makes a cooperative setting with respect to the upper level control device 100, so that the upper level control device 100 can perform cooperative control.

[0198] As the cooperative setting, the user associates the heat sources of the air-conditioner and the ventilation device to be subject to cooperative control with each area to be processed based on the position information of the areas to be processed that are input by using a controller (not illustrated) or the like. Thus, cooperative control of the ventilation device 1B and the air-conditioner 2B by the upper level control device 100 can be implemented.

[0199] In the present embodiment, cooperative control is enabled when the same zone in the living room space R201 or the like is completely covered by the areas to be processed of the air-conditioners 2B or the areas to be processed of the ventilation device 1A of the same heat source. In the present embodiment, the device provided in a smaller number among the ventilation device 1B and the air-conditioner 2B is one unit, and the device provided in a larger number among the ventilation device 1B and the air-conditioner 2B is two units, but the present embodiment is not limited to these numbers.

[0200] Next, a processing procedure performed by the upper level control device 100 according to the present embodiment will be described. FIG. 11 is a flowchart illustrating a processing procedure performed by the upper level control device 100 according to the present embodiment.

[0201] First, the upper level control device 100 calculates a load target value in the living room space R201 (S2101). The calculation method of the load target value is the same as the above-described embodiment, and the description thereof will be omitted.

[0202] Next, the upper level control device 100 calculates the ventilation device load factor and the air-conditioner load factor (S2102). A specific calculation method of the ventilation device load factor and the air-conditioner load factor will be described later.

[0203] Next, based on the ventilation device load factor and the air-conditioner load factor, the upper level control device 100 transmits the target processing load in which the load target value is shared among devices, to the ventilation device 1B and the air-conditioner 2B (S2103).

[0204] Then, the ventilation device 1B implements control with the processing capability corresponding to the target processing load (S2104).

[0205] When the temperature is controlled, the air-conditioner 2B implements control with the processing capability corresponding to the target processing load, and when the temperature controlling is stopped, the air-conditioner 2B

maintains the temperature control stop state (S2105).

[0206] The upper level control device 100 determines whether the predetermined condition is satisfied (S2106).

[0207] The predetermined condition is a case in which the average value of the predetermined period (e.g., 5 minutes) of two or more indoor units connected to the external control unit whose temperature control is stopped, satisfies "the temperature of the air being taken in < the target temperature - A (e.g., 1.0 degrees)" or "the temperature of the air being taken in > the target temperature + B (e.g., 1.0 degrees)".

[0208] The other predetermined condition is a case in which the integrated value of the predetermined period (e.g., 5 minutes) of the indoor units connected to the external control unit whose temperature control is being operated satisfies "(the integrated value of the processing capability for the predetermined period - the integrated value of the target processing load for the predetermined period) > C (for example, 0.2) × (the integrated value of the target processing load for the predetermined period)".

[0209] That is, when the upper level control device 100 determines that the predetermined condition indicating a large deviation from the current status has been satisfied (YES in S2106), the upper level control device 100 performs processing from S2101 again.

[0210] On the other hand, when the upper level control device 100 determines that the predetermined condition has not been satisfied (NO in S2106), the upper level control device 100 continues the current processing and again performs determination in S2106 after 5 minutes.

[0211] Next, the calculation method of the ratio of the shares according to the present embodiment will be described. In the present embodiment, instead of the method indicated in the second embodiment, simply, the ventilation device 1B may be fixed to the target capacity, and the ratio of the shares for the air-conditioner 2B may be calculated by the following method.

[0212] First, in the case of the take in temperature of the air-conditioner 2B < target temperature - A (for example, 1.0 degrees), this is defined as the heating load, and in the case of the take in temperature of the air-conditioner 2B > target temperature + B (for example, 1.0 degrees), this is defined as the cooling load. The target temperature is the temperature set by the remote controller, etc.

[0213] In the modified example, when the heat source of the one of less units between the ventilation device 1B or the air-conditioner 2B is one system or less, and the heat source of the one of more units between the ventilation device 1B or the air-conditioner 2B is limited to two systems, the following combinations can be considered.

[0214] That is, in the present modified example, there are 1) a combination of ventilation device (two units)/air-conditioner (one unit), and 2) a combination of ventilation device (one unit)/air-conditioner (two units).

[0215]

1) In the case of ventilation device (two units)/air-conditioner (one unit), the load factor of the two ventilation devices shall be calculated as the same. In this case, the same calculation as that of the first embodiment can be performed, and, therefore, the calculation load can be reduced.

2) In the case of a combination of ventilation device (one unit)/air-conditioner (two units), there are three possible situations as described below.

[0216] Situation 1 includes the first air-conditioner 2B_1 (operating), the second air-conditioner 2B_2 (operating), and the ventilation device 1B (operating). In such a case, the load ratio of the first air-conditioner 2B_1 and the second air-conditioner 2B_2 is matched. Then, the ventilation device load ratio and the air-conditioner load ratio are calculated. The calculation load can be reduced by matching the load ratios.

[0217] Situation 2 includes the first air-conditioner 2B_1 (operating), the second air-conditioner 2B_2 (stopped), and the ventilation device 1B (operating). In this case, the load is shared between the first air-conditioner 2B_1 (operating) and the ventilation device 1B (operating). In this case, the load can be shared by the same procedure as in the first embodiment.

[0218] Situation 3 includes the first air-conditioner 2B_1 (stopped), the second air-conditioner 2B_2 (operating), and the ventilation device 1B (operating). In this case, the load is shared between the second air-conditioner 2B_2 (operating) and the ventilation device 1B (operating). In this case, the load can be shared by the same procedure as in the first embodiment.

[0219] When the load ratio of the first air-conditioner 2B_1 and the second air-conditioner 2B_2 cannot be set to 0 (from the state of the indoor unit), the processing of the situations 2 and 3 is not performed. For example, when there are N or more indoor units (for example, two units) connected to the same outdoor unit, the load ratio of the air-conditioner cannot be set to "0".

[0220] A heat source (for example, an external control unit) for which the previously calculated load factor is "0" and the load factor can be set to "0", the load factor is set to "0", unless the capability becomes insufficient. That is, in the present embodiment, the thermal-off time is controlled to be increased.

[0221] By setting the load ratio and the load sharing according to the definitions described above for each situation,

the calculation load when the load ratio is calculated by the procedure described in the embodiment described above can be reduced.

(Fourth embodiment)

[0222] In the above-described embodiments, the case where the temperature is adjusted by the cooperative control by the upper level control device 100 has been described. However, the above-described embodiment is not limited to the control of the temperature. Therefore, the adjustment of the humidity will be described in the fourth embodiment.

[0223] For example, the upper level control device 100 acquires the required amount of humidification or dehumidification in the area R101A (an example of the first area) in the living room space R101 illustrated in FIG. 7. Similarly, the upper level control device 100 acquires the required amount of humidification or dehumidification in the area R101B (an example of the second area).

[0224] Then, the upper level control device 100 adds the required amount of humidification or dehumidification in the area R101A (an example of the first area) and the required amount of humidification or dehumidification in the area R101B (an example of the second area), and performs temperature control (for example, controlling the evaporation temperature of the refrigerant) by using the first heat exchanger 22 of the ventilation device 1B and the heat exchanger (an example of the third heat exchanger) of the air-conditioner 2B based on the total amount of humidification or dehumidification. Further, if humidification is required, the air supply unit 20 or the air-conditioner 2B may be subjected to water supply control.

[0225] In the present embodiment, the efficiency of power consumption is improved by performing temperature control based on the sum of the dehumidification amount and the humidification amount calculated for each area.

(Modified example 1 of the fourth embodiment)

[0226] The upper level control device 100 may further control humidity in consideration of the humidity distribution in the living room space R101. In the present embodiment, an input of the target humidity is received from a remote controller or the like of the air-conditioner 2B. The air-conditioner 2B transmits the input target humidity to the upper level control device 100.

[0227] In the present embodiment, the humidity at each position is determined from the combination of absolute humidity and relative humidity distribution.

[0228] In the same air-conditioning zone as illustrated in FIG. 7, moisture and air circulate and diffuse, and moisture diffuses due to the concentration difference of absolute humidity. The absolute humidity is almost uniform, but when there is a temperature distribution in the air-conditioning zone, a relative humidity distribution corresponding to the temperature distribution occurs. Especially in winter, because the indoor temperature near the window decreases, the relative humidity increases, and condensation occurs on the window surface.

[0229] Therefore, the upper level control device 100 calculates the relative humidity distribution in the living room space R101 based on the temperature distribution. In the present embodiment, any method may be used to calculate the relative humidity distribution. For example, the relative humidity distribution in the living room space R101 may be calculated from the detection results of the temperature detecting units (not illustrated) provided in the exhaust units 10A and 10B, the air supply units 20A and 20B, and the air-conditioning indoor units 81A and 81B in the living room space R101.

[0230] In the living room space R101 having such a temperature distribution, a case where a user controls the temperature and humidity in the room by using one remote controller will be described.

[0231] When the remote controller of the air-conditioner 2B receives the input of the target temperature and the target humidity in the room from the user, the air-conditioner 2B transmits the input target temperature and target humidity in the room to the upper level control device 100.

[0232] The upper level control device 100 calculates the average humidity from the temperature measured by the remote controller and each device and the relative humidity distribution. The average humidity is the humidity assumed to be uniform in the living room space R101.

[0233] The upper level control device 100 calculates the required humidification amount or dehumidification amount according to the overall average, based on the difference between the calculated average humidity and the input target humidity.

[0234] The upper level control device 100 controls the humidity by using at least one of the air supply unit 20 of the ventilation device 1B and the heat exchanger (an example of a third heat exchanger) of the air-conditioner 2B so that the average humidity of the indoor space becomes the input target humidity, to perform humidification in accordance with the calculated humidification amount or dehumidification in accordance with the calculated dehumidification amount. When humidification is required, the upper level control device 100 may control the water supply to the air supply unit 20 of the ventilation device 1B.

[0235] Further, when a plurality of ventilation devices are provided and the upper level control device 100 recognizes the arrangement information of the air supply units 20 of the ventilation devices, the upper level control device 100 may implement control based on the arrangement. For example, when dehumidification or humidification is performed by the above-described processing, the upper level control device 100 may perform control such that low humidity air is blown out from the air supply unit near the window and high humidity air is blown out from the air supply unit 20 far from the window. Thus, the occurrence of condensation on the window surface can be prevented and the loss of humidified moisture caused by condensation can also be prevented. In the case where the air-conditioner 2B is used, the same control is performed, and the description is omitted.

(Fifth Embodiment)

[0236] FIG. 12 is a diagram illustrating an arrangement of a group of devices including an upper level control device 300 according to the fifth embodiment. The example illustrated in FIG. 12 includes at least living room spaces R301, R302, and R303, lavatory rooms R304, R305, and a pipe shaft R306.

[0237] The lavatory rooms R304, R305 are provided with ventilation fans 395, 396, respectively. When the ventilation fans 395, 396 are operating, air in the lavatory rooms R304, R305 is discharged to the outside. The control is performed by the upper level control device 300.

[0238] The living room spaces R301 and R302 are provided with a ventilation device and an air-conditioner (not illustrated).

[0239] The living room space R303 is provided with a ventilation device 1C and an air-conditioner 2C.

[0240] The air-conditioner 2C includes one outdoor unit 370 and three air-conditioning indoor units 381, 382, and 383. The one outdoor unit 370 and the three air-conditioning indoor units 381 to 383 are connected by a connection pipe.

[0241] The outdoor unit 370 is connected to the upper level control device 300 by a signal line. Thus, one outdoor unit 370 can perform air-conditioning control according to the control of the upper level control device 300.

[0242] The ventilation device 1C is a ventilation device provided in the living room space R303 and includes a compressor unit 350, an air supply unit 320, and an exhaust unit 310.

[0243] The air supply unit 320 supplies air (SA) from four air supply ports 392A to 392D. The exhaust unit 310 returns air (RA) from four exhaust ports 391A to 391D.

[0244] The compressor unit 350, the air supply unit 320, and the exhaust unit 310 are connected by a connection pipe. The connection pipe includes a plurality of refrigerant connection pipes. This allows a refrigerant to circulate between the compressor unit 350, the air supply unit 320, and the exhaust unit 310.

[0245] The compressor unit 350, the air supply unit 320, and the exhaust unit 310 are connected by a signal line (not illustrated). This enables transmission and reception of information between the units. The configurations of the compressor unit 350, the air supply unit 320, and the exhaust unit 310 are the same as those of the compressor unit 50, the air supply unit 20, and the exhaust unit 10 illustrated in FIG. 1, and the descriptions thereof will be omitted.

[0246] The compressor unit 350 is arranged on the pipe shaft R306.

[0247] The upper level control device 300 is connected to the compressor unit 350 by a signal line. Accordingly, the upper level control device 300 can recognize the state of each device of the ventilation device 1C and perform control on each device.

[0248] FIG. 13 is a diagram illustrating an arrangement of a group of devices in the living room space R303 according to the fifth embodiment. In the example illustrated in FIG. 13, an air-conditioner 2C and a ventilation device 1C are arranged.

[0249] Air-conditioning indoor units 381, 382, and 383 included in the air-conditioner 2C are arranged in a line near the center of the living room space R303.

[0250] The four air supply ports 392A to 392D, which are the air supply destinations of the air supply unit 320, are provided on the lower side (e.g., the south side) of FIG. 13 from the air-conditioning indoor units 381, 382, and 383.

[0251] The four air supply ports 392A to 392D have built-in fans (an example of the first air volume adjustment mechanism) for adjusting the amount of air supplied to each air supply port. The fans are controlled by the upper level control device 300.

[0252] The four exhaust ports 391A to 391D, which are air intake ports of the exhaust unit 310, are provided on the upper side (e.g., the north side) of FIG. 13 from the air-conditioning indoor units 381, 382, and 383.

[0253] The four exhaust ports 391A to 391D have built-in opening/closing dampers (an example of a second air volume adjustment mechanism) for adjusting the amount of air taken in at each exhaust port. The opening/closing dampers are controlled by the upper level control device 300.

[0254] That is, according to the detection result from the living room space R303, the upper level control device 300 of the present embodiment controls the corresponding fan for each of the four air supply ports 392A to 392D and controls the corresponding opening/closing damper for each of the four exhaust ports 391A to 391D.

[0255] In the present embodiment, the amount of air blown out can be finely adjusted in the living room space R303,

and, therefore, comfort can be improved and the amount of energy used can be reduced.

[0256] In the present embodiment, the upper level control device 300 calculates the heat load target value ACL by the same method as in the above-described embodiment. The upper level control device 300 causes the heat load target value ACL to be shared between the air-conditioner 2C and the ventilation device 1C.

[0257] The upper level control device 300 causes the air-conditioner 2C and the ventilation device 1C to perform processing corresponding to the assigned share of the heat load, and calculates and sets the air supply volumes of the four air supply ports 392A to 392D and the exhaust air volumes of the four exhaust ports 391A to 391D so that the ventilation air flow becomes an ideal state in the living room space R303. The supply air volume and the exhaust air volume by which the ventilation air flow becomes an ideal state are determined according to embodiments such as the arrangement relationship of the four air supply ports 392A to 392D and the four exhaust ports 391A to 391D, and the like, and the description is omitted.

[0258] For example, the total amount of air (air volume) blown out of the four air supply ports 392A to 392D may be controlled to be constant regardless of the distribution, or the total amount of air (air volume) taken in from the four exhaust ports 391A to 391D may be controlled to be constant in the same manner.

[0259] Further, the upper level control device 300 controls the ratio of the total amount of air blown out of the four air supply ports 392A to 392D and the total amount of air taken in from the four exhaust ports 391A to 391D to be constant.

[0260] The upper level control device 300 according to the present embodiment stores first position information indicating the position of each of the four air supply ports 392A to 392D and second position information indicating the position of each of the four exhaust ports 391A to 391D in the storage unit 102. Furthermore, the upper level control device 300 may store the shape of the living room space R300 in the storage unit 102.

[0261] Thus, the upper level control device 300 controls the fans of the air supply ports 392A to 392D and the opening/closing dampers of the exhaust ports 391A to 391D based on the positions of the air supply ports 392A to 392D indicated by the first position information and the exhaust ports 391A to 391D indicated by the second position information. A specific control method will be described later.

[0262] Accordingly, the upper level control device 300 can implement ventilation control by considering the positions of the four air supply ports 392A to 392D and the four exhaust ports 391A to 391D.

[0263] For example, the upper level control device 300 may adjust the amount of air blown out of the four air supply ports 392A to 392D and the amount of air taken in from the four exhaust ports 391A to 391D according to the time. That is, the air flow in the living room space R303 varies with time in a complex manner, and, therefore, the temperature in the living room space R303 can be made uniform by adjustment according to the time.

[0264] The upper level control device 300 may control the ventilation air flow according to the heat load distribution in the living room space R303 by adjusting the amount of air blown out from the four air supply ports 392A to 392D and the amount of air taken in from the four exhaust ports 391A to 391D.

[0265] For example, when the heat load target value ACL is a cooling load, the upper level control device 300 can effectively discharge the heat in the room by increasing the amount of air taken in by one of the exhaust ports 391A to 391D arranged near the area where the internal heat generation is high.

[0266] The upper level control device 300 may increase the amount of air supplied from one of the air supply ports 392A to 392D, which is separated from one of the exhaust ports 391A to 391D for which the amount of air taken in is increased. Similarly, the upper level control device 300 may increase the amount of air taken from the exhaust ports 391A to 391D, which is separated from one of the air supply ports 392A to 392D for which the amount of air taken in is increased. This prevents short cuts in ventilation and enables efficient ventilation.

[0267] As another example, when the heat load target value ACL is a heating load, the upper level control device 300 increases the amount of air supplied from one of the air supply ports 392A to 392D in the vicinity of an area with high internal heat generation.

[0268] The upper level control device 300 may also perform ventilation control based on the temperature distribution.

[0269] In the present embodiment, temperature sensors are installed in each of the air supply ports 392A to 392D and the exhaust ports 391A to 391D.

[0270] The upper level control device 300 can acquire the temperatures in the vicinity of each of the air supply ports 392A to 392D and the exhaust ports 391A to 391D from the detection result from the installed temperature sensor. It is desirable that the mounting position of the temperature sensor is far from the air path of the blown out air. The mounting position may be on the air path of the blown out air as long as the air is blown out by mixing indoor air and outside air.

[0271] The upper level control device 300 will now be described in an example in which temperature sensors are provided at each of the air supply ports 392A to 392D and the exhaust ports 391A to 391D. However, any arrangement of temperature sensors may be used if the temperature distribution of the living room space R303 can be obtained.

[0272] The upper level control device 300 controls a fan (an example of the first air volume adjustment mechanism) corresponding to the air supply port (for example, one of the air supply ports 392A to 392D) provided in the vicinity of an area where the difference is large between the temperature in each area indicated by the temperature distribution of the living room space R303 based on the detection results of the plurality of temperature sensors and the target tem-

perature which is received as input, so that the amount of air supplied from the fan is larger than that from the fans of the other air supply ports.

[0273] Alternatively, the upper level control device 300 controls an opening/closing damper (an example of the second air volume adjustment mechanism) corresponding to an exhaust port (for example, one of the exhaust ports 391A to 391D) provided in the vicinity of an area where the difference is large between the temperature in each area indicated by the temperature distribution of the living room space R303 based on the detection results of the plurality of temperature sensors and the input target temperature, so that the amount of air taken in by the opening/closing damper is larger than that of the opening/closing dampers of the other exhaust ports.

[0274] In the present embodiment, by finely adjusting the amount of air blown out or taken in, local heating can be prevented, comfort can be improved, and energy consumed can be reduced.

[0275] In addition to the above-described control to make the temperature of the air in the living room space R303 uniform, the upper level control device 300 of the present embodiment may perform control according to a user's request.

[0276] For example, the upper level control device 300 may display the shape of the living room space R303 and the positions of the air supply ports 392A to 392D and the exhaust ports 391A to 391D on the touch panel of the user's mobile terminal.

[0277] When the upper level control device 300 receives the information input to the touch panel of the mobile terminal, the upper level control device 300 can freely adjust the amount of air supplied and exhausted from the air supply ports 392A to 392D and the exhaust ports 391A to 391D according to the input information.

[0278] When the air supply is cold at a specific place in the state of a cooling operation by the ventilation device 1C, the user can improve comfort by reducing the amount of air supplied from the air supply ports (e.g., the air supply ports 392A to 392D) in the vicinity thereof by operating the touch panel of the mobile terminal.

[0279] When the temperature is felt to be cold in a specific place in the state of a heating operation by the ventilation device 1C, the amount of air supplied from the air supply ports (the air supply ports 392A to 392D) in the vicinity thereof can be increased to improve comfort.

[0280] The upper level control device 300 automatically controls the amount of air taken in by the exhaust ports 391A to 391D to prevent a short circuit of air supplying and exhausting. For example, when the amount of air supplied from a predetermined air supply port increases, the exhaust air volume of the exhaust port far from the predetermined air supply port is increased.

[0281] For example, the upper level control device 300 may perform control to increase the ventilation air volume in an area with a large number of occupants and to decrease the ventilation air volume in an area with a small number of occupants. Thus, ventilation can be performed efficiently.

(Modified example 1 of the fifth embodiment)

[0282] The configuration for providing ventilation is not limited to the configuration described above, and may include additional configurations.

[0283] FIG. 14 is a diagram illustrating an arrangement of a group of devices in the living room space R303 according to a modified example 1 of the fifth embodiment. In the example illustrated in FIG. 14, an air exchange duct is provided in addition to the configuration described in the fifth embodiment.

[0284] In the example illustrated in FIG. 14, in the living room space R303, an area R303A of a heating load and an area R303B of a cooling load exist.

[0285] In the present embodiment, a duct P401 (an example of a third air flow path) for conveying air from a ventilation port (an example of a first opening) provided in the vicinity of the air supply port 392D of the area R303B of the cooling load of the living room space R303 to a ventilation port (an example of a second opening) provided in the vicinity of the area R303A of the heating load of the living room space R303, is provided.

[0286] A blower fan 495 is provided on the path of the duct P401 (an example of a third air flow path).

[0287] In addition to the control illustrated in the above embodiment, an upper level control device 400 can adjust the amount of air flowing through the duct P401 by the blower fan 495. The upper level control device 400 can control the blower fan 495 to transport air from the area R303B which has become a cooling load as a result of air being warmed due to existing in the air supply port 392D, to the area R303A that is a heating load (that is, an area in which the temperature has become below the target temperature to the extent that heating is needed).

[0288] Thus, in the present embodiment, air can be stirred in the living room space R303 to make the temperature and humidity uniform, thereby preventing local heating.

[0289] Further, a device (such as a circulator) capable of stirring air may be installed in the living room space R303 instead of a duct. The upper level control device 400 may implement cooperative control on the ventilation device 1C and the device capable of stirring air.

[0290] The circulator is an elongated cylinder extending from near the ceiling to near the space under the floor, and one or more air blowers are incorporated in the cylinder. Thus, air can be stirred between the vicinity of the ceiling and

the vicinity of the space under the floor.

[0291] When cooling, the upper level control device 400 causes air to be taken in at the vicinity of the space under the floor and blown out to the vicinity of the ceiling by a circulator. When heating, the upper level control device 400 causes air to be taken in at the vicinity of the ceiling and blown out to the vicinity of the space under the floor by a circulator.

[0292] Accordingly, the temperature distribution of the room can be made uniform three-dimensionally by forming a vertical air flow by the circulator. Further, the amount of air flow may be controlled by the cooperation of a blower fan (not illustrated) in the air-conditioning indoor units 381 to 383 of the air-conditioner 2C.

(Modified example 2 of the fifth embodiment)

[0293] In modified example 1 of the fifth embodiment, an example of heat exchange between areas by stirring air has been described. However, heat exchange between areas is not limited to stirring air. Therefore, in the present modified example, a case where heat exchange is performed with a refrigerant will be described.

[0294] FIG. 15 is a diagram illustrating an arrangement of a group of devices in the living room spaces R301 and R303 according to the modified example 2 of the fifth embodiment. In the example illustrated in FIG. 15, an apparatus (an example of a heat transfer apparatus) is provided, the apparatus having an exhaust unit 521 including a heat exchanger (an example of a fourth heat exchanger) functioning as a condenser or an evaporator provided in the living room space R302 (an example of a seventh area of the indoor space), and an air supply unit 511 including a heat exchanger (an example of a fifth heat exchanger) functioning as a condenser or an evaporator provided in the living room space R303 (an example of an eighth area of the indoor space).

[0295] In the example illustrated in FIG. 15, the exhaust unit 521 and the air supply unit 511 are connected by connection pipes, and a compressor unit 551 is provided between the connection pipes. Further, an outdoor unit 571 is connected to the air supply unit 511.

[0296] The upper level control device 500 controls the exhaust unit 521, the air supply unit 511, and the compressor unit 551 in addition to the processing of the above-described embodiment.

[0297] The upper level control device 500 causes a heat exchanger (an example of a fourth heat exchanger) in the exhaust unit 521 to function as either one of a condenser and an evaporator, and causes a heat exchanger (an example of a fifth heat exchanger) in the air supply unit 511 to function as either one of a condenser and an evaporator. Thereby, heat transfer can be performed between the area R303C that is the cooling load of the living room space R303 and the area R3032A that is the heating load of the living room space R302.

[0298] That is, the air-conditioning efficiency in the building can be improved by transferring excess heat from the area R303C that is the heating load of the living room space R303 and the area R303C that is the cooling load of the living room space R302, to the area R302A of the heating load requiring heat.

[0299] Moreover, heat exchange is not limited to using a refrigerant, and the upper level control device 500 implements control to blow air from the living room space R303 to the living room space R302 by using a duct incorporating a blowing fan.

(Modified example 3 of the fifth embodiment)

[0300] In the above-described embodiment, the air supply amount and the exhaust amount are adjusted for each living room space. However, the adjustment method is not limited to the above method, and the air supply and exhaust amount may be adjusted in consideration of the living room space inside a building. The present modified example will be described with reference to FIG. 12.

[0301] In the example illustrated in FIG. 12, the air supply unit 320 is provided with a fan 21 (an example of a third air flow adjustment mechanism) for adjusting the amount of air that is taken in from outdoors and that flows from the first heat exchanger 22 to the living room space R303 through a duct (an example of a first air flow path), and the exhaust unit 310 is provided with a fan 11 (an example of a fourth air flow adjustment mechanism) for adjusting the amount of air that flows from the living room space R303 through a duct (an example of a second air flow path) and from the second heat exchanger 12 to the outdoors.

[0302] The upper level control device 300 sets the amount of air that is supplied by the fan 21 (a third air flow adjustment mechanism) and the amount of air that is taken in by the fan 11 (a fourth air flow adjustment mechanism) to be different amounts based on the amount of air that is supplied or exhausted by other devices (for example, ventilation fans 395, 396) other than the ventilation device 1C.

[0303] For example, the lavatory rooms R304 and R305 are provided with ventilation fans 395 and 396 (an example of a ventilation mechanism) that exhaust air to the outside from the lavatory rooms R304 and R305. The ventilation fans exhaust a predetermined amount of air.

[0304] Therefore, the upper level control device 300 adjusts the amount of air exhausted and the amount of air taken in by the ventilation device 1B based on the amount of air exhausted by the ventilation fans 395, 396 (an example of a

ventilation mechanism).

[0305] Specifically, the upper level control device 300 makes an adjustment such that the amount of air supplied by the air supply unit 320 = the amount of air exhausted by the exhaust unit 310 + the amount of air exhausted by the ventilation fans 395, 396.

[0306] When the amount of air exhausted by the ventilation fans 395, 396 changes, the upper level control device 300 adjusts the amount of air exhausted and the amount of air taken in by the ventilation device 1B according to the change. Thus, it is possible to balance the air supply and exhaust inside the building.

(Modified example 4 of the fifth embodiment)

[0307] In the present modified example, a case where the upper level control device 300 controls a plurality of (e.g., three units) ventilation devices 1C will be described.

[0308] Each of the plurality of (e.g., three units) ventilation devices 1C is provided with an exhaust unit 310 and an air supply unit 320.

[0309] A fan 21 (an example of a third air volume adjustment mechanism) is provided in the air supply unit 320 for adjusting the amount of air taken in from the outside to flow from the first heat exchanger 22 to the living room space R303 through a duct (an example of the first air flow path), and a fan 11 (an example of a fourth air volume adjustment mechanism) is provided in the exhaust unit 310 for adjusting the amount of air flowing from the living room space R303 to the outside from the second heat exchanger 12 through a duct (an example of the second air flow path).

[0310] The upper level control device 300 adjusts the air in the building (an example of the indoor space), such that the amount of air supplied by the fan 21 of the air supply unit 320 provided for each of the plurality of ventilation devices 1C and the amount of air taken in by the fan 11 of the exhaust unit 310 provided for each of the plurality of ventilation devices 1C, are substantially the same.

[0311] As a specific technique, the upper level control device 300 implements adjustment such that the sum of the amount of air supplied $\approx$ the sum of the amount of air exhausted in the plurality of ventilation devices 1C.

[0312] When the amount of air supplied by one of the air supply units 320 is increased, the upper level control device 300 decreases the amount of air supplied by the other air supply unit 320 by the increased amount of the one of the air supply units 320.

[0313] Also, in order to stabilize the heat balance between the air supply and the air exhaustion, the upper level control device 300 increases the amount of air exhausted from the exhaust unit 310 paired with the air supply unit 320 for which the amount of air is increased. Similarly, the upper level control device 300 decreases the amount of air exhausted from the exhaust unit 310 paired with the air supply unit 320 for which the amount of air is decreased.

[0314] As another technique, when the amount of air supplied by the air supply unit 320 is increased in the plurality of ventilation devices 1C, the upper level control device 300 increases the amount of air exhausted by the exhaust unit 310 by the increased amount of the air supply unit 320. This control can maintain a balance between the total amount of air supplied and the total amount of air exhausted.

(Modified example 5 of the fifth embodiment)

[0315] In this modified example, a case where the temperature, etc., is adjusted according to a device owned by the occupant will be described.

[0316] FIG. 16 is a diagram illustrating an arrangement of a group of devices in the living room space R900 according to a modified example 5 of the fifth embodiment. In the example illustrated in FIG. 16, an air-conditioner 2D and a ventilation device 1D are arranged.

[0317] The description of one outdoor unit 970 and three air-conditioning indoor units 981, 982, and 983 of the air-conditioner 2D will be omitted as these devices are the same as the one outdoor unit 370 and the three air-conditioning indoor units 381, 382, and 383 of the air-conditioner 2C of the fifth embodiment described above.

[0318] The description of the compressor unit 950, the air supply unit 920, and the exhaust unit 910 of the ventilation device 1D will be omitted as these devices are the same as the compressor unit 350, the air supply unit 32, and the exhaust unit 310 of the ventilation device 1C of the fifth embodiment described above.

[0319] The compressor unit 950 is the same as the compressor unit 350 of the fifth embodiment described above.

[0320] The air supply unit 920 will supply (SA) air from four air supply ports 992A to 992D. The exhaust unit 910 returns air (RA) from four exhaust ports 991A to 991D.

[0321] The four air supply ports 992A to 992D have built-in fans (an example of the first air volume adjustment mechanism) for adjusting the amount of air supplied to each air supply port. The fans are controlled by the upper level control device 900.

[0322] The four exhaust ports 991A to 991D have built-in opening/closing dampers (an example of a second air volume adjustment mechanism) that adjust the amount of air exhausted from each exhaust port. The fan is controlled by the

upper level control device 900.

[0323] Further, wireless receivers 993A to 993D are provided near each of the four exhaust ports 991A to 991D, respectively.

[0324] Similarly, wireless receivers 993E to 993H are provided in the vicinity of each of the four air supply ports 992A to 992D, respectively.

[0325] The upper level control device 900 according to the present embodiment stores first position information indicating the position of each of the four air supply ports 992A to 992D and second position information indicating the position of each of the four exhaust ports 991A to 991D, in the storage unit 102.

[0326] An occupant in the living room space R900 has a terminal (an example of a detector) that periodically performs wireless communication and that is equipped with a wireless transmitter, a temperature sensor, and a humidity sensor. The terminal (an example of a detector) can be any device, for example, a smart speaker or a smartphone (with an application for cooperation installed).

[0327] Further, any method of wireless communication between the terminal and the wireless receivers 993A to 993H may be used, for example, Wi-Fi (registered trademark).

[0328] The upper level control device 900 identifies the position of the terminal possessed by the occupant based on the signal strength from the terminal possessed by the occupant and the first position information and the second position information acquired from the wireless receivers 993A to 993H.

[0329] The upper level control device 900 receives the detection result (humidity and temperature at the current position) by the terminal from the terminal via wireless receivers 993A to 993H. Based on the detection result from the terminal, the upper level control device 900 controls the fan (an example of the first air volume adjustment mechanism) of the air supply port (for example, air supply ports 992A to 992D) located near the position of the terminal or the opening/closing damper (an example of the second air volume adjustment mechanism) of the exhaust port located near the position of the terminal.

[0330] Alternatively, the upper level control device 900 may implement control to increase the amount of air supplied from the air supply port (for example, the air supply ports 992A to 992D) located near the wireless receiver (the wireless receivers 993A to 993H) that has received a strong radio wave. With this control, it is possible to prevent stagnation in an area where there is an occupant (or an area where there are many occupants) and improve comfort.

[0331] The upper level control device 900 may optionally adjust the amount of air supplied or exhausted based on the radio wave intensity of the terminal. The upper level control device 900 may individually adjust the amount of air supplied and the amount of air exhausted by preparing a signal for an air supply port and a signal for an exhaust port for communication with the terminal.

[0332] In the present embodiment, comfort can be improved by preventing heating and stagnation according to the detection result of the terminal possessed by the occupant.

(Sixth embodiment)

[0333] In the embodiment described above, an example in which an air-conditioner and a ventilation device are provided in one living room space, and cooperation control is performed by an upper level control device, has been described. In the sixth embodiment, an example in which two air-conditioners are provided will be described.

[0334] FIG. 17 is a diagram illustrating an arrangement example of an upper level control device 700 according to the sixth embodiment and two air-conditioners 2E_1 and 2E_2. In the example illustrated in FIG. 17, air-conditioners of a plurality of systems are provided in a living room space R700. In the example illustrated in FIG. 17, in the living room space R700, the air-conditioner 2E_1 is provided in an area easily affected by the environment from the outside (referred to as the perimeter zone), and the air-conditioner 2E_2 is provided in an area that is not appreciably affected by the environment from the outside (referred to as the interior zone). In this way, the heat load is different depending on the area in which the air-conditioner is installed, and, therefore, the air-conditioner 2E_1 and the air-conditioner 2E_2 have different air-conditioning capabilities.

[0335] The air-conditioner 2E_1 includes an outdoor unit 771 and an air-conditioning indoor unit 781. The air-conditioning indoor unit 781 takes in air in the perimeter zone of the living room space R700 and exhausts the air, in which the heat is exchanged with a refrigerant flowing through the heat exchanger, into the perimeter zone of the living room space R700.

[0336] The air-conditioner 2E_2 includes an outdoor unit 772 and an air-conditioning indoor unit 782. The air-conditioning indoor unit 782 takes in air in the interior zone of the living room space R700 and exhausts air, in which heat is exchanged with a refrigerant flowing through the heat exchanger, to the interior zone of the living room space R700.

[0337] The upper level control device 700 controls the two air-conditioners 2E_1 and 2E_2.

[0338] The upper level control device 700 includes a control unit 701 and a storage unit 702. The control unit 701 performs overall control.

[0339] The storage unit 702 stores air-conditioner capability information 711 of the air-conditioner 2E_1 and air-con-

ditioner capability information 712 of the air-conditioner 2E_2.

[0340] The air-conditioner capability information 711 is capability information (an example of the first air-conditioning capability) indicating the correlation between the air-conditioning capability that can be output and the corresponding power consumption of the air-conditioner 2E_1.

[0341] The air-conditioner capability information 711 includes the minimum air-conditioning capability Th1min that can be set based on the power consumption of the air-conditioner 2E_1 out of the air-conditioning capability that the air-conditioner 2E_1 can output, and the air-conditioner capability information 711 includes the maximum air-conditioning capability Th1max that the air-conditioner 2E_1 can set out of the heat load that the air-conditioner 2E_1 can output.

[0342] The air-conditioner capability information 712 is the capability information (example of the second air-conditioning capability) indicating the correlation between the air-conditioning capability that can be output and the corresponding power consumption of the air-conditioner 2E_2.

[0343] The air-conditioner capability information 712 includes the minimum air-conditioning capability Th2min that can be set based on the power consumption of the air-conditioner 2E_2 out of the air-conditioning capability that can be output by the air-conditioner 2E_2, and the air-conditioner capability information 712 includes the maximum air-conditioning capability Th2max that can be set by the air-conditioner 2E_2 out of the heat load that can be output by the air-conditioner 2E_2.

[0344] FIG. 18 is a diagram illustrating the correspondence relationship between the power consumption in the air-conditioner capability information 711 and the air-conditioner capability information 712, and the air-conditioning capability (heat load that can be supported). A line 3201 indicates the air-conditioning capability (heat load that can be supported) that the air-conditioner 2E_1 can output according to the power consumption. As indicated by the line 3201, the higher the power consumption, the higher the air-conditioning capability that can be output. Even if the air-conditioning capability becomes lower than the air-conditioning capability Th1min, the power consumption does not decrease any further. Therefore, the air-conditioning capability Th1min is set as the minimum air-conditioning capability (heat load that can be supported). The maximum air-conditioning capability Th1max that can be output is also set with respect to the air-conditioner 2E_1.

[0345] A line 3202 indicates the air-conditioning capability (heat load that can be supported) that can be output by the air-conditioner 2E_2 according to the power consumption. As the power consumption increases, as indicated by the line 3202, the air-conditioning capability that can be output also increases. Even if the air-conditioning capability becomes lower than the air-conditioning capability Th2min, the power consumption does not decrease any further. Therefore, the air-conditioning capability Th2min is set as the minimum air-conditioning capability (heat load that can be supported). The maximum air-conditioning capability Th2max that can be output is also set with respect to the air-conditioner 2E_2.

[0346] As illustrated in FIG. 18, the maximum air-conditioning capability Th1max of the air-conditioner 2E_1 > the maximum air-conditioning capability Th2max of the air-conditioner 2E_2, and the minimum air-conditioning capability Th1min of the air-conditioner 2E_1 > the minimum air-conditioning capability Th2min of the air-conditioner 2E_2.

[0347] As illustrated in FIG. 18, up to the maximum air-conditioning capability Th2max of the air-conditioner 2E_2, the power consumption corresponding to the air-conditioning capability of the air-conditioner 2E_2 becomes lower than the power consumption corresponding to the air-conditioning capability of the air-conditioner 2E_1.

[0348] The control unit 701 acquires the temperature detection result from the air-conditioning indoor units 781 and 782 of the air-conditioners 2E_1 and 2E_2 and the remote controller through the outdoor units 771 and 772. The control unit 701 can acquire the temperature or the like in the living room space R700.

[0349] The control unit 101 calculates a heat load target value ACL (example of the first heat load) determined as a control target in the living room space R700 based on the temperature or the like of the living room space R700.

[0350] The control unit 101 processes the calculated heat load target value ACL (example of the first heat load) by using the air-conditioning capabilities of the air-conditioners 2E_1 and 2E_2.

[0351] For example, when the calculated heat load target value ACL (example of the first heat load) is lower than the minimum air-conditioning capability Th1min indicated by the air-conditioner capability information 711, the control unit 101 processes the heat load target value ACL (example of the first heat load) only with respect to the air-conditioner 2E_2 whose power consumption per air-conditioning capability is lower than that of the air-conditioner 2E_1. With this control, the air-conditioning control can be implemented in a state of high energy efficiency by using a lower capability than that of the air-conditioner 2E_1.

[0352] If the minimum air-conditioning capability Th1min of the air-conditioner 2E_1 < heat load target value ACL (example of the first heat load) < the maximum air-conditioning capability Th2max of the air-conditioner 2E_2, the control unit 701 outputs a control signal for processing using the air-conditioning capability of the air-conditioner 2E_2 which consumes less power among the air-conditioner 2E_1 and the air-conditioner 2E_2.

[0353] When the maximum air-conditioning capability Th2max of the air-conditioner 2E_2 < the target value of the heat load target value ACL (example of the first heat load) < the maximum air-conditioning capability Th1max of the air-conditioner 2E_1, the control unit 701 outputs a control signal for processing using the air-conditioning capability of the air-conditioner 2E_1.

[0354] When the maximum air-conditioning capability $Th1_{max}$ of the air-conditioner 2E_1 < the target value of the heat load target value ACL (example of the first heat load), the control unit 701 outputs a control signal for processing using the air-conditioning capability of the air-conditioner 2E_1 and the air-conditioner 2E_2.

(Seventh embodiment)

[0355] In the embodiment described above, the case where the heat load is shared between the air-conditioner and the ventilation device has been described. However, if the ventilation device is a device capable of reducing the evaporation temperature, a latent heat and sensible heat separation operation may be performed, in which the humidity is processed by the ventilation device and the temperature is processed by the air-conditioner.

[0356] The configuration of the present embodiment is similar to that illustrated in FIG. 1. However, the control unit 101 performs different processing in that the temperature and humidity are adjusted.

[0357] The air supply unit 20 according to the present embodiment functions as an evaporator and removes moisture by condensing moisture in the air when exchanging heat with the captured air. Thus, the air supply unit 20 is configured as a device capable of reducing the evaporation temperature of the refrigerant by condensation.

[0358] When the air-conditioner 2 receives the target temperature and target humidity of the living room space R11 from the remote controller or the like, the air-conditioner 2 reports, to the upper level control device 100, the target temperature and target humidity. Thus, the target temperature and target humidity are set in the upper level control device 100.

[0359] Then, the control unit 101 of the upper level control device 100 calculates the heat load target value ACL in the same manner as in the above-described embodiment. When the heat load target value ACL is a cooling load, a control signal is output such that the first heat exchanger 22 of the air supply unit 20 of the ventilation device 1 functions as an evaporator.

[0360] When the first heat exchanger 22 functions as an evaporator, the control unit 101 of the upper level control device 100 controls the ventilation device 1 such that the target humidity is attained by dehumidifying the air flowing in the state where the first heat exchanger 22 is condensed (a state in which the evaporation temperature is reduced).

[0361] Further, the control unit 101 of the upper level control device 100 controls the air-conditioner 2 such that the target temperature is attained by performing temperature control to attain the target temperature.

[0362] FIG. 19 is an air diagram illustrating the transition until the target temperature and target humidity are attained by controlling the ventilation device 1 and the air-conditioner 2 according to the present embodiment.

[0363] The point 3501 illustrated in FIG. 19 is the temperature and humidity of the air taken in from the outside, and the point 3504 is the target temperature and target humidity.

[0364] The control unit 101 outputs a control signal to the air supply unit 20. Accordingly, the air supply unit 20 controls the first heat exchanger 22 to function as an evaporator to lower the temperature of the captured air as indicated by the line 3511, and then to lower the temperature and humidity along the curve of the 100% relative humidity as indicated by the line 3512. Thus, the humidity reaches the target humidity. That is, the humidity (target humidity) and the temperature indicated by the point 3503 are reached by controlling the air supply unit 20.

[0365] Therefore, the control unit 101 outputs a control signal to the ventilation device 1 to cause the first heat exchanger 22 to function such that the temperature corresponds to the target humidity on a curve of 100% relative humidity in the air diagram. That is, in the present embodiment, the control unit 101 can maintain and control the dehumidification amount by implementing control such that the air supplied from the air supply unit 20 after the heat is exchanged by the second heat exchanger maintains the temperature corresponding to the target humidity on a curve of 100% relative humidity in the air diagram.

[0366] Thereafter, the control unit 101 outputs a control signal to the air-conditioner 2. Accordingly, the air-conditioner 2 increases the air temperature as indicated by the line 3513 from the humidity (target humidity) and temperature indicated by the point 3503, to reach the temperature (target temperature) and humidity (target humidity) indicated by the point 3504.

[0367] In the present embodiment, the temperature and humidity can be controlled with high accuracy by processing the latent heat load by the ventilation device 1 and processing the sensible heat load by the air-conditioner 2, respectively. The power consumption efficiency can be improved by the control.

(Eighth embodiment)

[0368] In the eighth embodiment, a method for adjusting humidity in the air supply unit will be described. The method for adjusting humidity may be combined with the method for adjusting humidity indicated in the fourth embodiment, for example.

[0369] The configuration of the present embodiment is similar to that illustrated in FIG. 1. However, the control unit 101 performs different processing in that temperature and humidity are adjusted.

[0370] The air supply unit 20 according to the present embodiment humidifies air by supplying water, after heat is

exchanged by the first heat exchanger 22.

[0371] When the air-conditioner 2 receives the target temperature and target humidity of the living room space R11 from the remote controller or the like, the air-conditioner 2 reports, to the upper level control device 100, the target temperature and target humidity. Thus, the target temperature and target humidity are set in the upper level control device 100.

[0372] Then, the control unit 101 of the upper level control device 100 calculates the heat load target value ACL in the same manner as in the above-described embodiment. When the heat load target value ACL is a heating load, a control signal is output such that the first heat exchanger 22 of the air supply unit 20 of the ventilation device 1 functions as a condenser.

[0373] In the present embodiment, when the air-conditioner 2 and the ventilation device 1 share the heat load target value ACL, the ventilation device 1 is assigned the share of the heat load corresponding to the amount of air supplied at the target temperature and target humidity, and the air-conditioner 2 is assigned the share of the difference between the heat load target value ACL and the heat load corresponding to the air supply.

[0374] When the ventilation device 1 performs a humidification operation, the control unit 101 of the upper level control device 100 sets the temperature of the air after heat exchange by the first heat exchanger, so as to attain the target temperature and target humidity when the air after heat exchange by the first heat exchanger 22 is supplied with water, and outputs a control signal to the air supply unit 20 so as to perform temperature control based on the setting.

[0375] FIG. 20 is an air diagram illustrating the transition until the target temperature and target humidity are reached by controlling the ventilation device 1 and the air-conditioner 2 according to the present embodiment.

[0376] The point 3401 illustrated in FIG. 20 indicates the temperature and humidity of the air taken in from the outside, and the point 343403 is the target temperature and target humidity.

[0377] The control unit 101 outputs a control signal to the air supply unit 20. Accordingly, the air supply unit 20 increases the temperature of the captured air as indicated by the line 3411 by causing the first heat exchanger 22 to function as a condenser. Accordingly, the humidity and temperature indicated by the point 3402 are reached.

[0378] Thereafter, the air supply unit 20 supplies water to the air after heat exchange. Thus, the humidity (target humidity) and temperature (target temperature) indicated by point 3403 are reached by an isenthalpic change as indicated by the line 3412.

[0379] Thus, when the ventilation device 1 performs a humidification operation, the control unit 101 sets the temperature of the air after heat exchange by the first heat exchanger such that the predetermined target temperature and target humidity are reached by an isenthalpic change when the air after heat exchange by the first heat exchanger 22 is supplied with water, and outputs a control signal to the air supply unit 20 so as to perform temperature control based on the setting.

[0380] In the present embodiment, considering that the temperature decreases with humidification by an isenthalpic process, efficient humidity control and temperature control can be achieved by having the first heat exchanger 22 perform heat exchange.

(Ninth embodiment)

[0381] FIG. 21 is a diagram illustrating an exemplary configuration of an upper level control device 1200, an air supply unit 1220, an exhaust unit 1210, and a compressor unit 1250 according to the present embodiment. The same reference numerals are assigned to the elements similar to those of the above-described embodiments, and descriptions thereof will be omitted.

[0382] The upper level control device 1200 also controls an air-conditioner (not illustrated). The upper level control device 1200 controls the cooperation of a ventilation device including the air supply unit 1220 and the exhaust unit 1210, and an air-conditioner, for example, during a heat collection ventilation operation, and the description thereof will be omitted as this configuration is the same as the above embodiment.

[0383] The air supply unit 1220 forms an air flow path from the outside to the living room space, and has at least the fan 21, the first heat exchanger 22, and a rectifying fin 1290.

[0384] The exhaust unit 1210 forms an air flow path from the living room space to the outside, and has the fan 11 and the second heat exchanger 12.

[0385] The upper level control device 1200 calculates a heat load target value ACL (example of the first heat load) determined as a control target in the living room space R11 based on the temperature and the like of the living room space R11 by performing the same processing as in the above-described embodiment. When the heat load target value ACL is determined as a cooling load, the upper level control device 1200 performs the following processing.

[0386] When the temperature of the outdoor air detected by the temperature detecting unit 24 of the air supply unit 20 is lower than the target temperature set in the living room space R11, the upper level control device 1200 reduces the driving of the compressor included in the compressor unit 50, and sets at least one of the wind direction or air volume of the air supplied from the air supply passage P1 by the air supply unit 20 so that the air in the living room space R11 is replaced with the outdoor air by the ventilation device 1.

[0387] In the present embodiment, the upper level control device 1200 adjusts the rectifying fin 1290 provided in the air supply unit 1220 to be downward.

[0388] Furthermore, the upper level control device 1200 sets the amount of air supplied from the air supply unit 1220 to the maximum value that can be set (the fan 21 is set to the maximum rotation speed), and sets the amount of air taken in and exhausted from the exhaust unit 1210 to the maximum value that can be set (the fan 11 is set to the maximum rotation speed).

[0389] With this control, the upper level control device 1200 switches the air flow 2611 in a case where the wind direction and the air volume are not adjusted to the air flow 2602 in a case where the wind direction and the air volume are not adjusted.

[0390] For example, in the early morning of summer, the outside air temperature may be lower than the target temperature of the living room space. In this case, the relationship between the outside air temperature < the indoor target temperature < the indoor temperature is established.

[0391] In such a case, the upper level control device 1200 can control the indoor temperature to the target temperature by stopping the temperature control of the air supply unit 1220 and the exhaust unit 1210 (reducing the driving of the compressor) and actively taking in outside air.

[0392] In this case, by adjusting the wind direction and the air volume, the upper level control device 1200 can improve the ventilation efficiency and quickly reach the target temperature with low power consumption.

(Modified example of the ninth embodiment)

[0393] The method for adjusting the temperature by using outside air is not limited to the method described in the ninth embodiment. For example, when there are a plurality of air supply ports and exhaust ports, a method for adjusting the temperature by controlling the living room space so that air circulates can be considered.

[0394] For example, as illustrated in FIG. 13, the four air supply ports 392A to 392D, which are the air supply destinations of the air supply unit 320, are provided on the lower side of FIG. 13 (e.g., south side: an example of the first direction side in the living room space) relative to the air-conditioning indoor units 381, 382, and 383, and the four exhaust ports 391A to 391D, which are the air intake ports of the exhaust unit 310, are provided on the upper side of FIG. 13 (e.g., north side: an example of the second direction side in the living room space) relative to the air-conditioning indoor units 381, 382, and 383.

[0395] The four air supply ports 392A to 392D have built-in fans (an example of the first air volume adjustment mechanism) for adjusting the amount of air supplied to each air supply port. The fans are controlled by the upper level control device 300.

[0396] The four exhaust ports 391A to 391D have built-in opening/closing dampers (an example of a second air volume adjustment mechanism) that adjust the amount of air taken in at each exhaust port. The opening/closing dampers are controlled by the upper level control device 300.

[0397] Then, the upper level control device 300 as illustrated in FIG. 13 performs the same processing as in the above-described embodiment, and calculates a heat load target value ACL (example of the first heat load) determined as a control target in the living room space R11 based on the temperature and the like of the living room space R11. When the heat load target value ACL is determined to be a cooling load, the upper level control device 300 performs the following processing.

[0398] When the temperature of the outdoor air detected by the temperature detecting unit 24 of the air supply unit 20 is lower than the target temperature set in the living room space R11, the upper level control device 300 reduces the driving of the compressor included in the compressor unit 50 and controls the air to be supplied by all air supply ports 392A to 392D arranged on the south side of the living room space and to be exhausted by all exhaust ports 391A to 391D arranged on the north side of the living room space. Further, the air supply ports 392A to 392D may be provided with rectifying fins and may be combined with the same control as in the ninth embodiment.

[0399] In the present embodiment, the ventilation efficiency is improved and the target temperature can be reached quickly.

(Tenth embodiment)

[0400] Another mode of processing in the upper level control device will be described. The ventilation device and the air-conditioner shall have the same configuration as in the above-described embodiment.

[0401] FIG. 22 is a diagram illustrating an exemplary configuration of an upper level control device 1100 according to the present embodiment. As illustrated in FIG. 22, the upper level control device 1100 (an example of an air-conditioning control apparatus) includes an air-conditioning load acquiring unit 1101, an operation instruction proposal creating unit 1102, a status calculating unit 1203, a storage unit 1204, and an operation proposal extracting unit 1205.

[0402] The air-conditioning load acquiring unit 1101 acquires the heat load target value ACL by the same procedure

as in the above-described embodiment.

[0403] Based on the heat load target value ACL, the operation instruction proposal creating unit 1102 creates a plurality of operation instruction proposals (an example of operation instruction information) for controlling the air-conditioner and the ventilation device in order to control the air-conditioning in the indoor space where the air-conditioner and the ventilation device are installed.

[0404] In the present embodiment, the upper level control device 1100 holds a trained model in which the heat load target value ACL and the operation of the air-conditioner and the ventilation device are learned by machine learning in advance.

[0405] The upper level control device 1100 generates a plurality of operation instruction proposals for the air-conditioner and the ventilation device by inputting the heat load target value ACL.

[0406] The status calculating unit 1203 acquires an amount correlated with the air-conditioning load of the indoor space, and calculates an energy amount when the air-conditioning load of the indoor space is processed according to the operation instruction proposal by considering the amount correlated with the air-conditioning load of the indoor space for each generated operation instruction proposal. Any method may be used for calculating the energy amount including known methods.

[0407] The amount correlated with the air-conditioning load in the indoor space includes the amount related to the air volume ventilated by the ventilation device.

[0408] The storage unit 1204 stores the correspondence between the operation instruction proposal and the calculated energy amount.

[0409] The operation proposal extracting unit 1205 outputs an operation instruction based on the operation instruction proposal associated with the energy amount satisfying a predetermined condition to at least one or more of the air-conditioner or the ventilation device. At that time, the operation proposal extracting unit 1205 selects the proposal with the least energy consumption among the operation instruction proposals associated with the energy amount satisfying the predetermined condition.

[0410] The predetermined conditions are, for example, conditions under which cold heat can be collected from exhausted air (high-temperature refrigerant flows through exhaust path heat exchange) when the total heat balance of the indoor space is a temperature rise, and warm heat can be collected from exhausted heat when the total heat balance of the indoor space is a temperature fall.

[0411] That is, when the air-conditioner and the ventilation device cooperate with each other, in a case where the heat balance in the living room space is a temperature rise, cold heat is collected in the exhaust unit (a cooling operation in which a high-temperature refrigerant flows), and the air-conditioner also performs a cooling operation. Further, in a case where the heat balance in the living room space is a temperature fall, the condition is such that warm heat is collected in the exhaust unit (heating operation), and the air-conditioner is also set to perform a heating operation.

[0412] That is, energy efficiency can be improved by matching the heating and cooling in temperature control between the air-conditioner and the ventilation device.

(Eleventh embodiment)

[0413] In the above embodiment, the air supply unit and the exhaust unit are installed in the space behind the ceiling in order for the ventilation device to perform ventilation, and the air supply port connected to the air supply unit and the exhaust port connected to the exhaust unit are installed in the ceiling of the living room space. However, the above embodiment is not limited to the above arrangement. Therefore, in the eleventh embodiment, an example in which the air supply unit and the exhaust unit are arranged in the living room space will be described.

[0414] FIG. 23 is a diagram illustrating a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to the eleventh embodiment. In the example illustrated in FIG. 23, an air-conditioning system includes a ventilation device 1G, the air-conditioner 2, and the upper level control device 100 for air-conditioning an indoor space. In the present embodiment, the same reference numerals are assigned to the same elements as in the above-described embodiment, and descriptions thereof will be omitted.

[0415] Similar to the first embodiment, the air-conditioner 2 includes the outdoor unit 70 and two air-conditioning indoor units 81 and 82. Further, the upper level control device 100 can implement the same control as in the above-described embodiment, for example, the heat load sharing illustrated in the first embodiment.

[0416] The ventilation device 1G includes a compressor unit 50, an exhaust unit 1310, an air supply unit 1320, and refrigerant circuits F1, F2, F3, and F4.

[0417] The air supply unit 1320 has a structure (an example of a first casing) in which a control unit 23, a first heat exchanger 22, and a fan 21 (an example of a first air volume adjustment mechanism) for supplying air (SA) to a living room space R11 after passing outside air (OA) taken in from the outside through the first heat exchanger 22 are housed.

[0418] The exhaust unit 1310 has a structure (an example of a second casing) in which the control unit 13, the second heat exchanger 12, and the fan 11 (an example of a second air volume adjustment mechanism) for exhausting air (EA)

to the outside after passing air (RA) returned from the living room space R11 through the second heat exchanger 12 are housed.

[0419] The exhaust unit 1310 and the air supply unit 1320 according to the present embodiment are installed in the living room space R11. In the present embodiment, the exhaust unit 1310 and the air supply unit 1320 are installed at different heights.

[0420] In the example illustrated in FIG. 23, the control unit 101 causes the first heat exchanger 22 to function as a condenser and causes the second heat exchanger 12 to function as an evaporator with respect to the ventilation device 1G.

[0421] Therefore, in the air supply unit 1320, the outside air (OA) taken in is warmed and then supplied (SA) to the living room space R11. By the air supply unit 1320, the living room space R11 is warmed from the vicinity of the floor by the warmed air supply (SA). The air supply (SA) is warm and thus rises in the living room space R11.

[0422] Then, the exhaust unit 1310 functions to take in the return air (RA) from the living room space R11 and exhaust the air (EA) to the outside. The exhaust unit 1310 is provided near the ceiling, and, therefore, the heated supply air (SA) returns air (RA) that rises from the vicinity of the floor, so that the circulation of air in the living room space R11 can be efficiently implemented. Furthermore, in the present embodiment, an air stream circulating in the height direction can be formed, so that the temperature distribution of the living room space R11 can be controlled to be substantially uniform.

[0423] The present embodiment may be combined with the configurations of the above-described embodiments. For example, a plurality of exhaust units 1310 and air supply units 1320 may be provided.

(Modified example of eleventh embodiment)

[0424] In the eleventh embodiment, an example in which the exhaust unit 1310 is installed near the ceiling and the air supply unit 1320 is installed near the floor has been described. However, the eleventh embodiment indicates an example of an arrangement, and if the heights of the exhaust unit and the air supply unit are different, the arrangement may be different.

[0425] FIG. 24 is a diagram illustrating a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to a modified example of the eleventh embodiment. In the example illustrated in FIG. 24, an air-conditioning system includes a ventilation device 1H, the air-conditioner 2, and the upper level control device 100 for air-conditioning the living room space R11. In the present embodiment, the same reference numerals are assigned to the same elements as in the above-described embodiment, and descriptions thereof will be omitted.

[0426] The ventilation device 1H includes the compressor unit 50, an exhaust unit 1410, an air supply unit 1420, the compressor unit 50, and refrigerant circuits F1, F2, F3, and F4.

[0427] The exhaust unit 1410 and the air supply unit 1420 according to the present embodiment are installed in the living room space R11. In the present embodiment, the exhaust unit 1410 and the air supply unit 1420 are installed at different heights as in the eleventh embodiment.

[0428] In the example illustrated in FIG. 24, the exhaust unit 1410 is installed near the floor and the air supply unit 1420 is installed near the ceiling. Further, the exhaust unit 1410 is installed near the wall on the right side of the living room space R11, and the air supply unit 1420 is installed near the wall on the left side of the living room space R11. The present modified example indicates an example of an arrangement, and other arrangements may suffice as long as the exhaust unit 1410 and the air supply unit 1420 are respectively installed near walls that face each other.

[0429] In the example illustrated in FIG. 24, the control unit 101 causes the first heat exchanger 22 to function as an evaporator and causes the second heat exchanger 12 to function as a condenser for the ventilation device 1H.

[0430] Therefore, the air supply unit 1420 supplies air (SA) to the living room space R11 after cooling the outside air (OA) taken in. In the present modified example, the living room space R11 is cooled from the side of the ceiling by the cooled air supply (SA) from the air supply unit 1420. The air supply (SA) is cold and thus moves downward in the living room space R11.

[0431] Then, the exhaust unit 1410 functions to take the return air (RA) from the living room space R11 and exhaust the air (EA) to the outside. The exhaust unit 1410 is provided near the floor, and, therefore, the return air (RA) coming down from the ceiling side is taken in by the cooled supply air (SA), so that the air circulation in the living room space R11 can be efficiently implemented. Furthermore, in the present embodiment, the air flow circulating in the height direction can be formed, so that the temperature distribution in the living room space R11 can be controlled to be substantially uniform.

[0432] The above-described eleventh embodiment and the modified example thereof illustrate an example of an arrangement of an exhaust unit and an air supply unit, and other arrangements may suffice as long as these units are arranged such that the heights of the exhaust unit and the air supply unit are different. The present embodiment may be combined with each of the configurations of the above-described embodiment. For example, a plurality of exhaust units and air supply units may be provided.

(Twelfth embodiment)

[0433] The above embodiments indicate examples of an air supply unit and an exhaust unit of a ventilation device, and there may be other modes of the air supply unit and the exhaust unit. Therefore, in the twelfth embodiment, an example in which the air supply unit and the exhaust unit are provided in a mode different from the above embodiment will be described.

[0434] FIG. 25 is a diagram illustrating a configuration example of a ventilation device, an air-conditioner, and an upper level control device according to the twelfth embodiment. In the example illustrated in FIG. 25, an air-conditioning system includes a ventilation device 11, the air-conditioner 2, and an upper level control device 1600 for air-conditioning the living room space R11. In the present embodiment, the same reference numerals are assigned to the same elements as in the above embodiment, and descriptions thereof will be omitted.

[0435] Similar to the first embodiment, the air-conditioner 2 includes the outdoor unit 70 and the two air-conditioning indoor units 81 and 82.

[0436] The upper level control device 1600 performs the same control as the upper level control device of the above embodiment (for example, heat load sharing control), and also includes a control unit 1601 for performing the following control on the exhaust unit 1610 and the air supply unit 1620 according to the temperature of the living room space R11.

[0437] The ventilation device 11 includes the compressor unit 50, an exhaust unit 1610, an air supply unit 1620, a compressor unit 50, and refrigerant circuits F1, F2, F3, and F4.

[0438] The air supply unit 1620 has a structure (an example of a first casing) containing an air supply damper 1625 (an example of a first switching mechanism) capable of switching the air intake destination between outdoors and the living room space R11, the first heat exchanger 22, and the fan 21 (an example of a first air volume adjustment mechanism) for supplying air to the living room space R11 after passing the air taken in from the intake destination switched by the air supply damper 1625 through the first heat exchanger 22.

[0439] The exhaust unit 1610 has a structure (an example of a second casing) including an exhaust damper 1615 (an example of a second switching mechanism) capable of switching the air output destination between outdoors and the living room space R11, the second heat exchanger 12, and the fan 11 (an example of a second air volume adjustment mechanism) for discharging air taken in from the living room space R11 to the output destination switched by the exhaust damper 1615 after passing the second heat exchanger 12.

[0440] The exhaust unit 1610 and the air supply unit 1620 according to the present embodiment are installed in the living room space R11. In the present embodiment, the exhaust unit 1610 and the air supply unit 1620 are installed at different heights in the same manner as in the eleventh embodiment.

[0441] In the example illustrated in FIG. 25, the control unit 1601 causes the first heat exchanger 22 to function as a condenser and causes the second heat exchanger 12 to function as an evaporator with respect to the ventilation device 11.

[0442] In the example illustrated in FIG. 25, the air supply damper 1625 is switched to take in outside air (OA) from the outside, and the exhaust damper 1615 is switched to exhaust (EA) the return air (RA) taken in.

[0443] Incidentally, when the difference between the temperature of the living room space R11 and the temperature of the outside is large, much energy is required to warm the outside air to the same temperature as the air of the living room space R11 when performing ventilation as illustrated in FIG. 25. On the other hand, when there are not many people in the living room space R11, the CO₂ concentration is low, so it can be regarded as a situation where it is not necessary to actively perform ventilation. That is, there are situations where the ventilation capacity can be reduced.

[0444] Therefore, the control unit 1601 of the present embodiment controls switching of the exhaust damper 1615 and the air supply damper 1625 in accordance with the outdoor environment and the indoor environment of the living room space R11.

[0445] FIG. 26 is a diagram illustrating an example of the switching of the air supply damper 1625 and the exhaust damper 1615 according to the present embodiment. In the example illustrated in FIG. 26, the air intake destination is switched to the outside by the air supply damper 1625, and the output destination of the air is controlled to be switched to the living room space R11 by the exhaust damper 1615. The living room space R11 may be provided with an exhaust port (not illustrated) for natural exhaust. That is, in the example illustrated in FIG. 26, a type 2 ventilation system is implemented.

[0446] When a first environmental condition is satisfied, the control unit 1601 performs switching control as illustrated in FIG. 26. The first environmental condition is, for example, when the CO₂ concentration detected by the sensor unit (not illustrated) is lower than a first concentration and the difference between the temperature of the living room space R11 and the outdoor temperature is higher than a first temperature difference. The first concentration is the CO₂ concentration determined as a criteria for determination when there is no person in the living room space R11. The first temperature difference is a temperature difference determined as a criteria for determination of whether energy saving measures should be taken, and is determined according to the implemented mode.

[0447] In the example illustrated in FIG. 26, by referring to the detection result of the sensor unit (not illustrated), the exhaust damper 1615 switches the output destination of the air to the living room space R11, while preventing the

increase of the CO₂ concentration, thereby preventing the discharge of warm air to the outside. Thus, the air-conditioning system according to the present embodiment can implement energy saving.

[0448] FIG. 27 is a diagram illustrating an example of the switching of the air supply damper 1625 and the exhaust damper 1615 according to the present embodiment. In the example illustrated in FIG. 27, the air intake destination is switched to the living room space R11 by the air supply damper 1625, and the air output destination is switched to the living room space R11 by the exhaust damper 1615.

[0449] When a second environmental condition is satisfied, the control unit 1601 performs switching control as illustrated in FIG. 26. The predetermined condition is, for example, a case where the CO₂ concentration is lower than the first concentration and the difference between the temperature of the living room space R11 and the outdoor temperature is higher than a second temperature difference (second temperature difference > first temperature difference). The second temperature difference is a temperature difference that serves as a criterion for determining whether energy saving measures should be taken and is larger than the first temperature difference, and is determined according to the mode.

[0450] In the example illustrated in FIG. 27, by referring to the detection result of the sensor unit (not illustrated), a decrease in the temperature of the living room space R11 can be prevented because the air supply damper 1625 switches the air intake destination to the living room space R11 and the exhaust damper 1615 switches the air output destination to the living room space R11, while preventing the increase in the CO₂ concentration. The switching situation illustrated in FIG. 27 does not require the outside air to rise to the temperature of the living room space R11 as compared with the switching situation illustrated in FIG. 26, and, therefore, further energy saving can be implemented.

[0451] FIGS. 25 to 27 are examples in which the air supply damper 1625 and the exhaust damper 1615 perform switching by being turned on/off, that is, the switching between ventilation and indoor circulation is performed. In the present embodiment, ventilation and indoor circulation may be performed in combination.

[0452] FIG. 28 illustrates an example of the switching of the air supply damper 1625 and the exhaust damper 1615 according to the present embodiment. In the example illustrated in FIG. 28, switching control is performed so that the living room space R11 and the outdoors are both set in combination as the air intake destination by the air supply damper 1625, and the living room space R11 and the outdoors are both set in combination as the air output destination by the exhaust damper 1615.

[0453] When a third environmental condition is satisfied, the control unit 1601 performs switching control as illustrated in FIG. 26. The third environmental condition is, for example, when the CO₂ concentration is lower than a second concentration (the second concentration > the first concentration) and the difference between the temperature of the living room space R11 and the outdoor temperature is higher than the second temperature difference. The second concentration is, for example, the CO₂ concentration determined as a criterion for determination for the case where only a few people exist in the living room space R11.

(Thirteenth embodiment)

[0454] FIG. 29 is a diagram illustrating an arrangement of a group of devices including an upper level control device 1700 according to the thirteenth embodiment. The example illustrated in FIG. 29 includes at least living room spaces R301, R302, and R303, lavatory rooms R304, R305, and R307, and a pipe shaft R306.

[0455] An air-conditioner 2C and a ventilation device 1J are provided in the living room space R303 and the lavatory rooms R304, R305, and R307.

[0456] The air-conditioner 2C includes one outdoor unit 370 and three air-conditioning indoor units 381, 382, and 383. One outdoor unit 370 and three air-conditioning indoor units 381 to 383 are connected by a connection pipe.

[0457] The outdoor unit 370 is connected to the upper level control device 1700 by a signal line. Thus, one outdoor unit 370 can perform air-conditioning control according to the control of the upper level control device 1700.

[0458] The ventilation device 1J includes a compressor unit 350, an air supply unit 1720, and an exhaust unit 1710.

[0459] The compressor unit 350, the air supply unit 1720, and the exhaust unit 1710 are connected by a connection pipe. The connection pipe includes a plurality of refrigerant connection pipes. This allows refrigerant to circulate between the compressor unit 350, the air supply unit 1720, and the exhaust unit 1710.

[0460] The compressor unit 350, the air supply unit 1720, and the exhaust unit 1710 are connected by a signal line (not illustrated). This enables transmission and reception of information between the units. The configuration of the compressor unit 350, the air supply unit 1720, and the exhaust unit 1710 is the same as that of the compressor unit, the air supply unit, and the exhaust unit described in the above-described embodiment, and the description thereof will be omitted.

[0461] The compressor unit 350 is arranged on the pipe shaft R306.

[0462] The upper level control device 1700 is connected to the compressor unit 350 by a signal line. Accordingly, the upper level control device 1700 can recognize the state of each device of the ventilation device 1J and perform control on each device.

[0463] The four air supply ports 1792A to 1792D, which are the air supply destinations of the air supply unit 1720, are provided in the living room space R303.

[0464] The four air supply ports 1792A to 1792D have built-in fans (an example of the first air volume adjustment mechanism) for adjusting the amount of air supplied to each air supply port. The fans are controlled by the upper level control device 1700.

[0465] Three exhaust ports 1791A to 1791C, which are air intake ports of the exhaust unit 1710, are provided in the lavatory rooms R304, R305, and R307.

[0466] The three exhaust ports 1791A to 1791C have built-in fans (an example of a second air volume adjustment mechanism) for adjusting the amount of air taken in at each exhaust port. The fans are controlled by the upper level control device 1700.

[0467] The upper level control device 1700 of the present embodiment controls the air volumes of the fans of the four air supply ports 1792A to 1792D and the air volumes of the fans of the three exhaust ports 1791A to 1791C so that the total amount of air supply (SA) provided by the four air supply ports 1792A to 1792D and the total amount of air return (RA) provided by the three exhaust ports 1791A to 1791C match each other.

[0468] Further, the air volumes of the fans of the three exhaust ports 1791A to 1791C may change in the lavatory rooms R304, R305, and R307 in accordance with the usage situation by people.

[0469] When the amount of air taken in from the fans of at least one of the three exhaust ports 1791A to 1791C changes, the upper level control device 1700 adjusts the amount of air taken in from the other exhaust ports of the three exhaust ports 1791A to 1791C by using other fans provided in the exhaust ports 1791A to 1791C so that the total amount of air taken in from the four air supply ports 1792A to 1792D and the total amount of air taken in from the three exhaust ports 1791A to 1791C substantially match each other.

[0470] In the example illustrated in the thirteenth embodiment, the case where one of each of the air supply unit 1720 and the exhaust unit 1710 are provided has been described. However, the present embodiment is not limited to an example in which one of each of the air supply unit 1720 and the exhaust unit 1710 are provided, and at least one of the air supply unit 1720 or the exhaust unit 1710 may be provided in plurality.

[0471] Even when a plurality of either one or more of the air supply unit 1720 and the exhaust unit 1710 are provided, the upper level control device 1700 controls the air volume of the fan provided at the exhaust port and the air supply port so that the total amount of outside air taken in by the air supply unit 1720 and the total amount of exhaust air exhausted by the exhaust unit 1710 substantially match each other.

[0472] In the present embodiment, the ventilation device 1J is provided across the plurality of living room spaces, and, therefore, effective utilization of exhaust heat can be implemented between the plurality of living room spaces. Furthermore, the total air volume of the exhaust unit 1710 and the air supply unit 1720 can be stabilized by the above-described control. Thus, the performance of the ventilation device 1J can be stabilized, and the air pressure in the plurality of living room spaces can be stably maintained.

(Fourteenth embodiment)

[0473] In the fourth embodiment described above, an example of a method for adjusting humidity has been described. However, another mode may be used as a humidity control method. Therefore, in the fourteenth embodiment, an example in which the amount of humidification is allocated to each area will be described.

[0474] The present embodiment has the same configuration as that in FIG. 7. The upper level control device 100 acquires the required amount of humidification in the living room space R101. The required amount of humidification (hereinafter referred to as the target humidification amount) in the living room space R101 may be acquired by a conventional method, and may be calculated according to the target humidity input by the user, for example.

[0475] The upper level control device 100 acquires the temperature of the air in the area R101A (an example of the first area), and acquires the temperature of the air in the area R101B (an example of the second area). The method of acquiring the temperature of air in the area R101A (an example of the first area) and the area R101B (an example of the second area) may be performed by using a known method, for example, by acquiring the temperature of air from a sensor unit (not illustrated) provided in each of the area R101A (an example of the first area) and the area R101B (an example of the second area).

[0476] To determine the target humidification amount, when humidifying the living room space R101, the upper level control device 100 compares the temperature of air in the area R101A (an example of the first area) in the living room space R101 with the temperature of air in the area R101B (an example of the second area) in the living room space R101, and allocates the humidification amount in the area where the temperature is high, to be more than the humidification amount in the area where the temperature is low.

[0477] For example, when the temperature of the area R101A is higher than that of the area R102B, the upper level control device 100 controls the humidification amount to be greater for the air supply unit 20A of the ventilation device 1A installed in the area R101A, as compared with that for the air supply unit 20B of the ventilation device 1B installed

in the area R101B. Any method for allocating the humidification amount may be used, including known methods. For example, the humidification amount may be allocated so that the relative humidity of the areas R101A and R102B is the same.

[0478] In the upper level control device 100 according to the present embodiment, condensation at the outlet of the ventilation device installed in the low temperature area is prevented by performing the control described above.

[0479] In the above embodiments and modified examples, an example has been described in which the air supply unit is a casing (an example of the first casing) that accommodates at least a part of the first heat exchanger 22 and the air flow path (an example of the first air flow path), and the exhaust unit is a casing (an example of the second casing) that accommodates at least a part of the second heat exchanger 12 and the air flow path (an example of the second air flow path), each of which is separated by a casing.

[0480] Thus, the exhaust unit and the air supply unit can be arranged at different positions. Thus, the degree of freedom of arrangement of the ventilation device capable of collecting heat can be increased compared with the conventional ventilation device.

[0481] However, the above-described embodiments and modified examples are not limited to the case where the casing of the air supply unit and the casing of the exhaust unit are separated, and the air supply unit and the exhaust unit may be integrated. That is, when the first heat exchanger 22 and the second heat exchanger 12 are connected by a refrigerant circuit, and the fan 21 corresponding to the first heat exchanger 22 and a fan corresponding to the second heat exchanger 12 are provided, the air volume adjustment and the temperature adjustment of the refrigerant as described in the above-described embodiments and modified examples may be applied. As described above, the technique illustrated in the above-described embodiments and modified examples may be applied when the air supply unit and the exhaust unit are integrated.

[0482] The above-described embodiments and modified examples describe a technique for cooperation in air-conditioning. The technique described in the above-described embodiments and modified examples is not limited to the use of the technique alone, but may be used in combination with one or more techniques described in other embodiments and modified examples.

[0483] Although the embodiments have been described above, it will be understood that various changes in form and details are possible without departing from the object and scope of the claims. Various variations and improvements such as combinations and substitutions with some or all of the other embodiments are possible.

[0484] The present international application is based upon and claims priority to Japanese patent application no. 2021-205608 filed on December 17, 2021, the entire contents of which are incorporated herein by reference.

Reference Signs List

[0485]

1, 1A, 1B, 1C, 1D, 1F_1, 1F_2, 1F_3, 1G, 1H, 1I, 1J ventilation device
 2, 2A, 2B, 2C, 2D, 2E_1, 2E_2 air-conditioner 10, 10A, 10B, 310, 521, 1210, 1310, 1410, 1610, 1710 exhaust unit
 11 fan
 12 second heat exchanger
 13, 113, 313 control unit
 14 temperature detecting unit
 1615 exhaust damper
 20, 20A, 20B, 320, 511, 1220, 1320, 1420, 1620, 1720 air supply unit
 21 fan
 22 first heat exchanger
 23 control unit
 24 temperature detecting unit
 1625 air supply damper
 50, 50A, 50B, 350, 551, 1250 compressor unit
 51 driving motor
 52, 152 control unit
 70, 70A, 70B, 370, 571, 771, 772 outdoor unit
 71, 171 control unit
 81, 82, 83, 81A, 81B, 381, 382, 382, 781, 782, 981, 982, 982 air-conditioning indoor unit
 92A, 92B, 92C, 92D, 392A, 392B, 392C, 392D, 992A, 992B, 992C, 992D air supply port
 93A, 93B, 93C, 93D, 393A, 393B, 393C, 393D, 991A, 991B, 991C, 991D exhaust port
 100, 300, 400, 500, 700, 900, 1100, 1200, 1600, 1700 upper-level control device
 101, 701, 1601 control unit

102, 702 storage unit
 F1, F2, F3, F4 refrigerant circuit
 F101, F102 connection pipe
 P1 air supply passage
 P2 return air flow path
 P101 air supply duct
 P102 exhaust duct

Claims

1. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power consumption of the ventilation device and a second capability indicating a heat load that can be output by the air-conditioner according to power consumption of the air-conditioner,
 acquires a temperature of the indoor space, and
 makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first capability and the second capability.

2. The air-conditioning system according to claim 1, wherein

the ventilation device is provided in plurality,
 the air-conditioner is provided in plurality, and
 the control unit makes a setting to cause the plurality of ventilation devices and the plurality of air-conditioners to share the first heat load that needs to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to the first capability and the second capability.

3. The air-conditioning system according to claim 1, wherein the control unit causes the first heat exchanger to function as a condenser or an evaporator to adjust a temperature of air supplied to the indoor space, in a case where a part of the first heat load is set as a share assigned to the ventilation device.

4. The air-conditioning system according to claim 1, wherein

the control unit stores, as the first capability, a first minimum heat load determined as a minimum value that can

be set based on the power consumption of the ventilation device out of the heat load that can be output by the ventilation device, and stores, as the second capability, a second minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit implements control such that the ventilation device repeats operating by a capability corresponding to a minimum heat load and stopping to operate, and makes a setting such that the air-conditioner stops operating, in a case where the first heat load is less than the first minimum heat load and the first heat load is less than the second minimum heat load.

5. The air-conditioning system according to claim 4, wherein the control unit sets an operation time of the ventilation device to perform processing corresponding to the first heat load per unit time, in a case where the first heat load is less than a minimum heat load according to the first capability and the first heat load is less than a minimum heat load according to the second capability.

6. The air-conditioning system according to claim 1, wherein

the ventilation device is provided in plurality,

the air-conditioner is provided in plurality, and

the control unit holds in advance, as the first capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the ventilation device out of the heat load that can be output by the ventilation device, and holds in advance, as the second capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit makes a setting to cause at least one of the plurality of ventilation devices to stop operating, and to cause other ones of the plurality of ventilation devices to operate according to a capability corresponding to the first heat load,

in a case where the first heat load is less than a sum of the minimum heat loads according to the first capability of the plurality of ventilation devices,

and the first heat load is less than a sum of the minimum heat loads according to the second capability of the plurality of air-conditioners.

7. The air-conditioning system according to claim 1, wherein

the control unit holds in advance, as the second capability, a minimum heat load determined as a minimum value that can be set based on the power consumption of the air-conditioner out of the heat load that can be output by the air-conditioner, and

the control unit causes the air-conditioner to maintain an operation of processing the minimum heat load of the second capability.

8. The air-conditioning system according to claim 1, wherein when the second heat exchanger is functioning as a condenser, an input target temperature is higher than a temperature of air of the outdoors, and the target temperature is lower than the temperature of air in the indoor space, the control unit reduces driving of the compressor, sets an amount of air that can be supplied from the first air flow path to be a maximum value that can be set, and sets an amount of air that can be exhausted from the second air flow path to be a maximum value that can be set.

9. The air-conditioning system according to any one of claims 1 to 8, wherein the control unit adds a heat load generated in the indoor space to a heat load generated by ventilation between the indoor space and the outdoors, and acquires a result of the addition as the first heat load.

10. The air-conditioning system according to any one of claims 1 to 9, wherein

the control unit

acquires a temperature or a humidity of first air that has passed through the first heat exchanger via the first air flow path, and acquires a temperature or a humidity of second air in the indoor space,

determines whether the temperature or the humidity of the first air and the temperature or the humidity of the second air satisfy a predetermined criterion, and

reduces a capability of processing a heat load by the ventilation device and increases a capability of process-

ing a heat load by the air conditioner as compared to before determining whether the predetermined criterion is satisfied, when the control unit determines that the predetermined criterion is not satisfied.

11. The air-conditioning system according to any one of claims 1 to 10, wherein the control unit adds a heat load corresponding to control of reducing a temperature generated in a first area in the indoor space to a heat load corresponding to control of raising a temperature generated in a second area in the indoor space, and acquires a result of the addition as the first heat load.

12. The air-conditioning system according to any one of claims 1 to 11, wherein

the control unit causes the first heat exchanger to function as the evaporator and causes the second heat exchanger to function as the condenser when the first heat load is determined to be a cooling load, and the control unit causes the first heat exchanger to function as the condenser and causes the second heat exchanger to function as the evaporator when the first heat load is determined to be a heating load.

13. The air-conditioning system according to claim 12, wherein

the ventilation device is provided in plurality,
the control unit sets a share of the first heat load to be assigned to the ventilation device including the second heat exchanger for taking in air from an area with low temperature among the plurality of ventilation devices, to be larger than a share of the first heat load to be assigned to other ones of the plurality of ventilation devices, when the first heat load is determined to be a cooling load, and
the control unit sets a share of the first heat load to be assigned to the ventilation device including the second heat exchanger for taking in air from an area with high temperature among the plurality of ventilation devices, to be larger than a share of the first heat load to be assigned to other ones of the plurality of ventilation devices, when the first heat load is determined to be a heating load.

14. The air-conditioning system according to any one of claims 1 to 13, wherein

the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space.

15. The air-conditioning system according to any one of claims 1 to 14, wherein the control unit adds a humidification amount or a dehumidification amount required for a first area in the indoor space to a humidification amount or a dehumidification amount required for a second area in the indoor space, and performs temperature control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner based on a result of the addition.

16. The air-conditioning system according to any one of claims 1 to 15, wherein when input of a target humidity in the indoor space is received, the control unit performs humidity control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner such that an average humidity in the indoor space becomes the target humidity, based on a relative humidity distribution in the indoor space.

17. The air-conditioning system according to any one of claims 1 to 16, wherein

the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and includes a first air volume adjustment mechanism configured to adjust an air volume for each of the air supply ports, the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space, and includes a second air volume adjustment mechanism configured to adjust an air volume for each of the exhaust ports, and the control unit controls, for each of the air supply ports, the first air volume adjustment mechanism of the corresponding supply port, and the control unit controls, for each of the exhaust ports, the second air volume adjustment mechanism of the corresponding exhaust port.

18. The air-conditioning system according to claim 1, wherein

the ventilation device is provided in each of a first area of the indoor space and a second area in the indoor space, and
the control unit acquires a target humidification amount indicating a humidification amount required for the indoor

space, and when humidifying the indoor space with the target humidification amount, the control unit compares a temperature of air in the first area in the indoor space with a temperature of air in the second area in the indoor space, and allocates a larger humidification amount for an area with a higher temperature among the first area and the second area than a humidification amount to be allocated to an area with a lower temperature among the first area and the second area.

19. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit adds a humidification amount or a dehumidification amount required for a first area in the indoor space to a humidification amount or a dehumidification amount required for a second area in the indoor space, and performs temperature control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner based on a result of the addition.

20. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein when input of a target humidity in the indoor space is received, the control unit performs humidity control by using the first heat exchanger of the ventilation device and the third heat exchanger of the air-conditioner such that an average humidity in the indoor space becomes the target humidity, based on a relative humidity distri-

bution in the indoor space.

21. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
 the first air flow path includes a plurality of air supply ports for supplying air to the indoor space, and includes a first air volume adjustment mechanism configured to adjust an air volume for each of the air supply ports, the second air flow path includes a plurality of exhaust ports for taking in air from the indoor space, and includes a second air volume adjustment mechanism configured to adjust an air volume for each of the exhaust ports, and the control unit controls, for each of the air supply ports, the first air volume adjustment mechanism of the corresponding supply port, and the control unit controls, for each of the exhaust ports, the second air volume adjustment mechanism of the corresponding exhaust port.

22. The air-conditioning system according to claim 21, further comprising:

a plurality of detecting units configured to detect a temperature of air in the indoor space, wherein the control unit controls an air volume supplied by the first air volume adjustment mechanism corresponding to the air supply port provided near an area in the indoor space having a large difference between a temperature indicated by a temperature distribution in the indoor space based on detection results of the plurality of detecting units and a target temperature received as input, to be greater than an air volume supplied by another first air volume adjustment mechanism, or
 the control unit controls an air volume taken in by the second air volume adjustment mechanism corresponding to the exhaust port provided near an area in the indoor space having a large difference between a temperature indicated by a temperature distribution in the indoor space based on detection results of the plurality of detecting units and a target temperature received as input, to be greater than an air volume taken in by another second air volume adjustment mechanism.

23. The air-conditioning system according to claim 21, wherein

the control unit stores first position information indicating a position of each of the air supply ports and second position information indicating a position of each of the exhaust ports, and
 the control unit controls the first air volume adjustment mechanism and the second air volume adjustment mechanism based on the position of the air supply port indicated by the first position information and the position of the air supply port indicated by the second position information.

24. The air-conditioning system according to claim 23, further comprising:

a wireless receiver installed at at least one of the air supply port or the exhaust port; and
 a detector configured to detect a temperature or a humidity, the detector being capable of performing wireless

communication with the wireless receiver, wherein
 the control unit identifies a position of the detector based on a signal strength of the detector acquired from the
 wireless receiver, and the first position information or the second position information, and
 the control unit controls the first air volume adjustment mechanism at the air supply port existing near the position
 of the detector or controls the second air volume adjustment mechanism of the exhaust port existing near the
 position of the detector, based on a detection result of the detector.

25. The air-conditioning system according to claim 21, further comprising:

a third air flow path configured to transport air from a first opening provided near the air supply port in a fifth
 area in the indoor space to a second opening provided in a sixth area in the indoor space, wherein
 the control unit controls an amount of air flowing in the third air flow path.

26. The air-conditioning system according to claim 21, further comprising:

a heat transfer apparatus including:

a second compressor;

a fourth heat exchanger configured to function as a condenser or an evaporator, the fourth heat exchanger
 being provided in a seventh area in the indoor space;

a fifth heat exchanger configured to function as a condenser or an evaporator, the fifth heat exchanger
 being provided in an eighth area in the indoor space; and

a second refrigerant circuit in which a refrigerant flows, the second refrigerant circuit being connected to
 the second compressor, the fourth heat exchanger, and the fifth heat exchanger by a refrigerant pipe, wherein

the control unit causes the fourth heat exchanger to function as one of a condenser or an evaporator and causes
 the fifth heat exchanger to function as another one of a condenser or an evaporator.

27. The air-conditioning system according to any one of claims 21 to 26, further comprising:

a ventilation mechanism configured to exhaust air from the indoor space to the outdoors, wherein
 the control unit adjusts an amount of air exhausted and an amount of air exhausted by the ventilation device,
 based on an amount of air exhausted by the ventilation mechanism.

28. The air-conditioning system according to claim 21, wherein

the plurality of air supply ports are provided in an indoor space different from the indoor space in which the
 plurality of exhaust ports are provided, and

when an amount of air taken in from at least one exhaust port of the plurality of exhaust ports changes, the
 control unit adjusts an amount of air taken in by another exhaust port of the plurality of exhaust ports by using
 the second air volume adjustment mechanism, such that a sum of amounts of air supplied from the plurality of
 air supply ports and a sum of amounts of air taken in from the plurality of exhaust ports substantially match
 each other.

29. An air-conditioning system comprising:

a ventilation device including:

a compressor;

a first heat exchanger configured to function as a condenser or an evaporator;

a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then
 supply the air that has passed through the first heat exchanger to an indoor space;

a second heat exchanger configured to function as a condenser or an evaporator;

a second air flow path configured to pass air taken in from the indoor space through the second heat
 exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and

a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor,
 the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the
 taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone
 heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
 the first heat exchanger is configured to reduce an evaporation temperature of a refrigerant flowing through the
 first heat exchanger, and
 when a target temperature and a target humidity are set, and the first heat exchanger is functioning as an
 evaporator, the control unit implements control to dehumidify air flowing in a state where the evaporation tem-
 perature in the first heat exchanger is reduced to reach the target humidity, and controls the temperature by
 the air-conditioner to reach the target temperature.

30. The air-conditioning system according to claim 29, wherein when the target temperature and the target humidity
 are set, and the first heat exchanger is functioning as an evaporator, when performing heat exchange on the air
 flowing in a state where the evaporation temperature in the first heat exchanger is reduced, the control unit implements
 control such that the air supplied to the indoor space after being subjected to heat exchange in the second heat
 exchanger maintains a temperature corresponding to the target humidity on a curve of 100% relative humidity in an
 air diagram.

31. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then
 supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat
 exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor,
 the first heat exchanger, and the second heat exchanger by a refrigerant pipe, and

a control unit configured to control the ventilation device, wherein
 when the ventilation device performs a humidification operation, the control unit performs temperature control
 based on a temperature set for air that has undergone heat exchange by the first heat exchanger such that a
 target temperature and a target humidity set in advance are reached, according to isenthalpic change when
 water is supplied to the air that has undergone the heat exchange by the first heat exchanger.

32. An air-conditioning system comprising:

a first air-conditioner including:

a first heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in an indoor space, perform heat exchange on the
 taken in air with a refrigerant flowing through the first heat exchanger, and exhaust the air that has undergone
 heat exchange by the first heat exchanger to the indoor space,

a second air-conditioner including:

a second heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the
 taken in air with a refrigerant flowing through the second heat exchanger, and exhaust the air that has
 undergone heat exchange by the second heat exchanger to the indoor space, and

a control unit configured to control the first air-conditioner and the second air-conditioner, wherein the control unit

stores, in a storage unit, a first air-conditioning capability including a first minimum heat load determined as a minimum value of a heat load that can be output by the first air-conditioner, and a second air-conditioning capability including a second minimum heat load determined as a minimum value of a heat load that can be output by the second air-conditioner, acquires a temperature in the indoor space, and makes a setting to cause the second air-conditioner to process a first heat load, in a case where power consumption by the second air-conditioner for processing the second minimum heat load is lower than power consumption by the first air-conditioner for processing the first minimum heat load, and the first heat load required to be adjusted in the indoor space that is calculated based on the temperature of the indoor space is lower than the first minimum heat load.

33. The air-conditioning system according to claim 32, wherein

the first air-conditioning capability stored in the storage unit includes a first maximum heat load determined as a maximum value of a heat load that can be output by the first air-conditioner, the second air-conditioning capability stored in the storage unit includes a second maximum heat load determined as a maximum value of a heat load that can be output by the second air-conditioner, and when the second maximum heat load is lower than the first maximum heat load, and the first heat load calculated based on the temperature of the indoor space is higher than the first minimum heat load and the first heat load is lower than the second maximum heat load, the control unit causes an air-conditioner, among the first air-conditioner and the second air-conditioner, that requires a lower power consumption for processing the first heat load, to process the first heat load.

34. The air-conditioning system according to any one of claims 1 to 31, further comprising:

a first casing configured to accommodate at least a part of the first heat exchanger and the first air flow path; and a second casing configured to accommodate at least a part of the second heat exchanger and the second air flow path, wherein the first casing and the second casing are separable.

35. The air-conditioning system according to any one of claims 1 to 31, further comprising:

a third air volume adjustment mechanism configured to adjust an air volume of the air taken in from the outdoors and flowing to the indoor space from the first heat exchanger through the first air flow path; and a fourth air volume adjustment mechanism configured to adjust an air volume of the air that passes through the second air flow path from the indoor space and flows to the outdoors from the second heat exchanger, wherein the control unit sets an air volume of air supplied by the third air volume adjustment mechanism and an air volume of air taken in by the fourth air volume adjustment mechanism to be different from each other, based on an air volume of air supplied or exhausted by another device.

36. The air-conditioning system according to any one of claims 1 to 31, wherein

the ventilation device is provided in plurality, and the air-conditioning system further comprises, for each of the plurality of ventilation devices:

a third air volume adjustment mechanism configured to adjust an air volume of the air taken in from the outdoors and flowing to the indoor space from the first heat exchanger through the first air flow path, and a fourth air volume adjustment mechanism configured to adjust an air volume of the air that passes through the second air flow path from the indoor space and flows to the outdoors from the second heat exchanger, and wherein

the control unit sets an air volume of air supplied by the third air volume adjustment mechanism and an air volume of air taken in by the fourth air volume adjustment mechanism in the indoor space, to be substantially the same.

37. An air-conditioning system comprising:

a ventilation device including:

a compressor used when performing a heat collection ventilation operation;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit acquires a temperature of the indoor space, and when a first heat load required to be adjusted in the indoor space calculated based on the temperature of the indoor space is a cooling load, and when a temperature of air in the outdoors is lower than a predetermined temperature, the control unit reduces driving of the compressor, and sets at least one of an air direction or an air volume of air supplied from the first air flow path such that air in the indoor space is replaced by air in the outdoors by the ventilation device.

38. The air-conditioning system according to claim 37, further comprising:

a plurality of air supply ports configured to supply air to the indoor space by the first air flow path; and
 a plurality of exhaust ports configured to return air from the indoor space by the second air flow path, wherein when the first heat load required to be adjusted in the indoor space calculated based on the temperature of the indoor space is a cooling load, and when a temperature of air in the outdoors is lower than a predetermined temperature, air is supplied by the plurality of air supply ports arranged on a first direction side in the indoor space and air is exhausted by the plurality of exhaust ports arranged on a second direction side that is an opposite direction to the first direction side in the indoor space.

39. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air volume adjustment mechanism configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a first casing configured to accommodate the first heat exchanger and the first air volume adjustment mechanism;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air volume adjustment mechanism configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors;
 a second casing configured to accommodate the second heat exchanger and the second air volume adjustment mechanism; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the
 taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone
 heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
 the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power
 consumption of the ventilation device and a second capability indicating a heat load that can be output by
 the air-conditioner according to power consumption of the air-conditioner,
 acquires a temperature of the indoor space, and
 makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs
 to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to
 the first capability and the second capability, and wherein

the first casing and the second casing are provided at different heights.

40. An air-conditioning system comprising:

a ventilation device including:

a compressor;
 a first heat exchanger configured to function as a condenser or an evaporator;
 a first air volume adjustment mechanism configured to pass air taken in from outdoors through the first heat
 exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
 a first casing configured to accommodate the first heat exchanger and the first air volume adjustment
 mechanism;
 a second heat exchanger configured to function as a condenser or an evaporator;
 a second air volume adjustment mechanism configured to pass air taken in from the indoor space through
 the second heat exchanger and then supply the air that has passed through the second heat exchanger to
 the outdoors;
 a second casing configured to accommodate the second heat exchanger and the second air volume ad-
 justment mechanism; and
 a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor,
 the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
 an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the
 taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone
 heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein
 the control unit

stores a first capability indicating a heat load that can be output by the ventilation device according to power
 consumption of the ventilation device and a second capability indicating a heat load that can be output by
 the air-conditioner according to power consumption of the air-conditioner,
 acquires a temperature of the indoor space, and
 makes a setting to cause the ventilation device and the air-conditioner to share a first heat load that needs
 to be adjusted in the indoor space calculated based on the temperature of the indoor space, according to
 the first capability and the second capability, and wherein

the first casing further includes a first switching mechanism configured to switch an air intake destination between

the outdoors and the indoor space, and
the second casing further includes a second switching mechanism configured to switch an air exhaust destination between the outdoors and the indoor space.

41. An air-conditioning control apparatus comprising:

a ventilation device including:

a compressor;
a first heat exchanger configured to function as a condenser or an evaporator;
a first air flow path configured to pass air taken in from outdoors through the first heat exchanger and then supply the air that has passed through the first heat exchanger to an indoor space;
a second heat exchanger configured to function as a condenser or an evaporator;
a second air flow path configured to pass air taken in from the indoor space through the second heat exchanger and then supply the air that has passed through the second heat exchanger to the outdoors; and
a refrigerant circuit in which a refrigerant flows, the refrigerant circuit being connected to the compressor, the first heat exchanger, and the second heat exchanger by a refrigerant pipe,

an air-conditioner including:

a third heat exchanger configured to function as a condenser or an evaporator; and
an air-conditioning indoor unit configured to take in air in the indoor space, perform heat exchange on the taken in air with a refrigerant flowing through the third heat exchanger, and exhaust the air that has undergone heat exchange to the indoor space, and

a control unit configured to control the ventilation device and the air-conditioner, wherein the control unit

generates a plurality of pieces of operation instruction information for controlling the air-conditioner and the ventilation device to control air-conditioning in the indoor space in which the air-conditioner and the ventilation device are installed,
acquires an amount correlated with an air-conditioning load in the indoor space,
calculates, for each piece of the operation instruction information, an energy amount in a case where processing is performed according to the operation instruction information of the air-conditioning load in the indoor space based on the amount correlated with the air-conditioning load in the indoor space,
stores the calculated energy amount in association with each piece of the operation instruction information in a storage unit, and
outputs the operation instruction information associated with the energy amount satisfying a predetermined condition to the air-conditioner or the ventilation device as an operation instruction.

42. The air-conditioning control apparatus according to claim 41, wherein the predetermined condition is a condition to collect cold heat from exhaust heat (a high-temperature refrigerant flows through exhaust path heat exchange) when a total heat balance in the indoor space is a temperature rise, and to collect warm heat from exhaust heat when the total heat balance in the indoor space is a temperature fall.

43. The air-conditioning control apparatus according to claim 41, wherein the amount correlated with the air-conditioning load in the indoor space includes an amount relating to an air volume to be ventilated by the ventilation device.

FIG.1

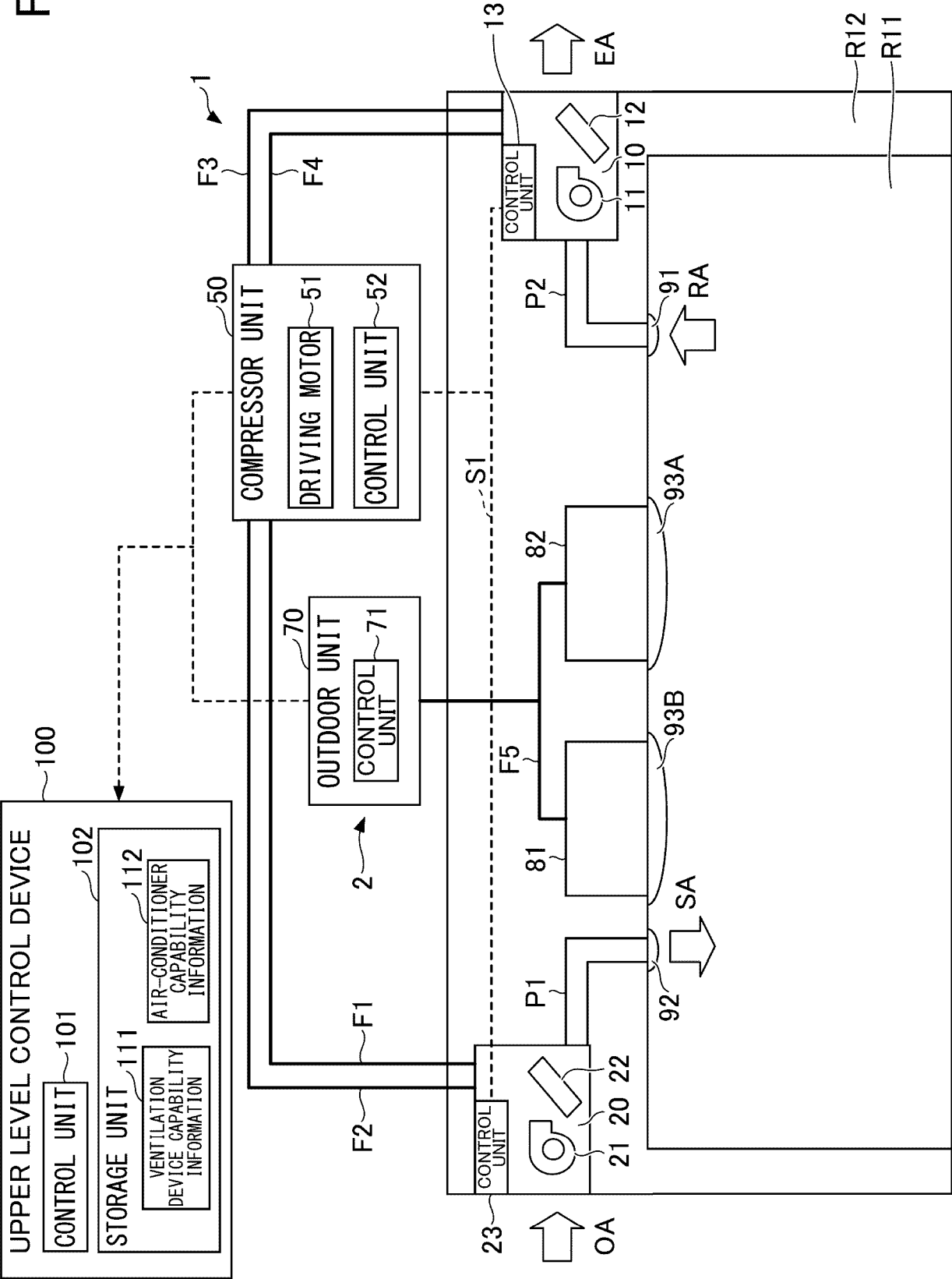


FIG.2

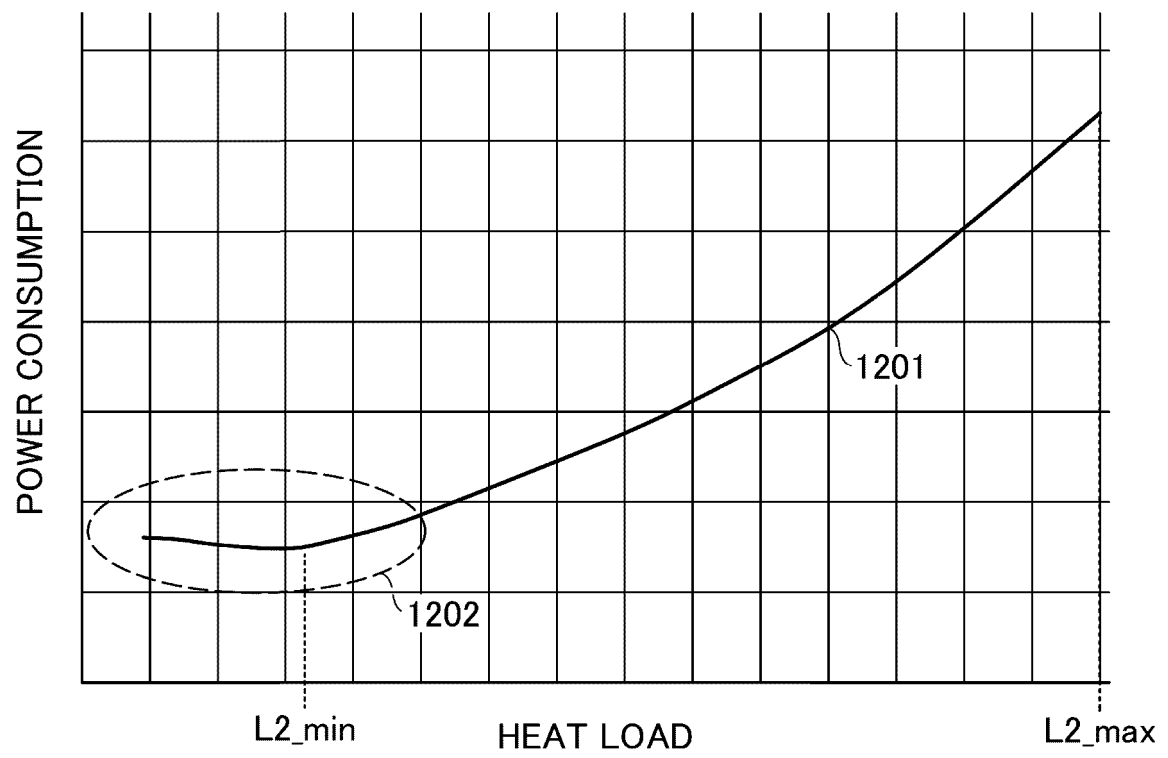


FIG.3

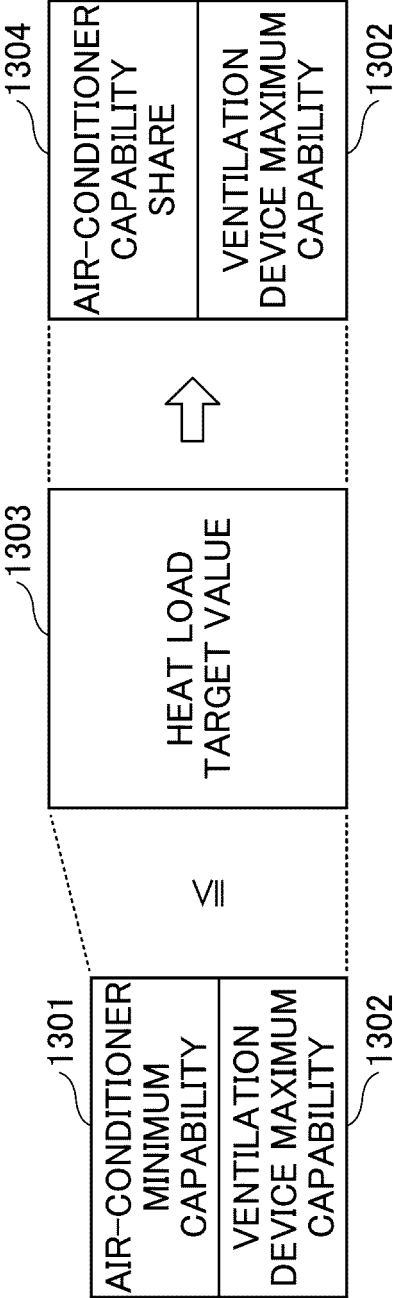


FIG.4

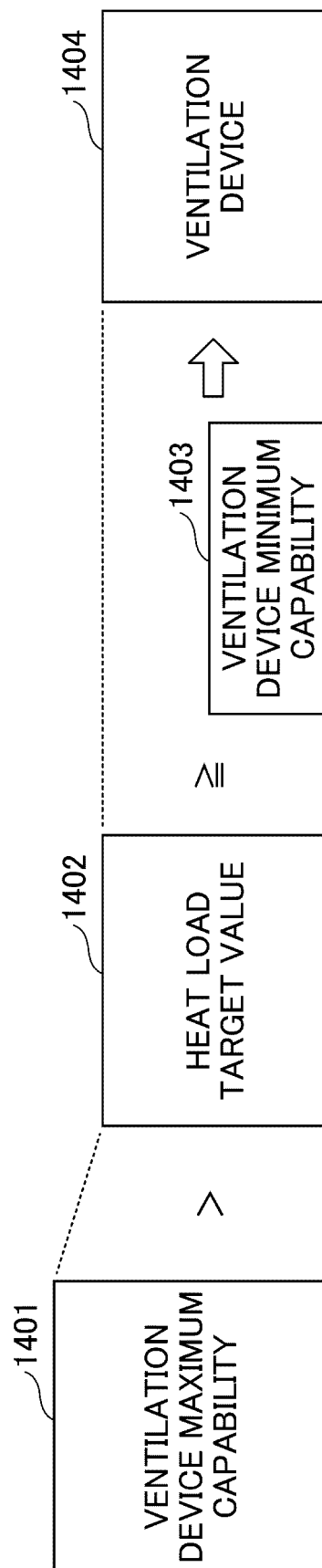


FIG.5

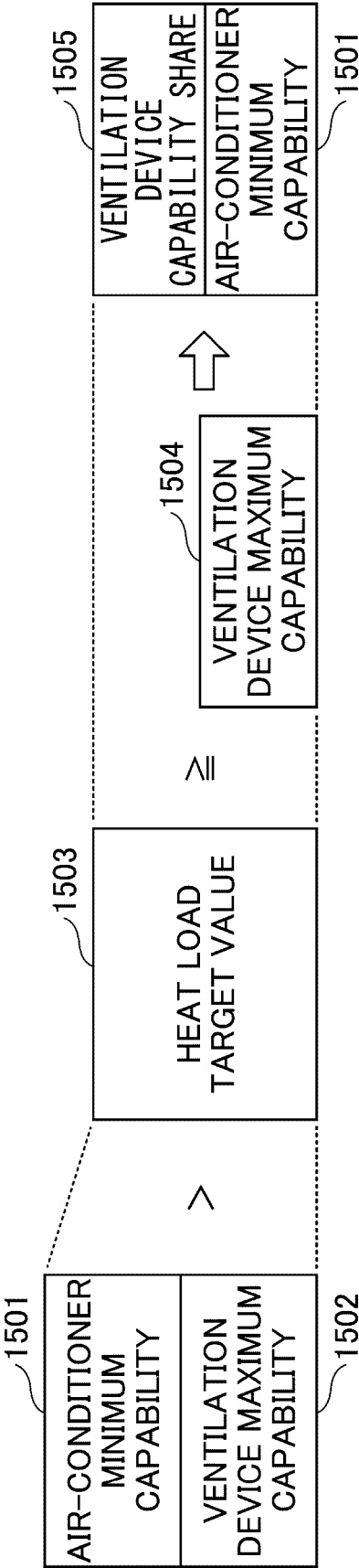


FIG.6

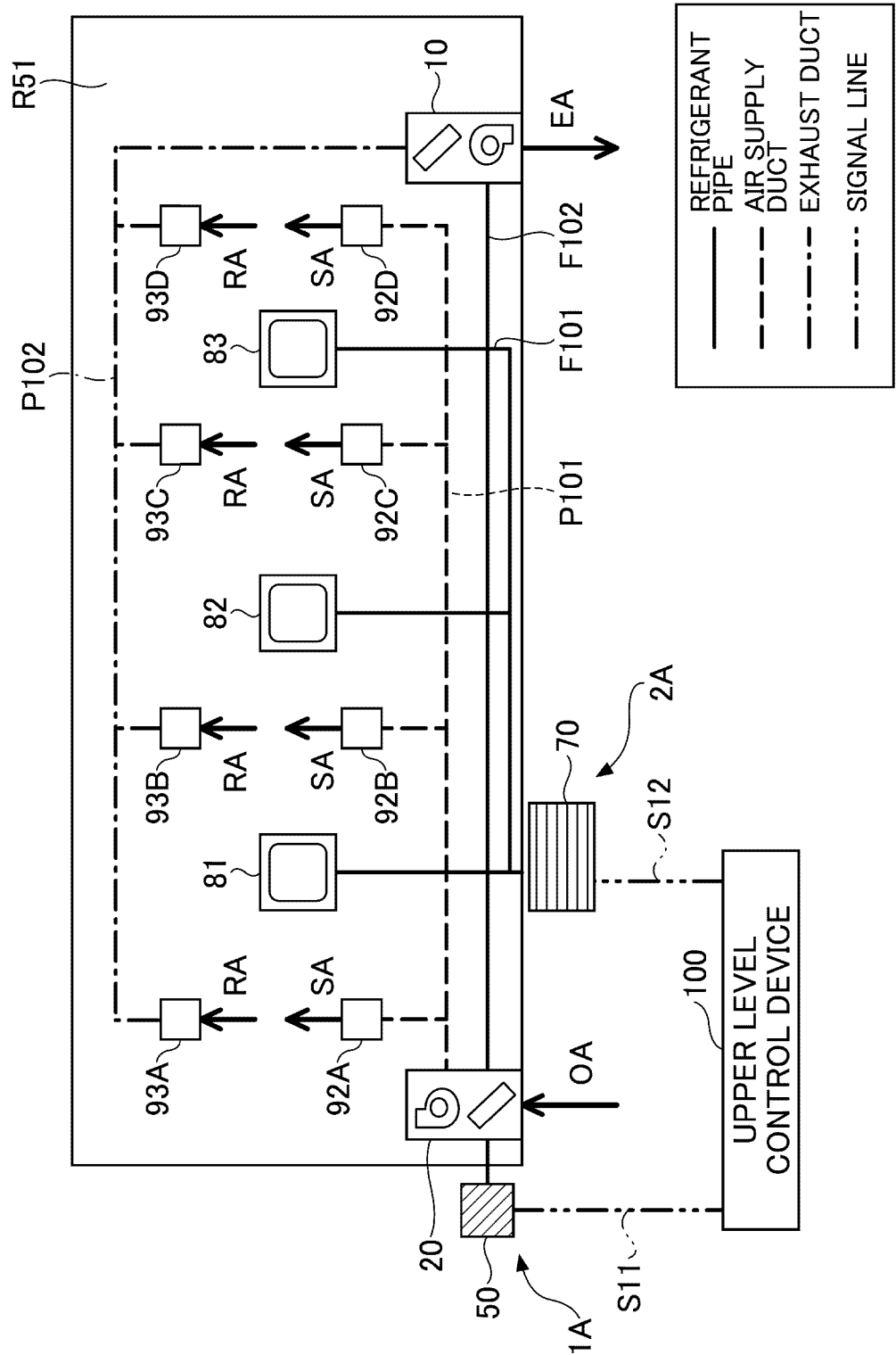


FIG.7

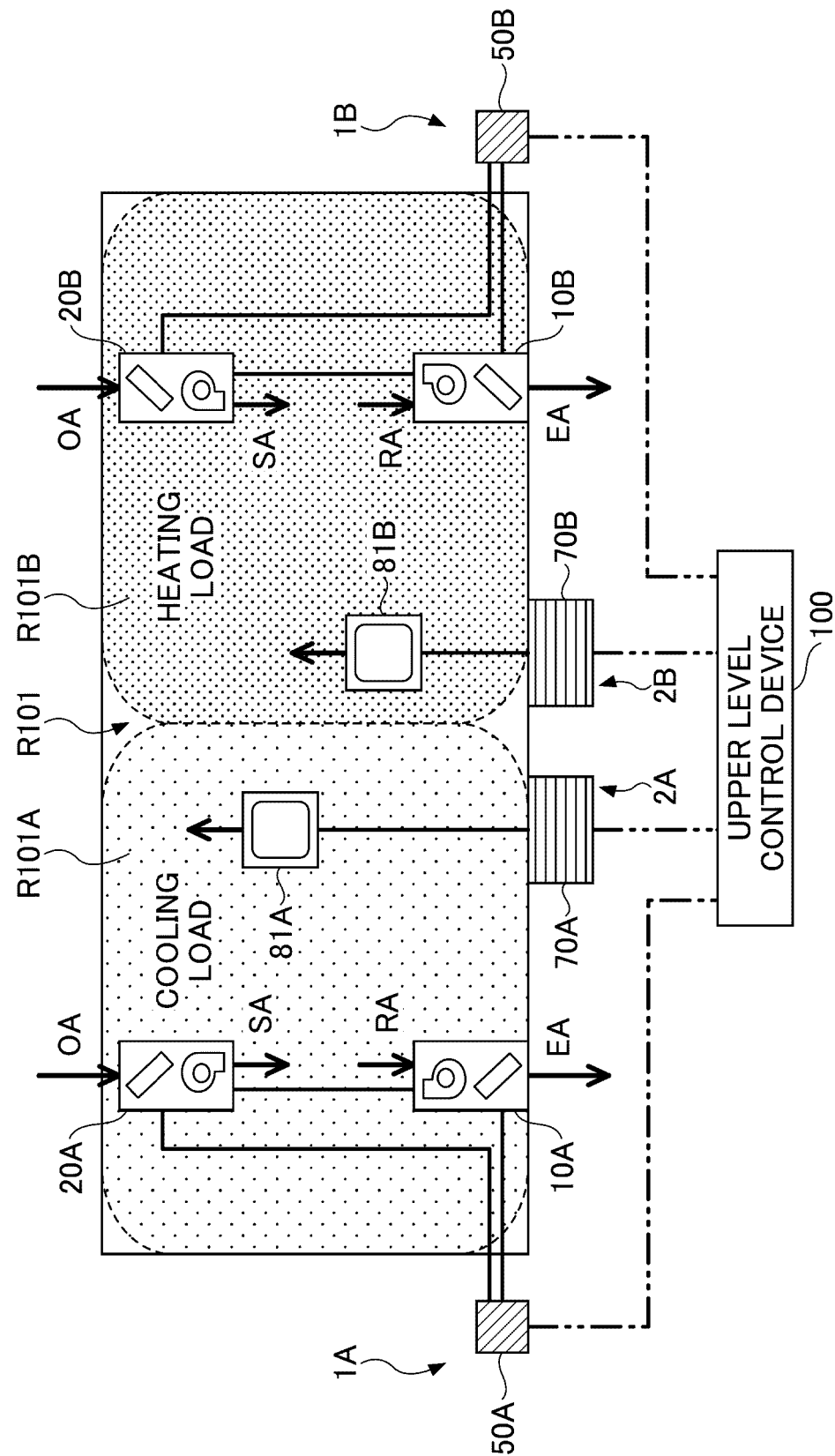


FIG.8

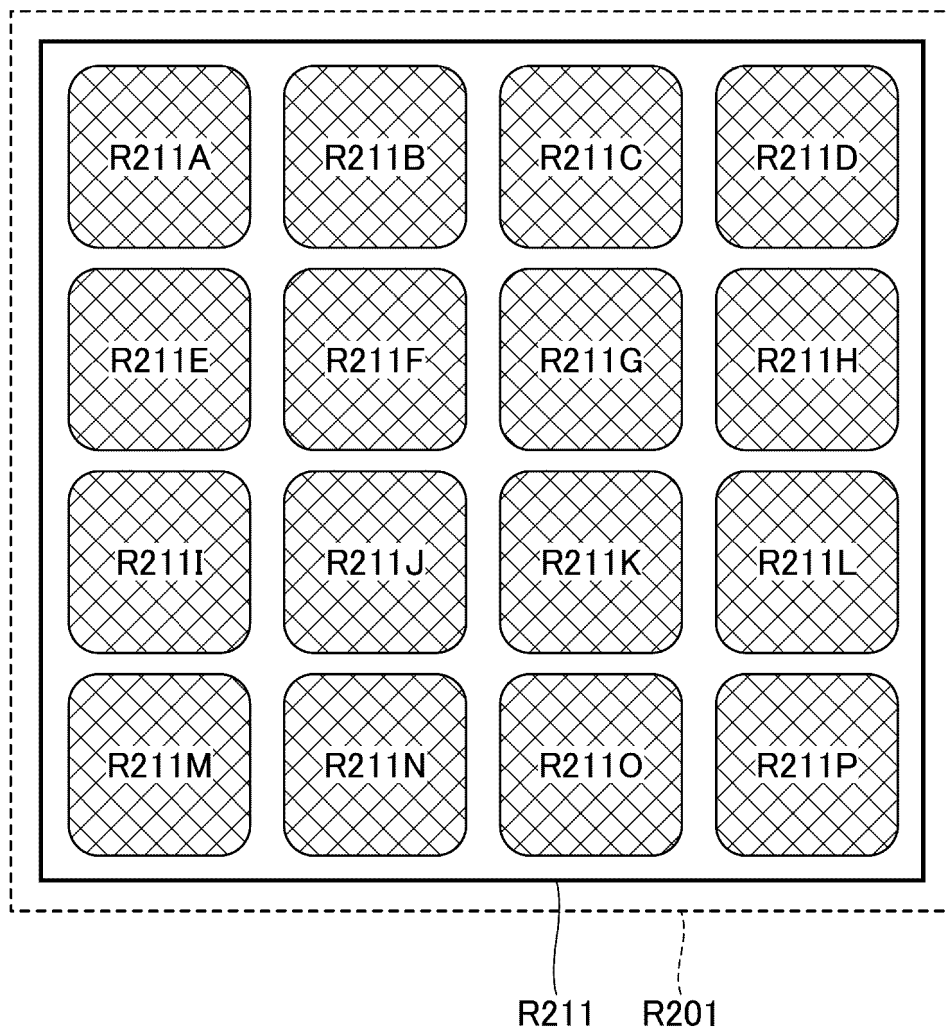


FIG.9

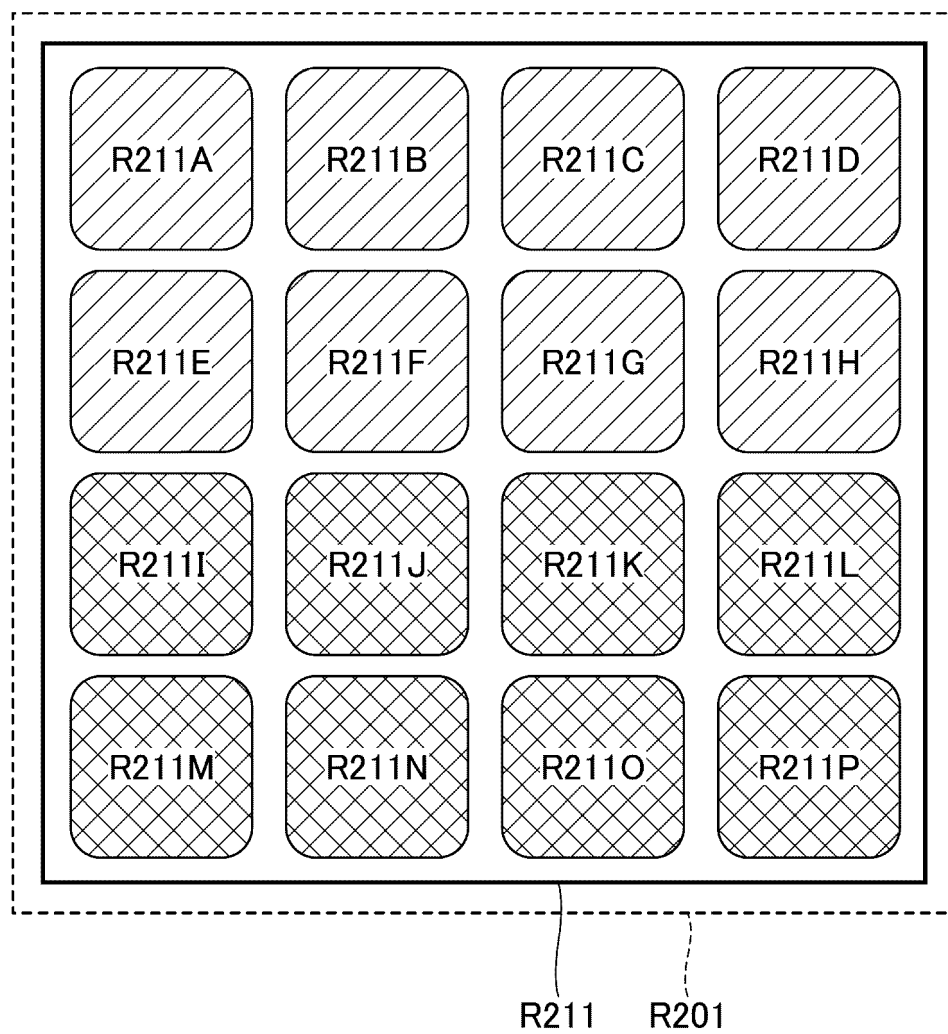


FIG.10

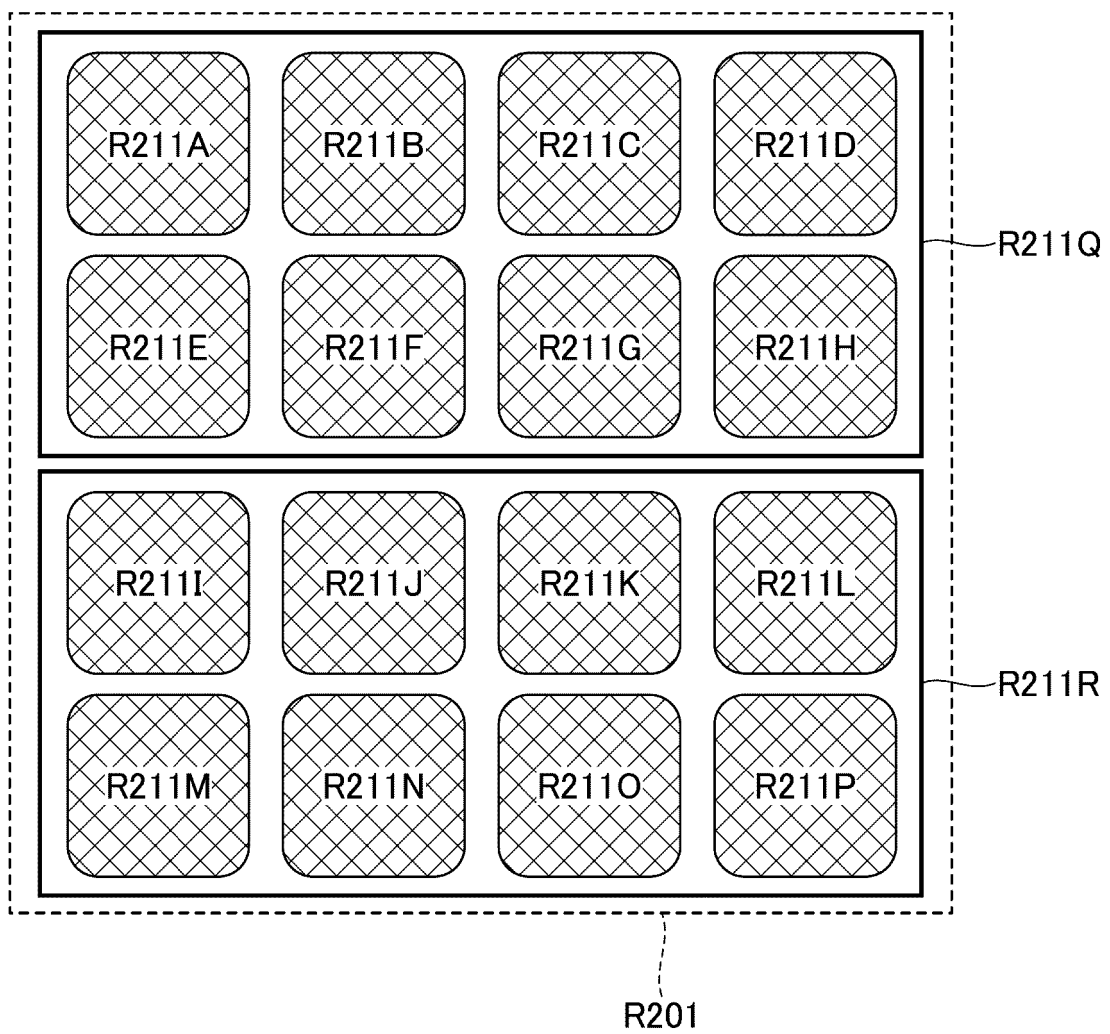


FIG.11

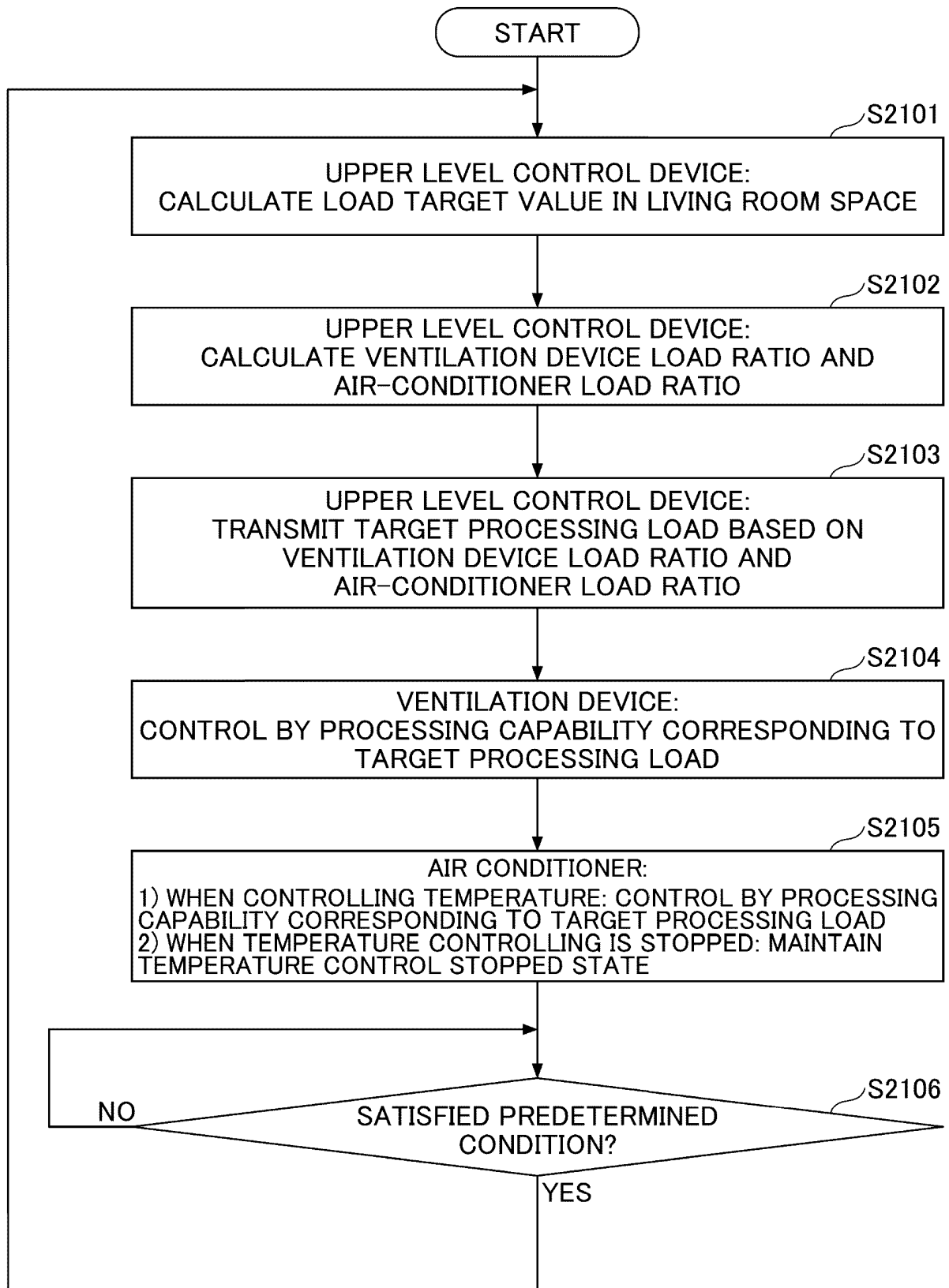


FIG.12

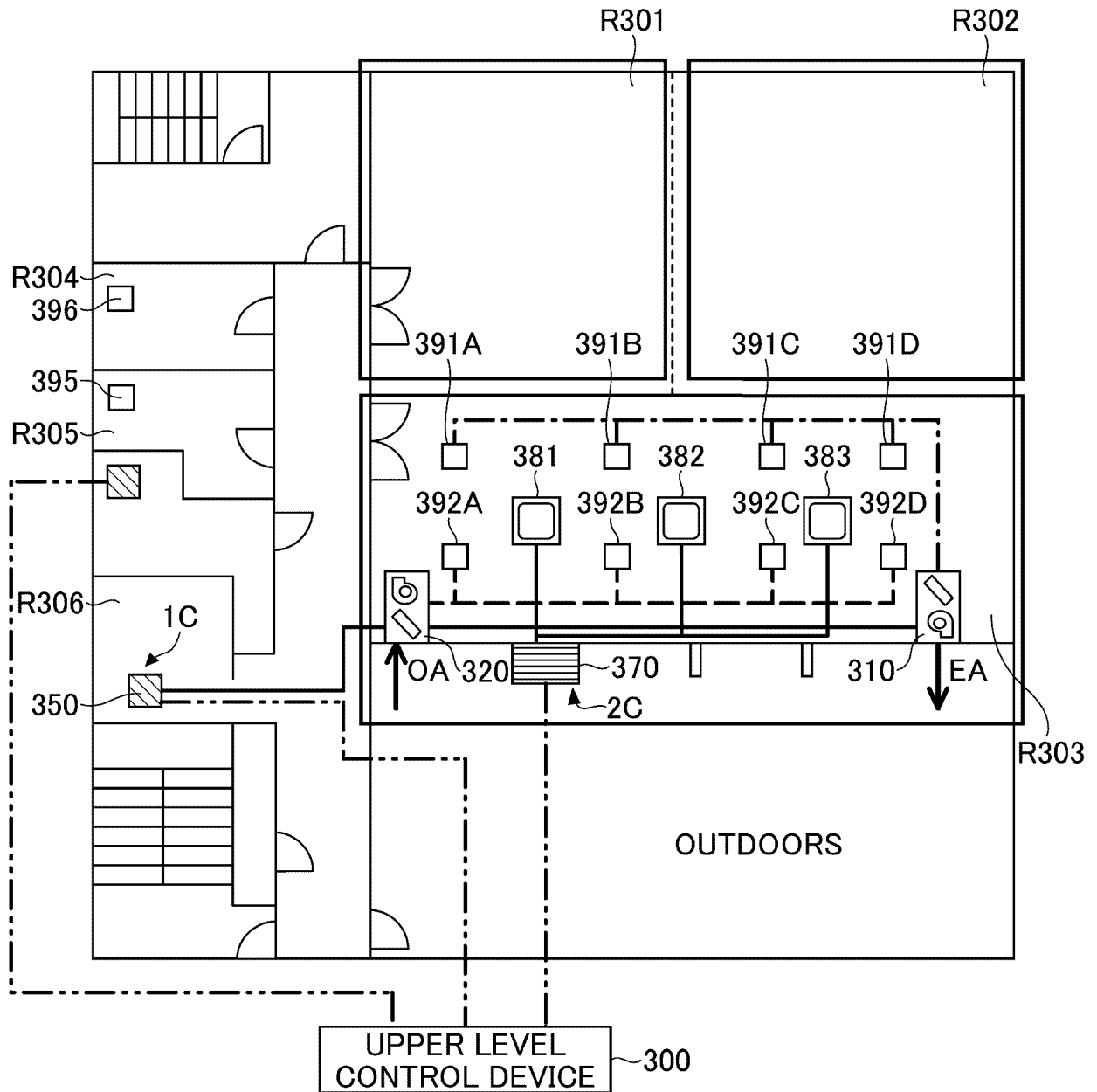


FIG.13

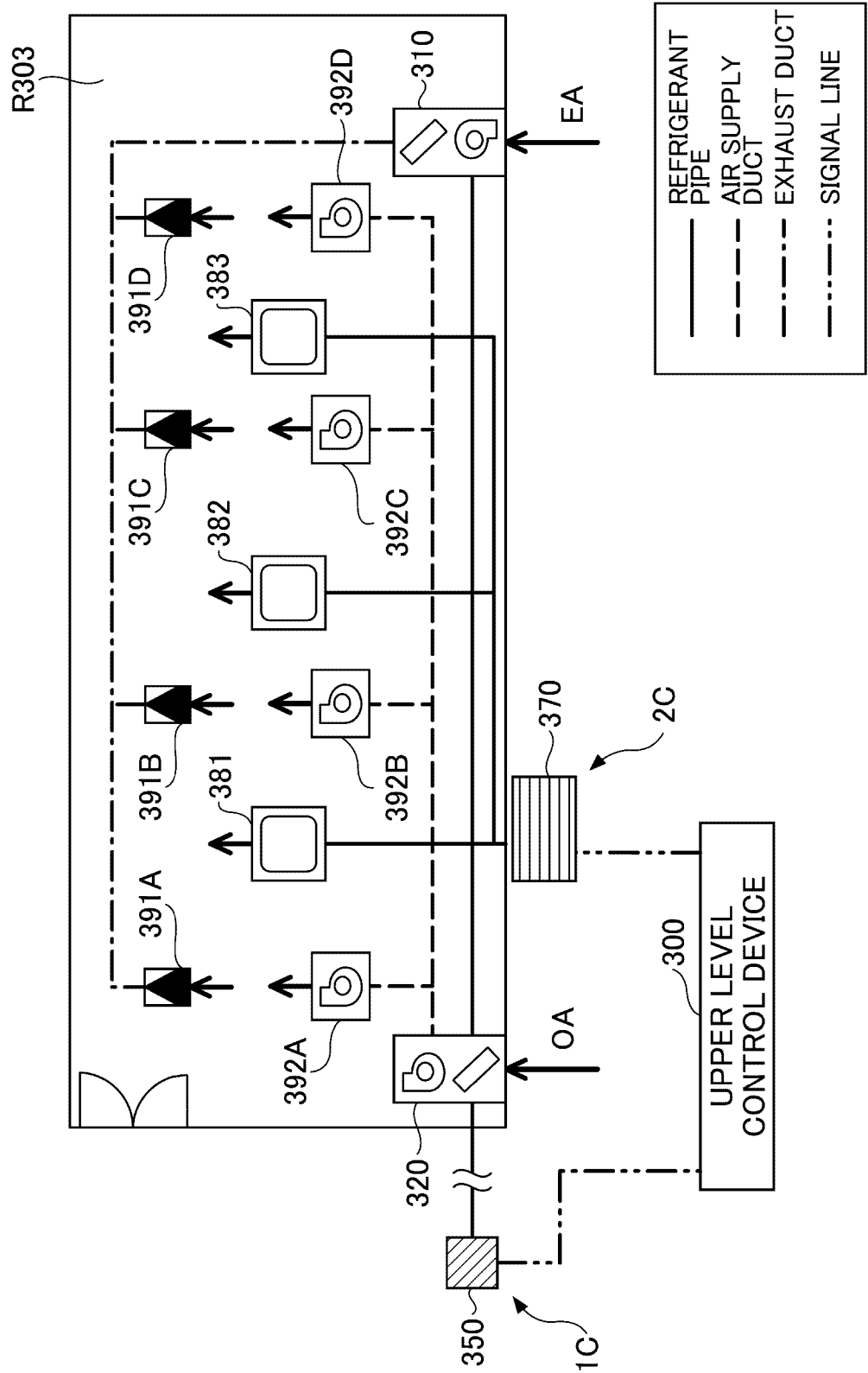


FIG.14

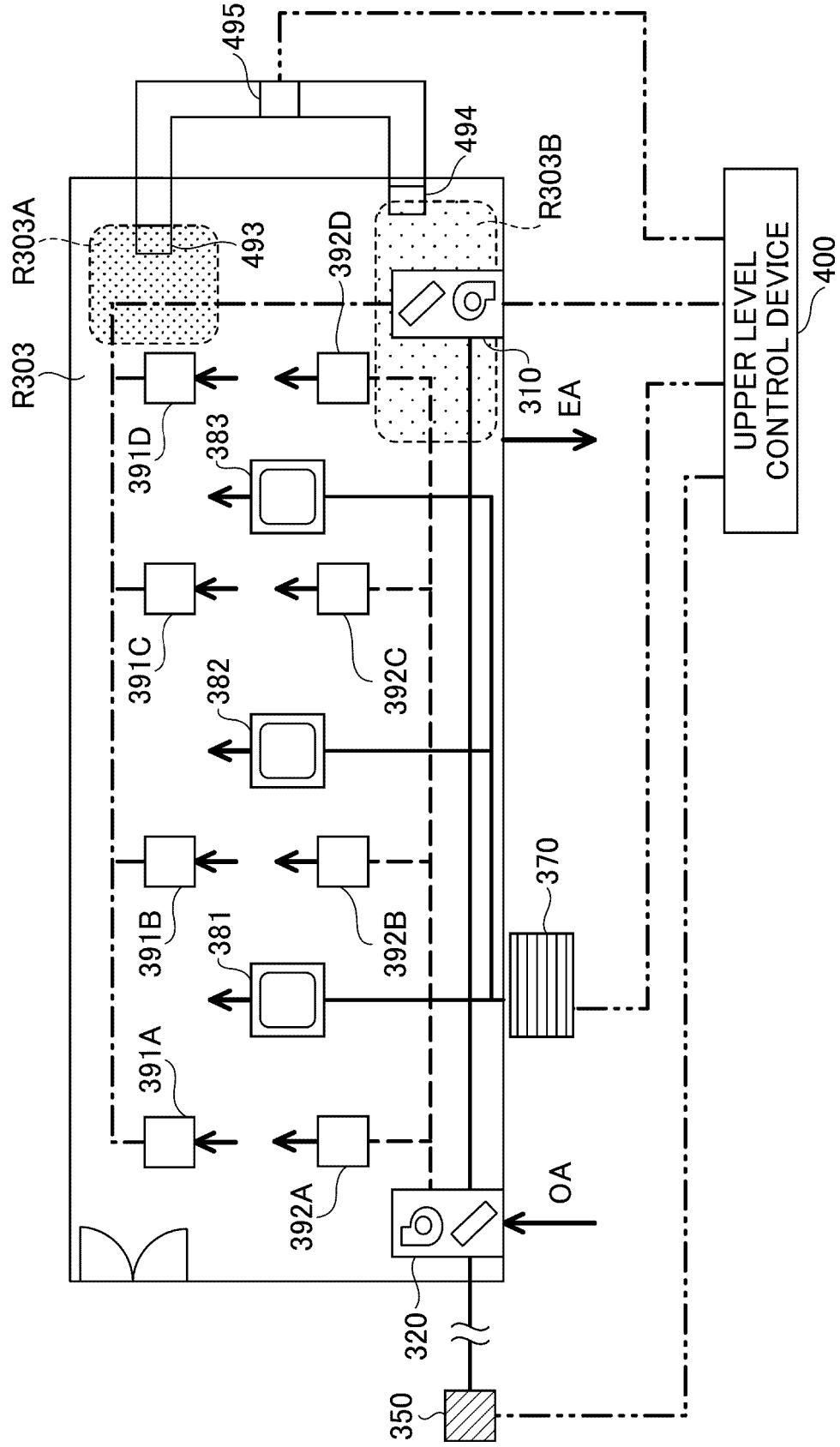


FIG.15

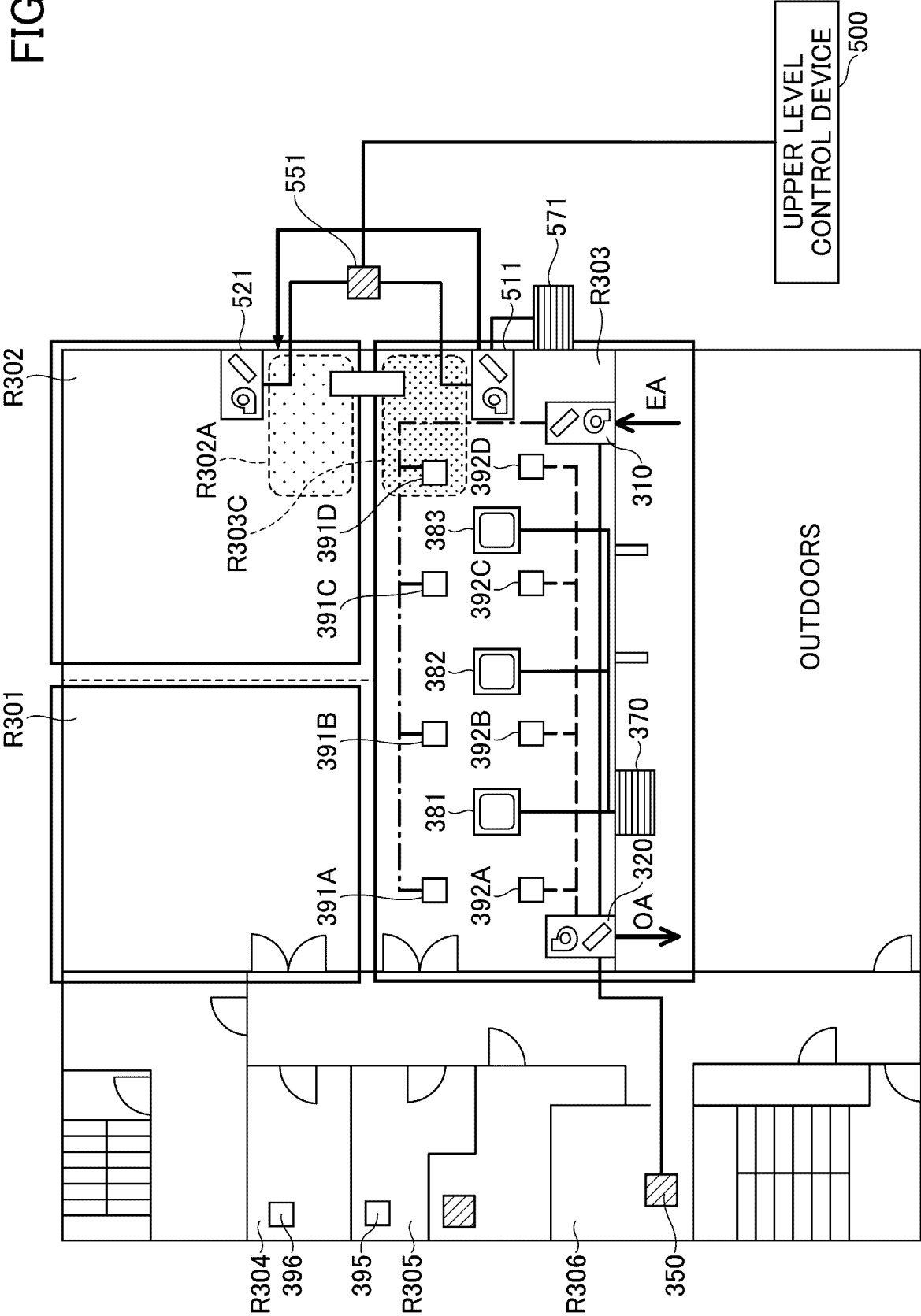


FIG.16

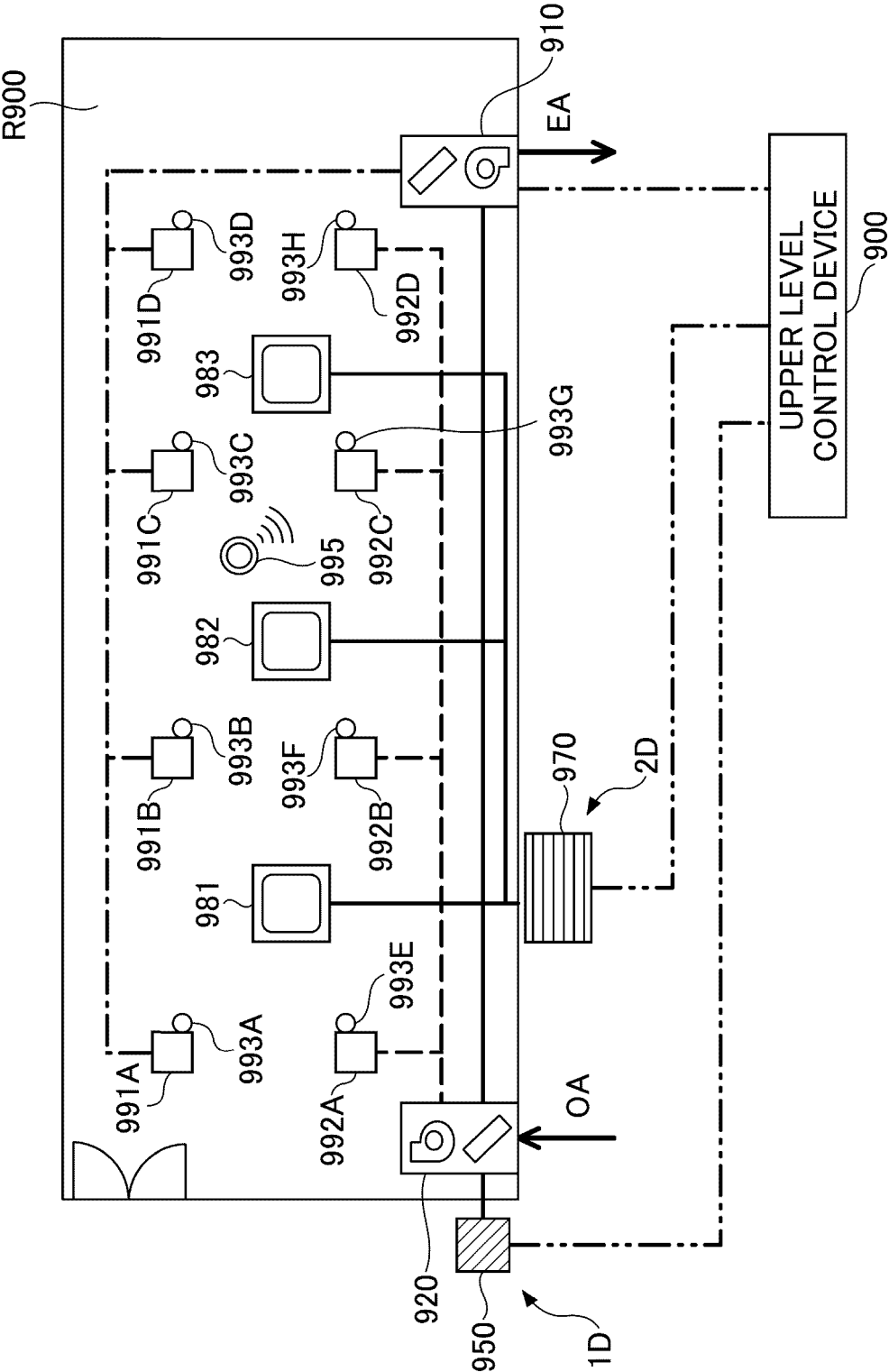


FIG.17

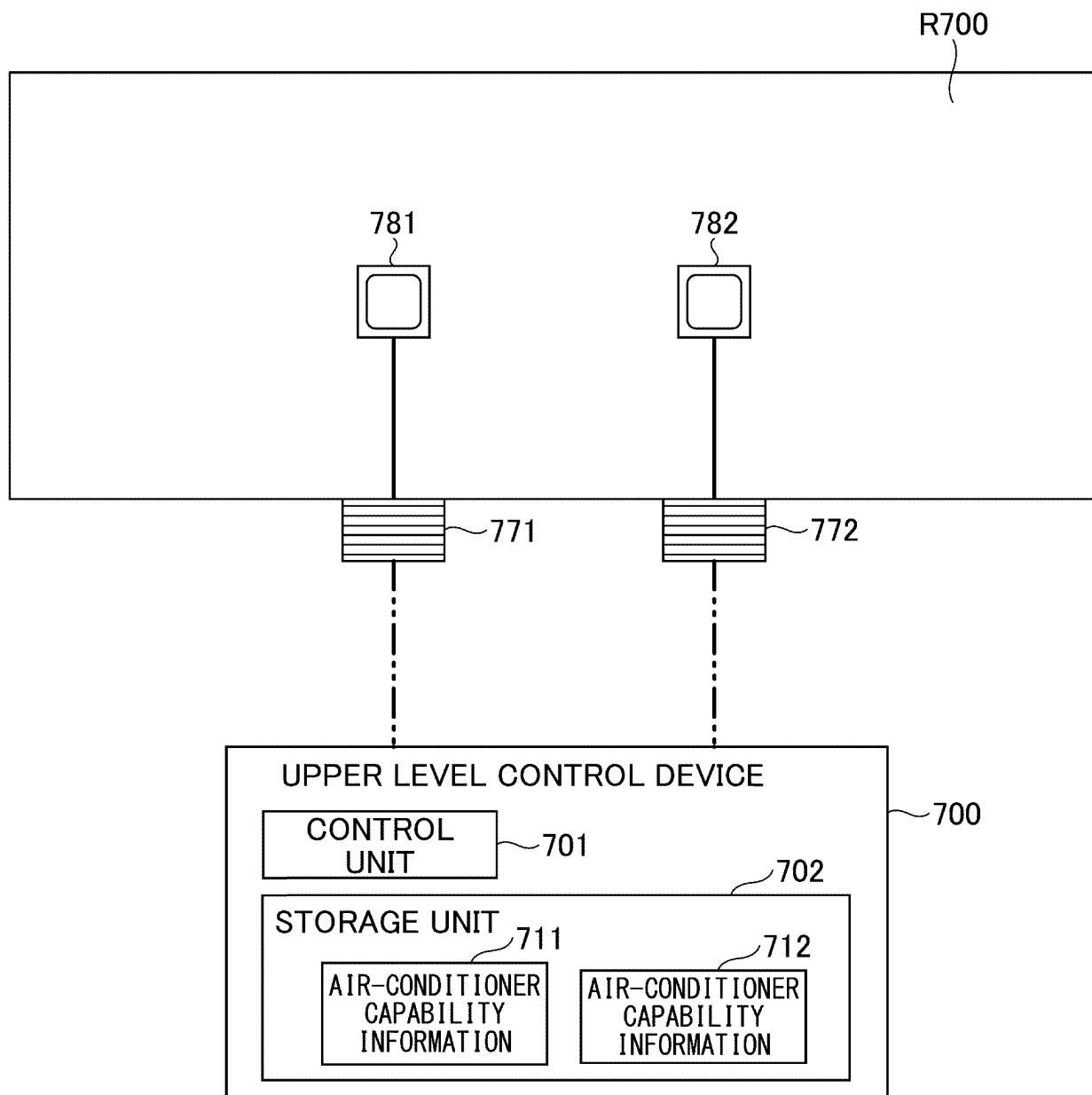


FIG.18

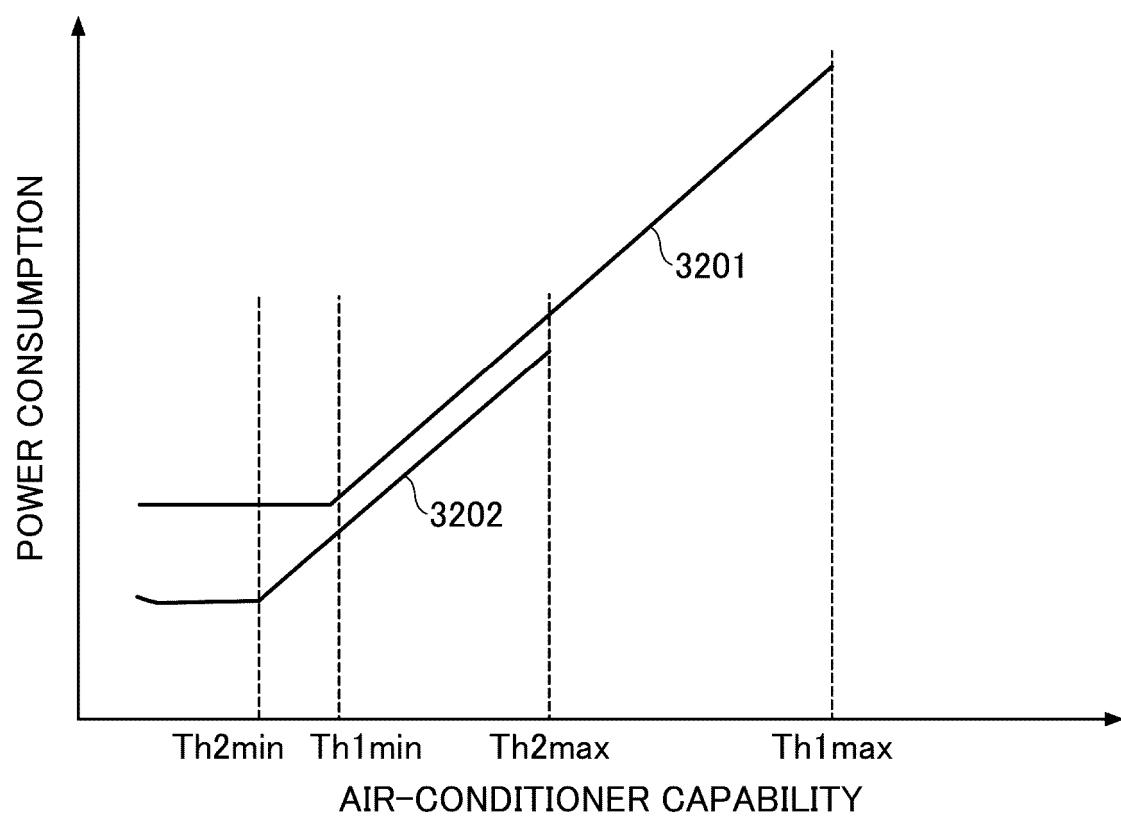


FIG.19

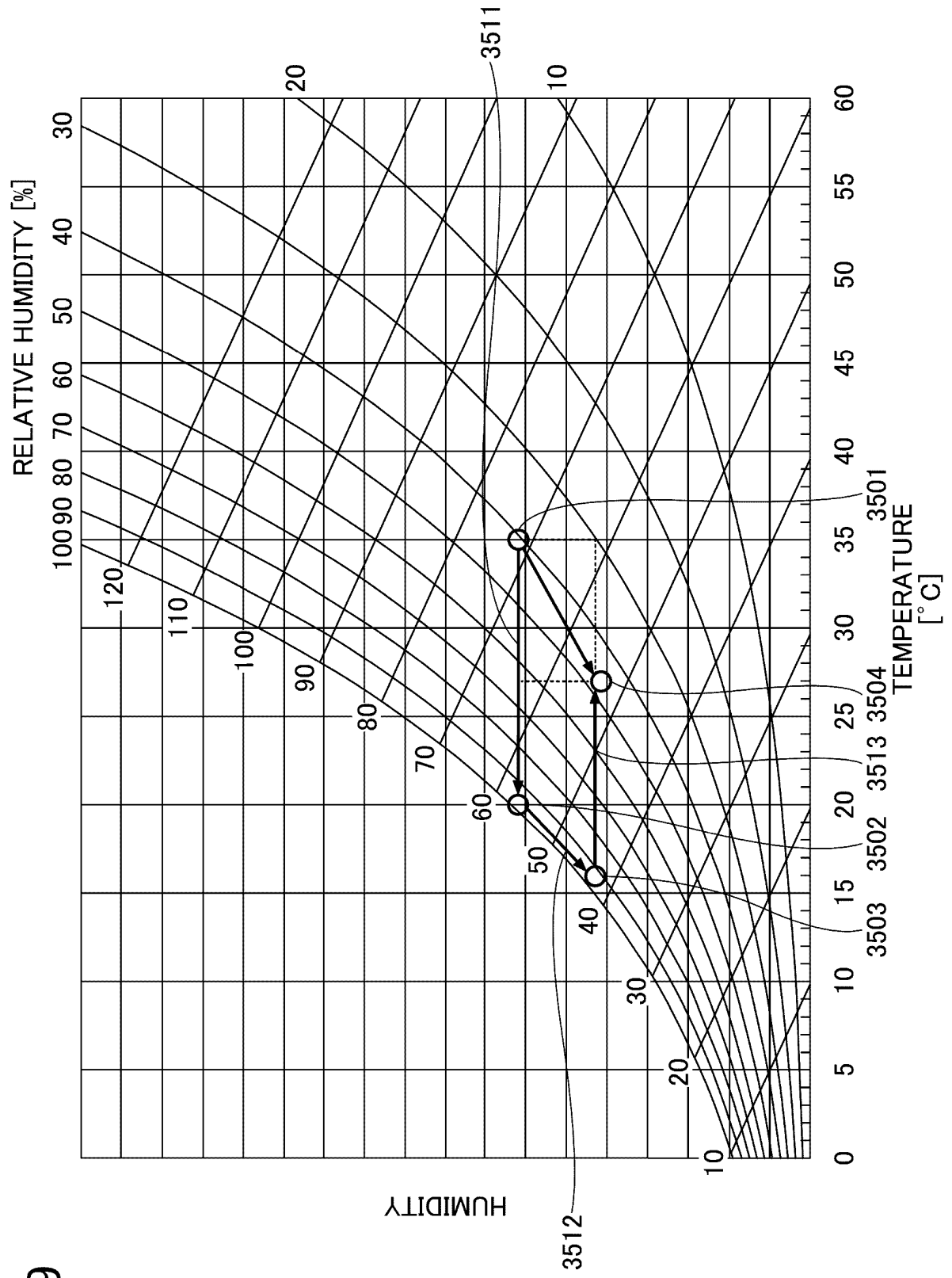


FIG.20

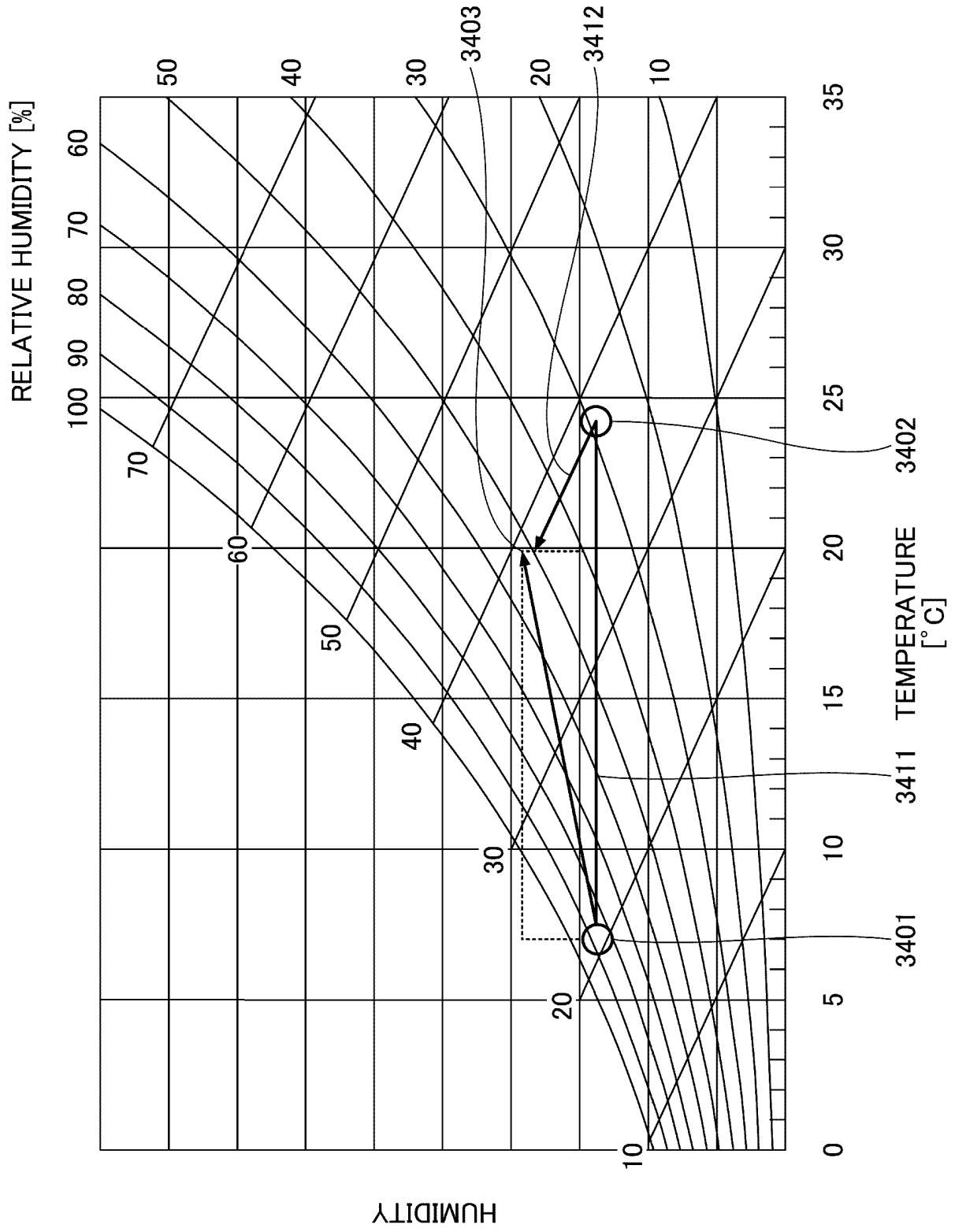


FIG.21

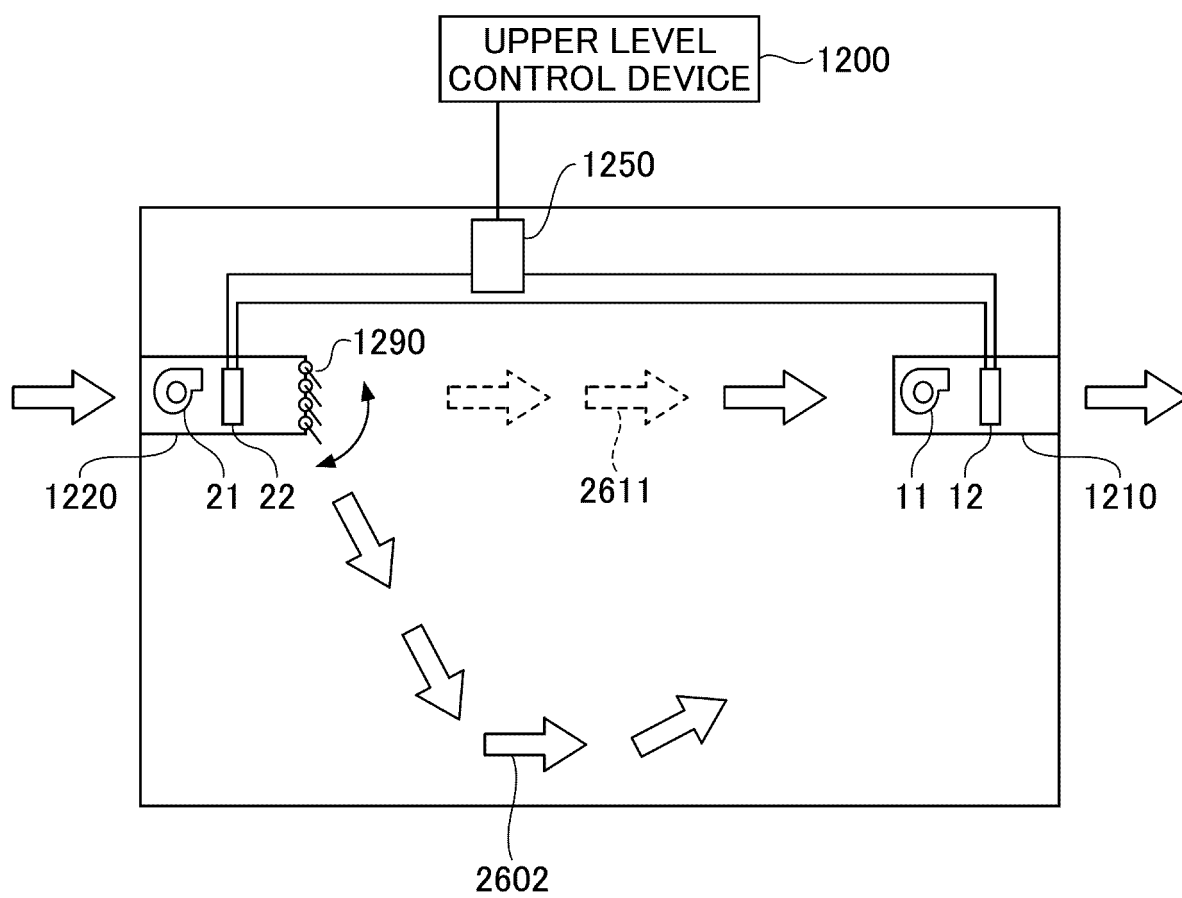


FIG.22

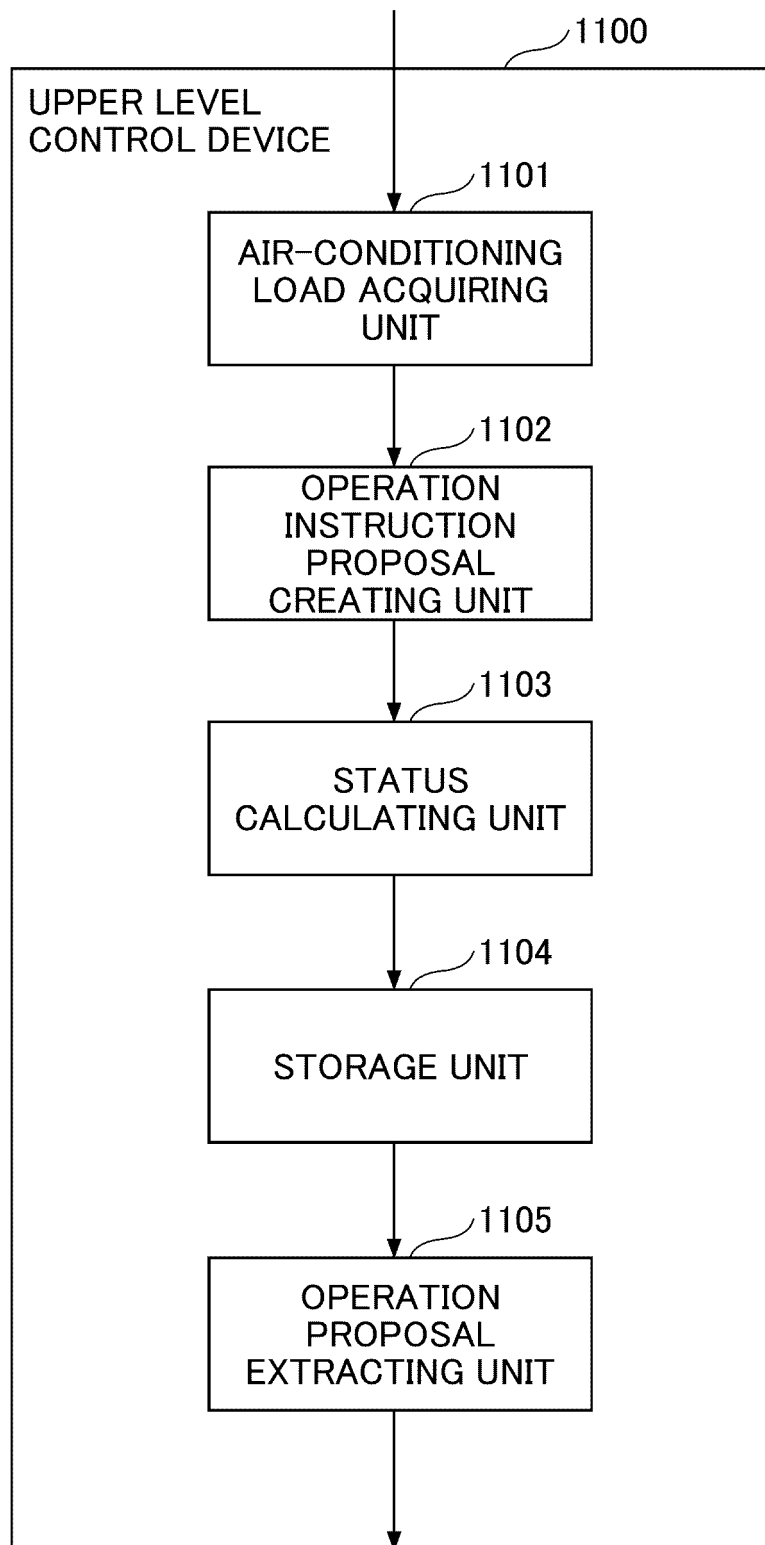


FIG.23

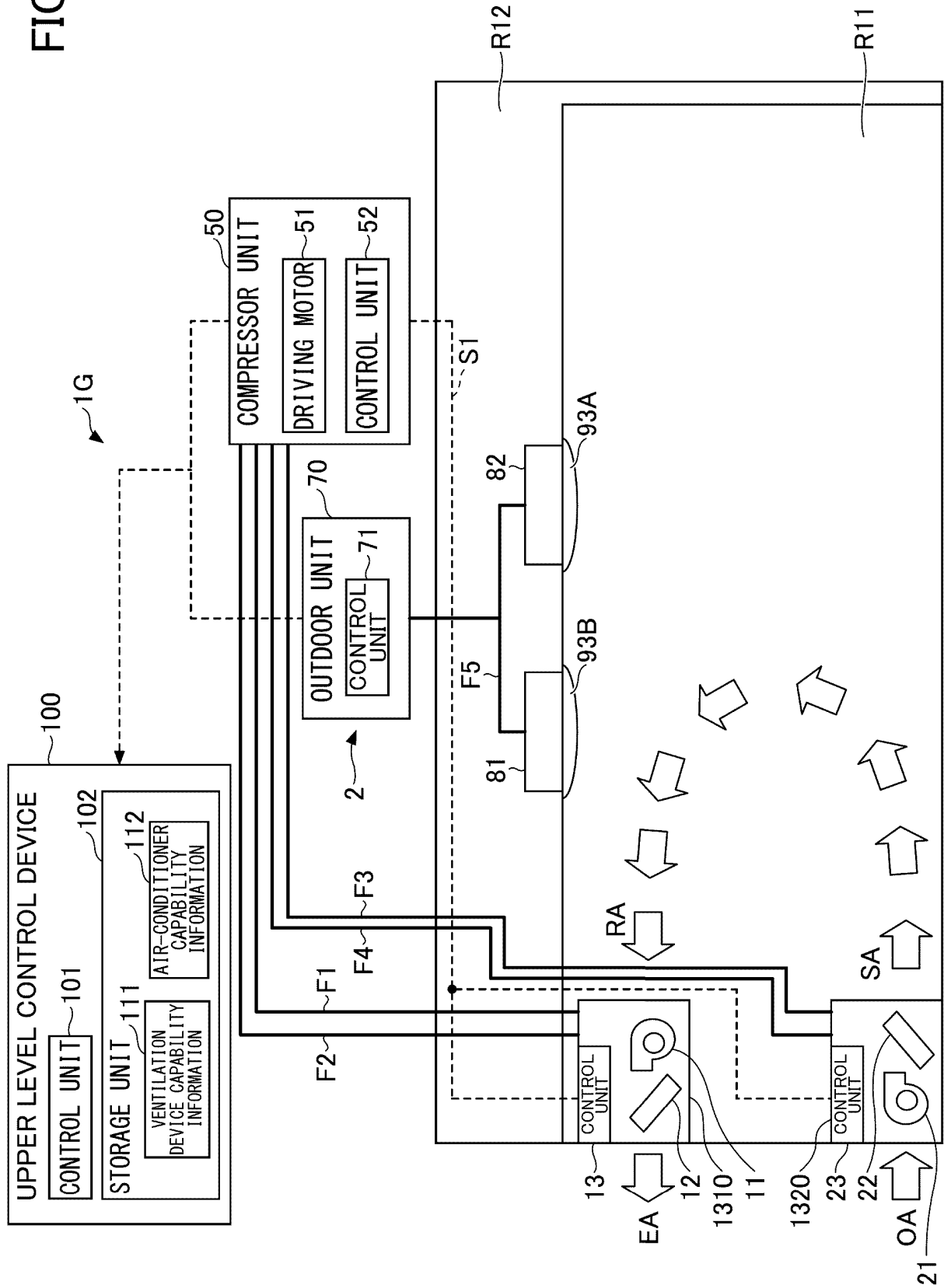


FIG.24

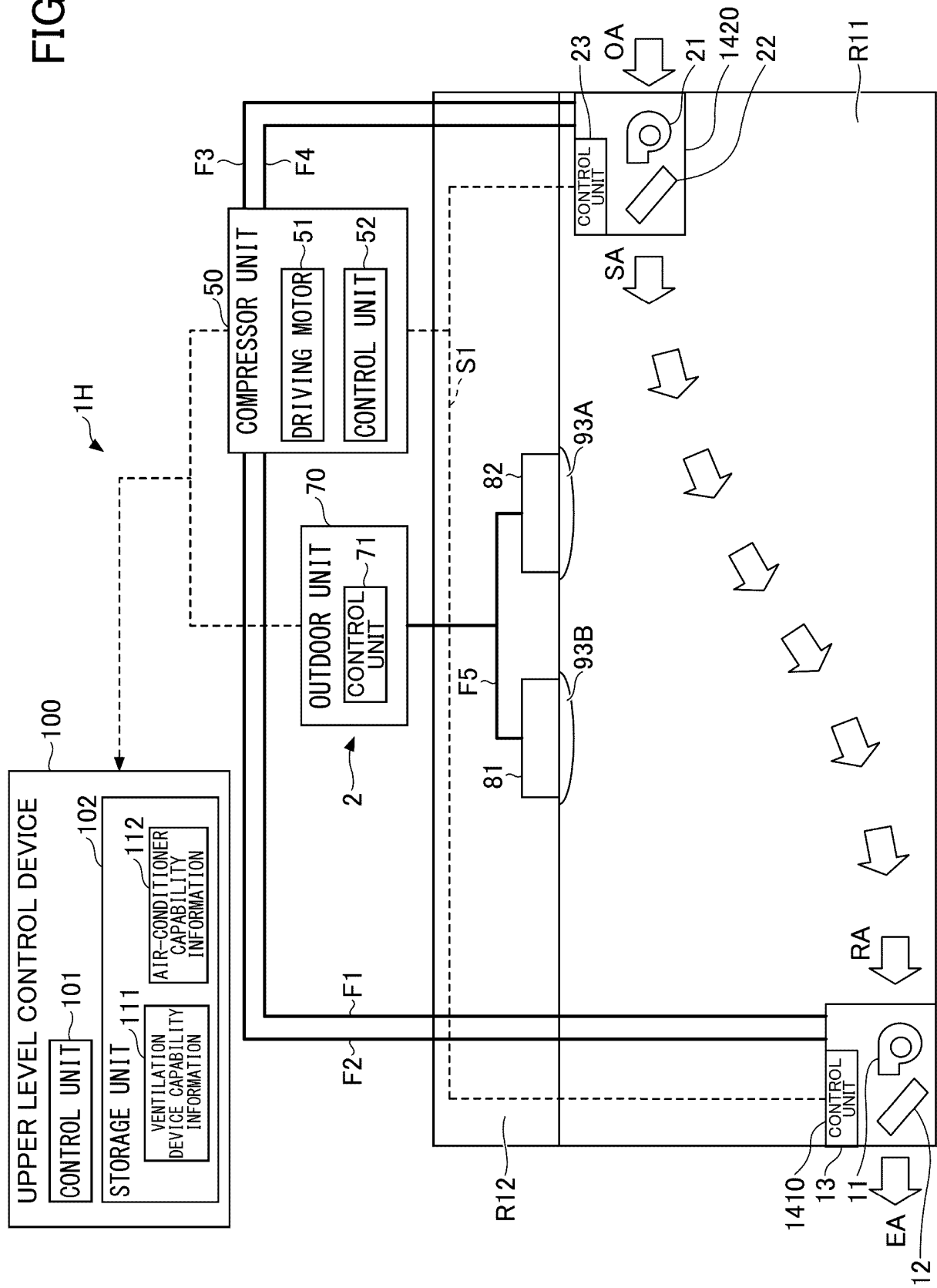


FIG.25

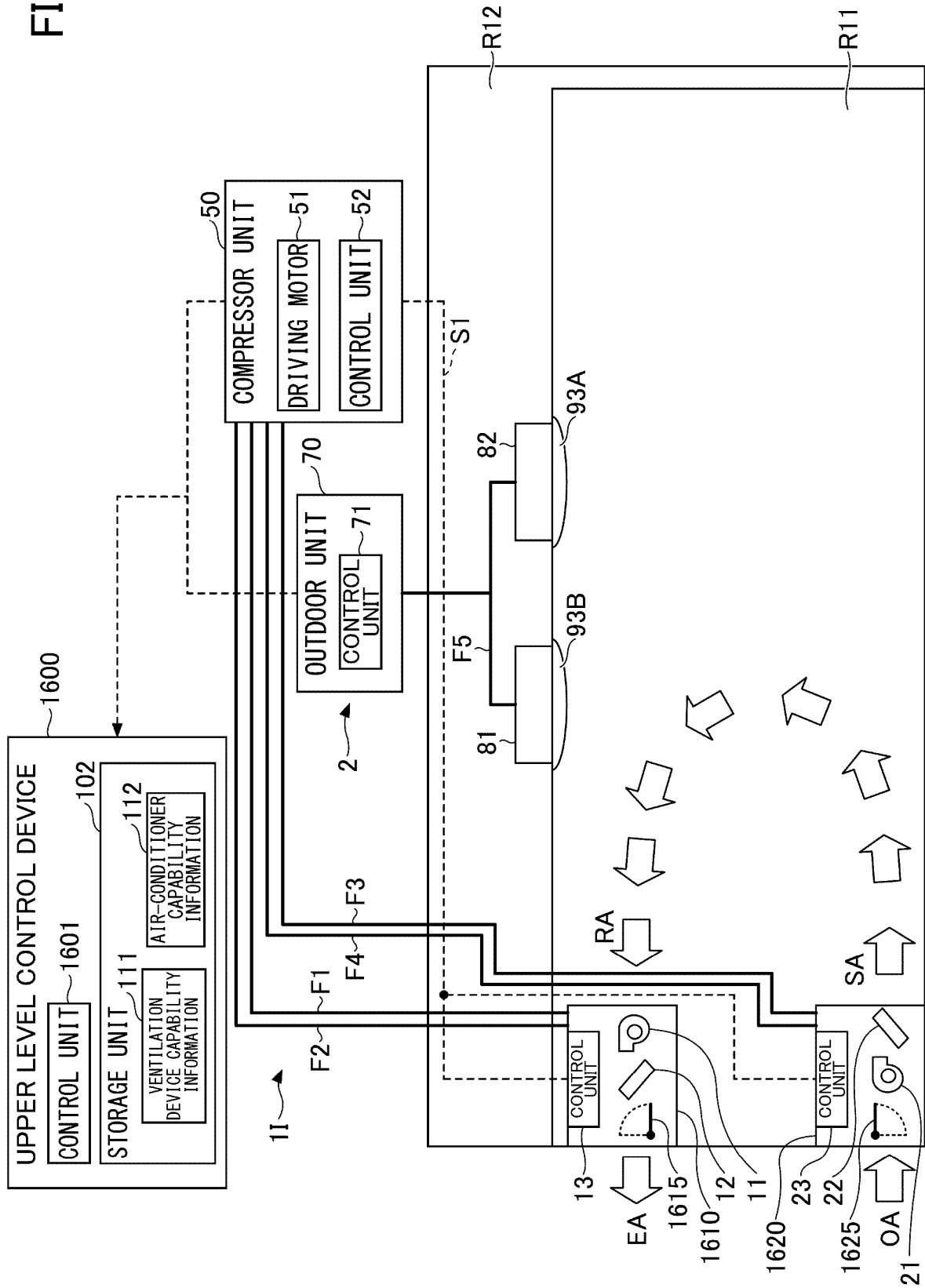


FIG.26

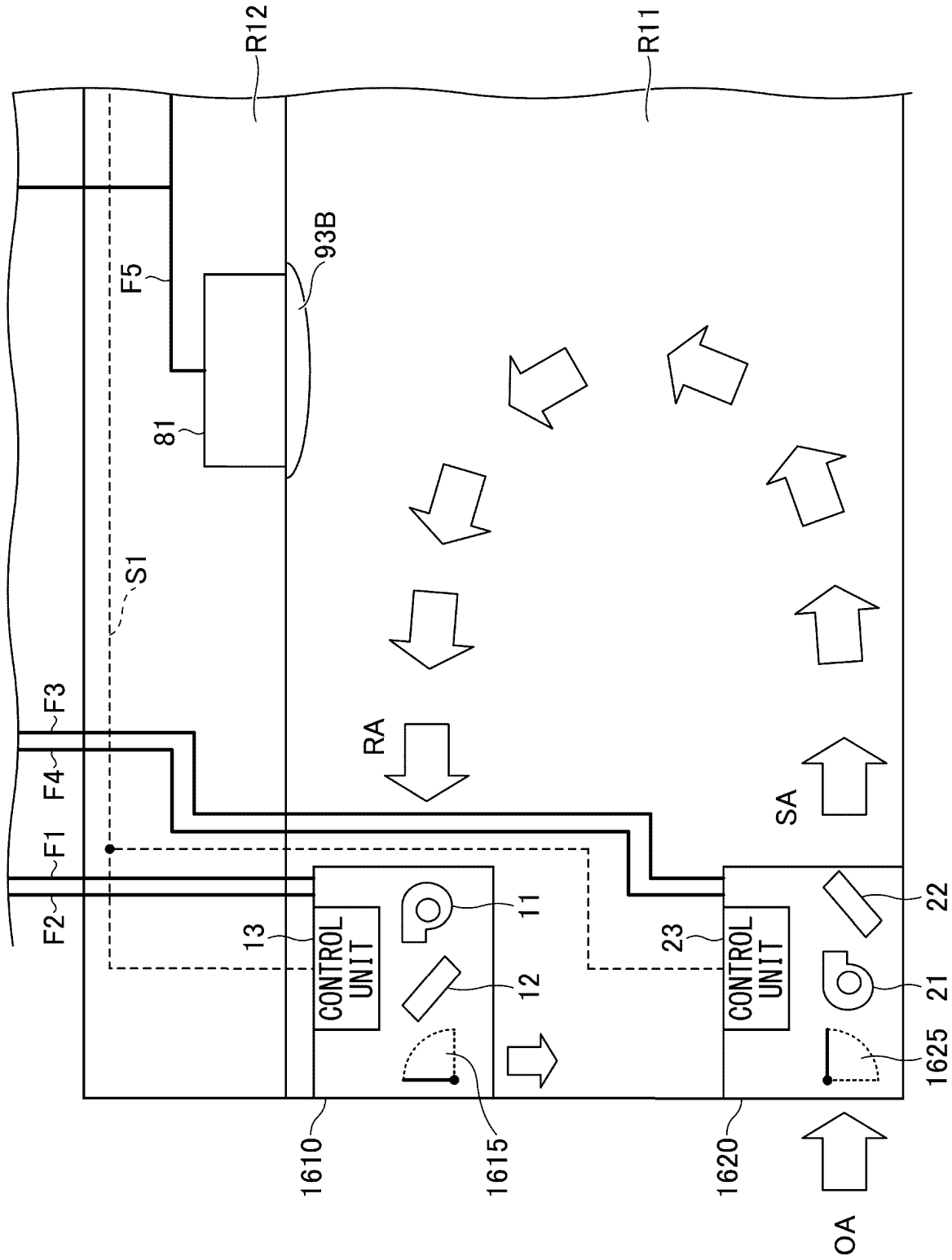


FIG.27

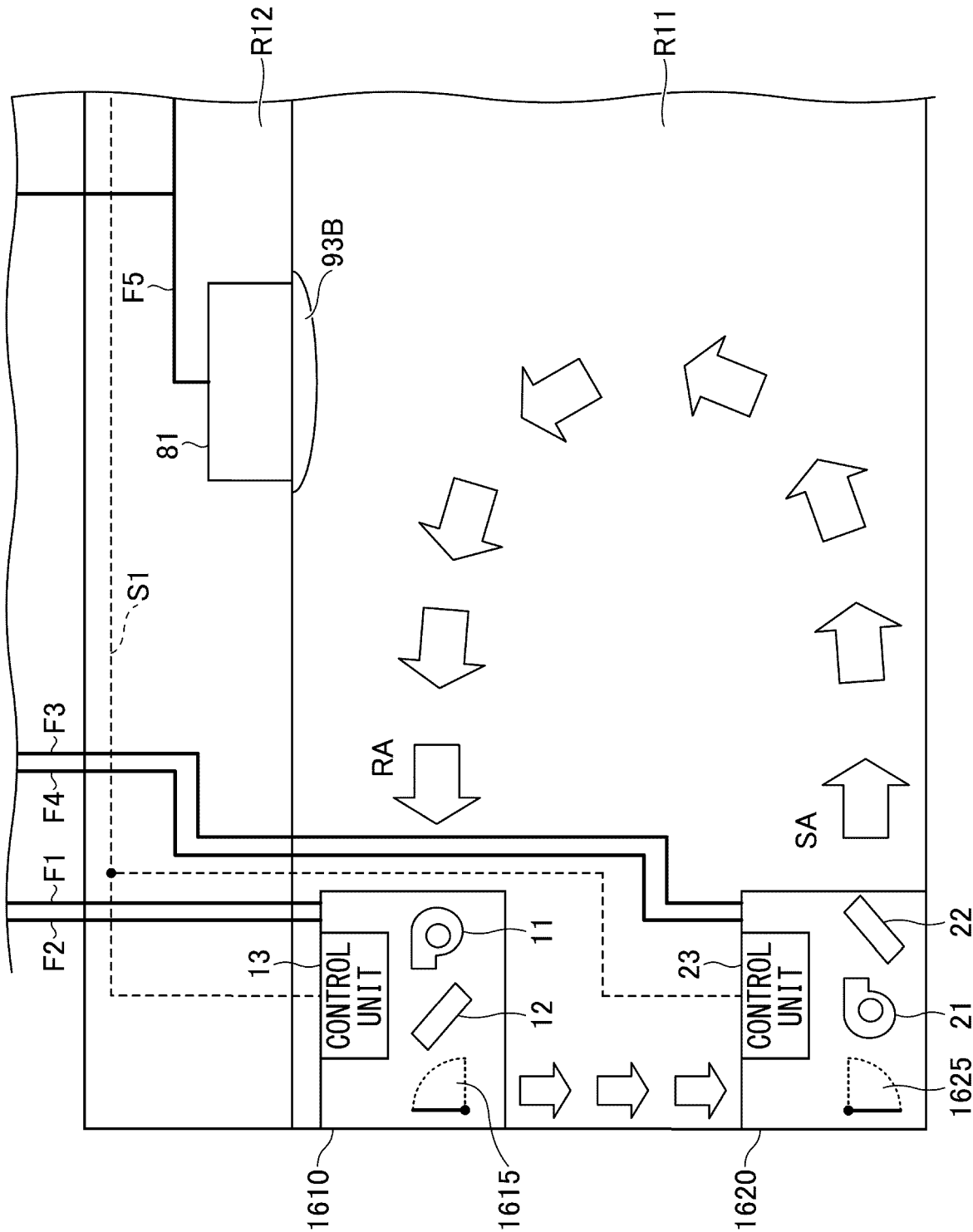


FIG.28

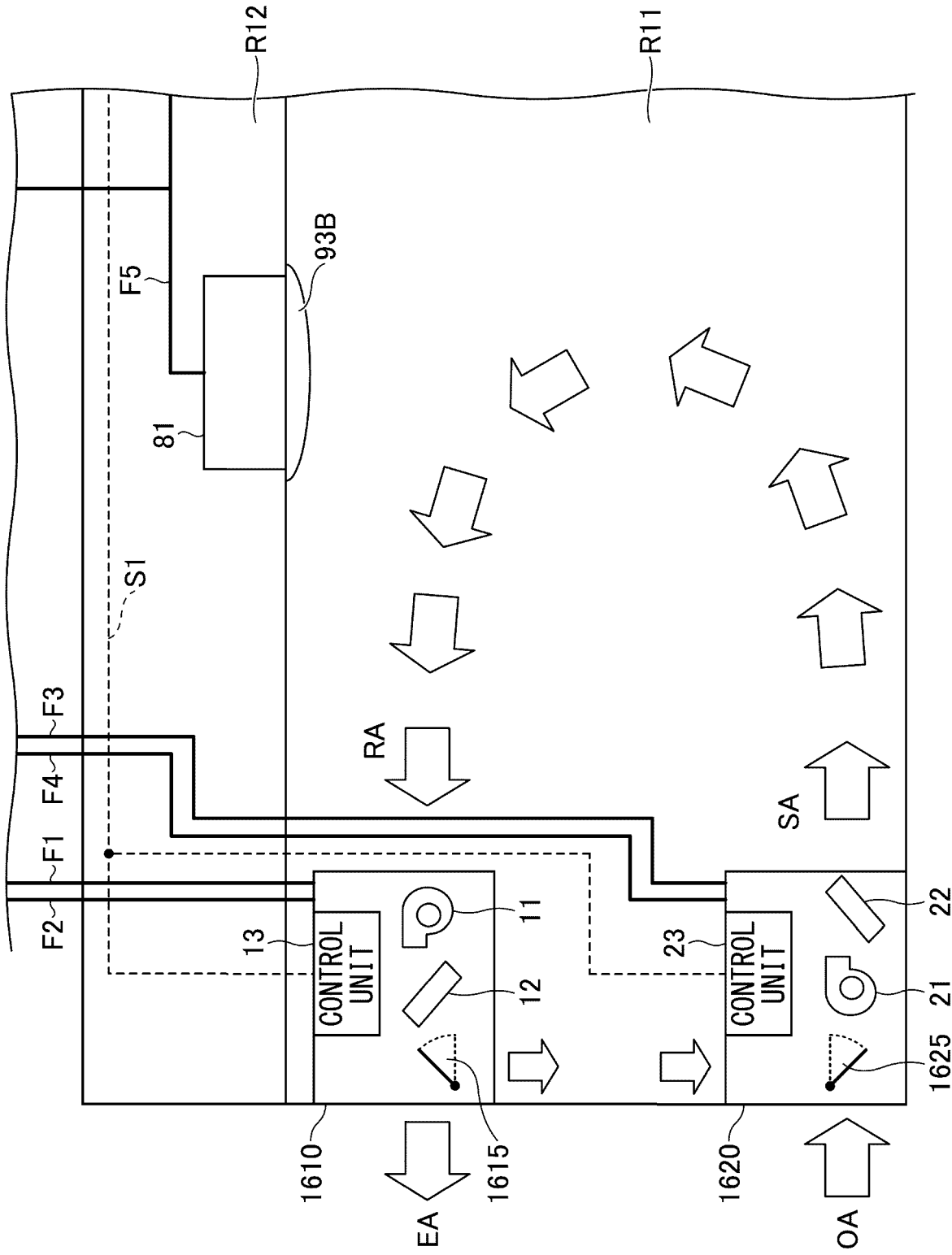
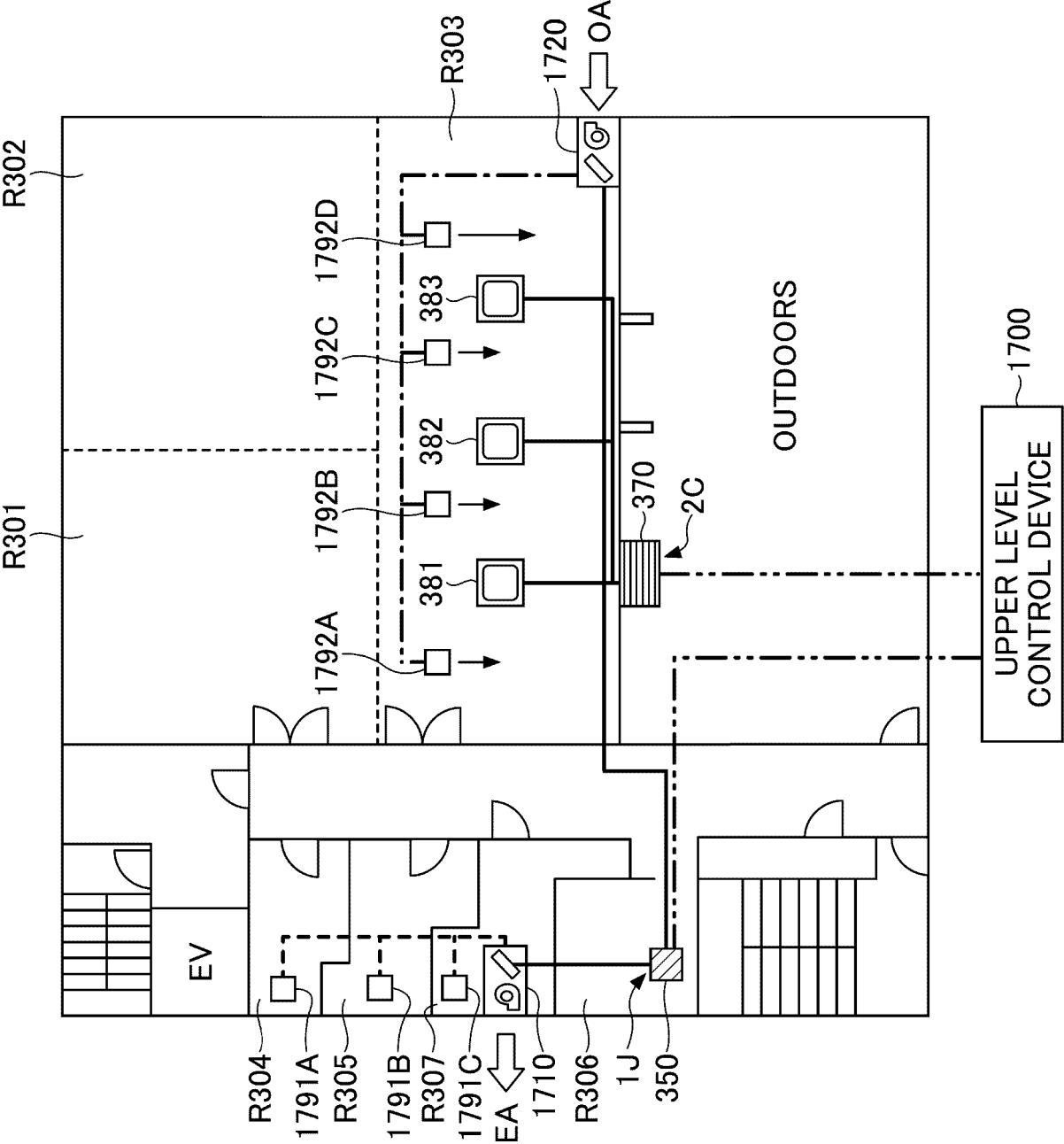


FIG.29



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/046551

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/70(2018.01)i; *F24F 1/0038*(2019.01)i; *F24F 7/007*(2006.01)i; *F24F 7/08*(2006.01)i; *F24F 11/46*(2018.01)i;
F24F 11/65(2018.01)i; *F24F 11/74*(2018.01)i; *F24F 11/77*(2018.01)i; *F24F 11/86*(2018.01)i
 FI: F24F11/70; F24F11/46; F24F11/65; F24F11/74; F24F11/86; F24F11/77; F24F7/007 B; F24F7/08 101A; F24F1/0038

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F11/70; F24F1/0038; F24F7/007; F24F7/08; F24F11/46; F24F11/65; F24F11/74; F24F11/77; F24F11/86

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2023
 Registered utility model specifications of Japan 1996-2023
 Published registered utility model applications of Japan 1994-2023

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2020-186821 A (DAIKIN IND LTD) 19 November 2020 (2020-11-19) paragraphs [0010]-[0064], fig. 1-8	1-31, 34-43
A		32-33
X	WO 2021/019761 A1 (MITSUBISHI ELECTRIC CORPORATION) 04 February 2021 (2021-02-04) paragraphs [0011]-[0096], fig. 1-9	32-33
Y		1-31, 34-36, 39-43
Y	WO 2019/193639 A1 (MITSUBISHI ELECTRIC CORPORATION) 10 October 2019 (2019-10-10) paragraphs [0039], [0048], fig. 10	4-6, 8-17, 34-38
Y	JP 2016-109344 A (MITSUBISHI ELECTRIC CORPORATION) 20 June 2016 (2016-06-20) paragraph [0058]	7, 9-17, 34-36
Y	JP 2008-75973 A (TOSHIBA CORP) 03 April 2008 (2008-04-03) paragraphs [0014]-[0136], fig. 1-19	16-17, 20, 24, 27, 34-36

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

24 February 2023

Date of mailing of the international search report

07 March 2023

Name and mailing address of the ISA/IP

Japan Patent Office (ISA/JP)
 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
 Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/046551

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009-276041 A (TOYOTA MOTOR CORP) 26 November 2009 (2009-11-26) paragraphs [0030]-[0046], fig. 1-2	25, 27, 34-36
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 44041/1973 (Laid-open No. 145454/1974) (DAIKIN IND LTD) 16 December 1974 (1974-12-16), specification, p. 3, line 20 to p. 7, line 8, drawings	26-27, 34-36, 39-40
Y	WO 2020/226091 A1 (DAIKIN IND LTD) 12 November 2020 (2020-11-12) paragraph [0032]	28, 34-36

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/046551

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Document 1: JP 2020-186821 A (DAIKIN IND LTD) 19 November 2020 (2020-11-19) paragraphs [0010]-[0064], fig. 1-8 & WO 2020/226091 A1, paragraphs [0064]-[0118], fig. 5-12

Claims are classified into the following six inventions.

(Invention 1) Claims 1-28 and 39-40 and parts referring to claims 1-28 in claims 34-36

Claims 1-18 and 39-40 and parts referring to claims 1-18 in claims 34-36 have the special technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; an air conditioner including a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger; and a controller for controlling the ventilation device and the air conditioner, wherein the controller stores a first capacity indicating a heat load that can be output in response to power consumption of the ventilation device and a second capacity indicating a heat load that can be output in response to power consumption of the air conditioner, acquires the temperature of the indoor space, and sets the first heat load, which is calculated on the basis of the temperature of the indoor space according to the first capacity and the second capacity and needs to be adjusted in the indoor space, so as to be shared between the ventilation device and the air conditioner,” and are thus classified as invention 1.

Also, claims 19-28 and parts referring to claims 19-28 in claims 34-36 are substantially identical to or similarly closely related to claim 1 and are thus classified as invention 1.

(Invention 2) Claim 29-30 and parts referring to claims 29-30 in claims 34-36

Claim 29-30 and parts referring to claims 29-30 in claims 34-36 share, with claim 1 classified as invention 1, the common technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor space passes through the first heat exchanger and is then supplied to the indoor, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; an air conditioner including a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger; and a controller for controlling the ventilation device and the air conditioner.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 29-30, parts referring to claims 29-30 in claim 34-36, and claim 1.

In addition, claims 29-30 and parts referring to claims 29-30 in claims claim 34-36 are not dependent on claim 1. Furthermore, claims 29-30 and parts referring to claims 29-30 in claim 34-36 are not substantially identical to or similarly closely related to any of the claims classified as invention 1.

Therefore, claims 29-30 and parts referring to claims 29-30 in claim 34-36 cannot be classified as invention 1.

Also, claims 29-30 and parts referring to claims 29-30 in claim 34-36 have the special technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; an air conditioner including a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger; and a controller for controlling the ventilation device and the air conditioner, wherein the first heat exchanger is configured to be able to lower the evaporation temperature of the

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flowing refrigerant, and the controller is configured to: set target temperature and target humidity; dehumidify air, which flows in a state in which the evaporation temperature of the first heat exchanger is lowered, when the first heat exchanger serves as an evaporator to achieve the target humidity; and perform temperature control with an air conditioner to achieve the target temperature,” and are thus classified as invention 2.

(Invention 3) Claim 31 and parts referring to claim 31 in claims 34-36

Claim 31 and parts referring to claim 31 in claims 34-36 share, with claim 1 classified as invention 1 and claim 29 classified as invention 2, the common technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; and a controller for controlling the ventilation device.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claim 31, parts referring to claim 31 in claim 34-36, and claim 1 or 29.

In addition, claim 31 and parts referring to claim 31 in claims 34-36 are not dependent on any of claim 1 and claim 29. Furthermore, claim 31 and parts referring to claim 31 in claims 34-36 are not substantially identical to or similarly closely related to any of the claims classified as invention 1 or 2.

Therefore, claim 31 and parts referring to claim 31 in claims 34-36 cannot be classified as either invention 1 or 2. Also, claim 31 and parts referring to claim 31 in claims 34-36 have the special technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; and a controller for controlling the ventilation device, wherein the controller is configured to: in a case where the ventilation device performs humidification operation, when water is supplied into the air that has been heat-exchanged by the first heat exchanger, set the temperature of the air so that the air reaches predetermined target temperature and target humidity due to an isenthalpic change; and perform temperature control on the basis of the above setting,” and are thus classified as invention 3.

(Invention 4) Claims 32-33

Claims 32-33 share, with claim 1 classified as invention 1 and claim 29 classified as invention 2, the common technical feature of an “air conditioning system comprising: an air conditioner including a heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the heat exchanger; and a controller for controlling the air conditioner.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 32-33 and claim 1 or 29.

Claims 32-33 share the common technical feature of an “air conditioning system comprising a controller” with claim 31 classified as invention 3. However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 32-33 and claim 31.

In addition, claims 32-33 are not dependent on any of claim 1, claim 29, and claim 31. Furthermore, claims 32-33 are not substantially identical to or similarly closely related to any of the claims classified as invention 1, 2, or 3.

Therefore, claims 32-33 cannot be classified as any of inventions 1, 2, and 3.

Also, claims 32-33 have the special technical feature of an “air conditioning system comprising: a first air conditioner including a first heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the first heat exchanger; a second air conditioner including a second heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the

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second heat exchanger; and a controller for controlling the first air conditioner and the second air conditioner, wherein the controller causes a storage unit to store a first air conditioning capacity including a first minimum heat load determined as a minimum value of a heat load that can be output by the first air conditioner and a second air conditioning capacity including a second minimum heat load determined as a minimum value of a heat load that can be output by the second air conditioner, and acquires the temperature of the indoor space, and wherein when power consumption used to process the second minimum heat load by the second air conditioner is lower than power consumption used to process the first minimum heat load by the first air conditioner, and when the first heat load, which is calculated on the basis of the temperature of the indoor space and needs to be adjusted in the indoor space, is lower than the first minimum heat load, the controller sets a first heat load to be processed by the second air conditioner,” and are thus classified as invention 4.

(Invention 5) Claims 37-38

Claim 37-38 share, with claim 1 classified as invention 1 and claim 29 classified as invention 2, the common technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; an air conditioner including a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger; and a controller for controlling the ventilation device and the air conditioner.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 37-38 and claim 1 or 29.

Claims 37-38 share, with claim 31 classified as invention 3, the common technical feature of an “air conditioning system comprising: a ventilation device including a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; and a controller for controlling the ventilation device.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 37-38 and claim 31.

Claims 37-38 share, with claim 32 classified as invention 4, the common technical feature of an “air conditioning system comprising: an air conditioner including a heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the heat exchanger; and a controller for controlling the air conditioner.” However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 37-38 and claim 32.

In addition, claims 37-38 are not dependent on any of claim 1, claim 29, claim 31, and claim 32. Furthermore, claims 32-33 are not substantially identical to or similarly closely related to any of the claims classified as invention 1, 2, 3, or 4.

Therefore, claims 37-38 cannot be classified as any of inventions 1, 2, 3, and 4.

Also, claims 37-38 have the special technical feature of an “air conditioning system comprising: a ventilation device including a compressor during heat recovery ventilation operation, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein; an air conditioner including a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with

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a refrigerant flowing through the third heat exchanger; and a controller for controlling the ventilation device and the air conditioner, wherein the controller acquires the temperature of the indoor space, and wherein when a first heat load, which is calculated on the basis of the temperature of the indoor space and needs to be adjusted in the indoor space, is a cooling load, the controller suppresses driving of the compressor if the temperature of the outdoor air is lower than a certain temperature, and sets at least one of the direction or amount of air supplied from the first air flow path so that the indoor air and the outdoor air are exchanged by the ventilation device," and are thus classified as invention 5.

(Invention 6) Claims 41-43

Claim 41-43 share, with claim 1 classified as invention 1, claim 29 classified as invention 2, and claim 37 classified as invention 5, the common technical feature of a "controller for controlling a ventilation device and an air conditioner, wherein the ventilation device includes a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein, and wherein the air conditioner includes a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger." However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 41-43 and claim 1, 29, or 37.

Claims 41-43 share, with claim 31 classified as invention 3, the common technical feature of a "controller for controlling a ventilation device, wherein the ventilation device includes a compressor, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein." However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 41-43 and claim 31.

Claims 41-43 share, with claim 32 classified as invention 4, the common technical feature of a "controller for controlling an air conditioner, wherein the air conditioner includes a heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the heat exchanger." However, said technical feature does not make a contribution over the prior art in light of the disclosure of document 1 (in particular, see paragraphs [0010]-[0064], fig. 1-8), and thus cannot be said to be a special technical feature. Also, there are no other same or corresponding special technical features between claims 41-43 and claim 32.

In addition, claims 41-43 are not dependent on any of claim 1, claim 29, claim 31, claim 32, and claim 37. Furthermore, claims 41-43 are not substantially identical to or similarly closely related to any of the claims classified as invention 1, 2, 3, 4, or 5.

Therefore, claim 41-43 cannot be classified as any of inventions 1, 2, 3, 4, and 5.

Also, claims 41-43 have the special technical feature of an "air conditioning control apparatus provided with a controller for controlling a ventilation device and an air conditioner, wherein the ventilation device includes a compressor during heat recovery ventilation operation, a first heat exchanger serving as a condenser or evaporator, a first air flow path in which air blowing in from the outdoor passes through the first heat exchanger and is then supplied to the indoor space, a second heat exchanger serving as a condenser or evaporator, a second air flow path in which air blowing in from the indoor space passes through the second heat exchanger and is then discharged to the outdoor, and a refrigerant circuit in which the compressor, the first heat exchanger, and the second heat exchanger are connected to a refrigerant pipe to allow a refrigerant to flow therein, wherein the air conditioner includes a third heat exchanger serving as a condenser or evaporator and an air conditioning indoor unit that suctions air in the indoor space and discharges, to the indoor space, the air subjected to be heat exchanged with a refrigerant flowing through the third heat exchanger, and wherein in order to control air conditioning of the indoor space in which the air conditioner and the ventilation device are installed, the controller is configured to: create a plurality of pieces of operation instruction information for controlling the air conditioner and the ventilation device; acquire a quantity correlating with an air conditioning load in the indoor space; calculate the amount of energy when the

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air conditioning load in the indoor space is processed according to the operation instruction information, on the basis of the quantity correlating with the air conditioning load in the indoor space for each of the pieces of operation instruction information; store the amount of energy calculated for each piece of operation instruction information in a storage unit in correspondence with each other; and output, as an operation instruction, the operation instruction information corresponding to the amount of energy that satisfies a certain condition, to the air conditioner or the ventilation device,” and are thus classified as invention 6.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

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REFERENCES CITED IN THE DESCRIPTION

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