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(54) CONTROL METHOD FOR FRESH AIR DEVICE, AND FRESH AIR DEVICE AND STORAGE MEDIUM

(57) Disclosed in the present application are a control method for a fresh air device, and a fresh air device and a storage medium. The control method comprises: when a starting instruction for a strong mode or an odor removal mode is received, controlling a fresh air device to operate in a first operation state, wherein the first operation state comprises adjusting rotation speeds of a fresh air fan and an exhaust fan to preset target rotation speeds, and controlling a fresh air valve, an exhaust air valve and a bypass air valve to start an internal circulation mode; and when the fresh air device operating in the first operation state meets a first preset condition, controlling the fresh air device to operate in a second operation state, wherein the second operation state comprises controlling the fresh air valve, the exhaust air valve and the bypass air valve to switch to an external circulation mode.

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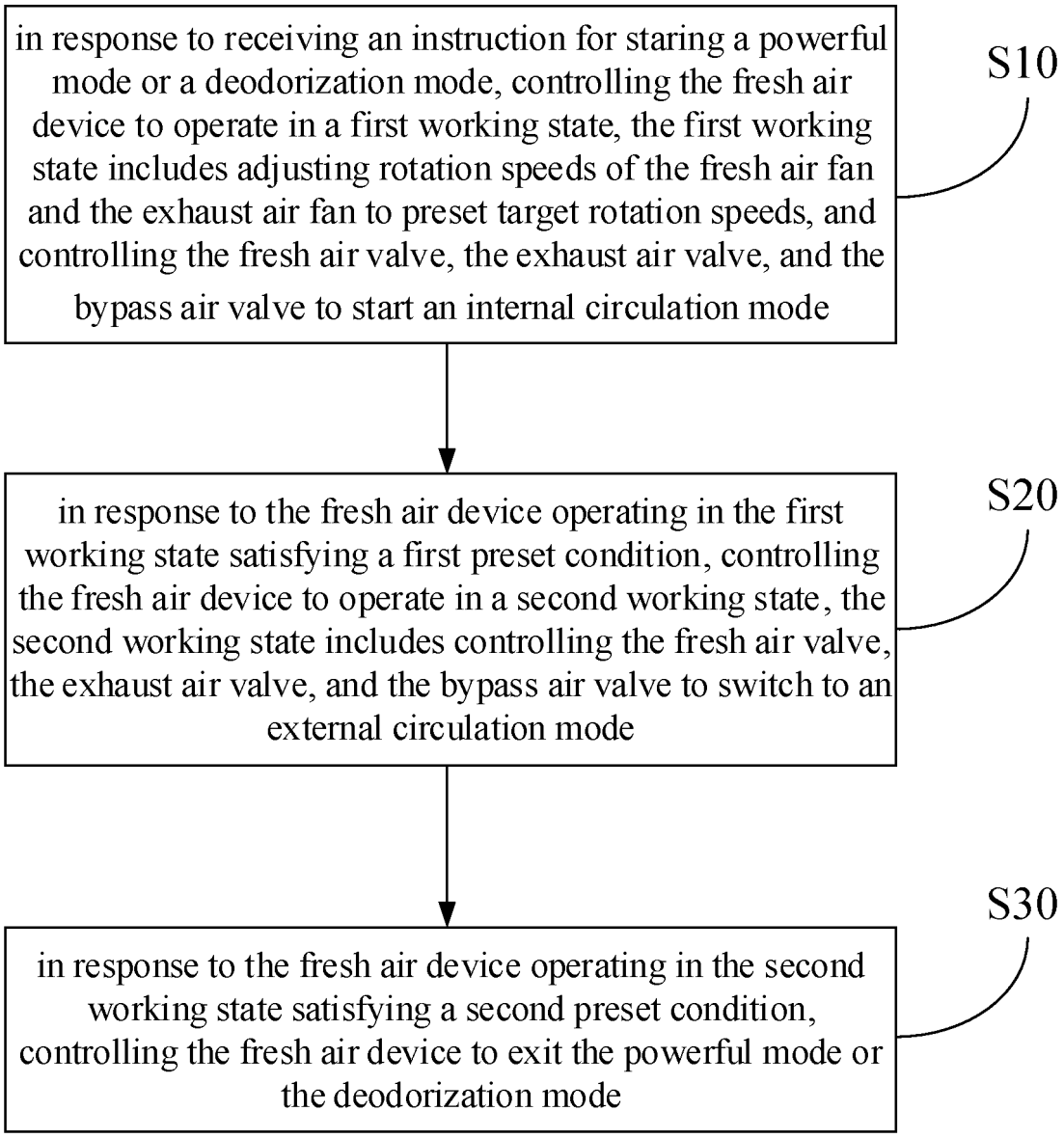

FIG. 4

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Description

[0001] This application claims priority to Chinese Patent Application No. 202211147960.1 filed on September 20, 2022, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of air conditioning, and in particular to a method for controlling a fresh air device, a fresh air device, and a storage medium.

BACKGROUND

[0003] Fresh air device is a dehumidification device that filters and dehumidifies outdoor air, and then delivers relatively dry air with target relative humidity into the room through fresh air channels to meet the comfort or process indoor environmental humidity requirements.

[0004] However, existing fresh air device consumes a lot of energy to process heat and humidity loads, has limited air volume, slow cooling and dehumidification, and cannot respond quickly when there is a powerful mode or deodorization mode demand indoor, resulting in relatively poor overall performance of the fresh air device.

SUMMARY

TECHNICAL PROBLEM

[0005] The main objective of the present application is to provide a method for controlling a fresh air device, a fresh air device and a storage medium, aiming at improving the overall performance of the current fresh air device.

TECHNICAL SOLUTION

[0006] In order to achieve the above objective, the present application provides a method for controlling a fresh air device, the fresh air device includes an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with an indoor environment through an air duct, and the fresh air channel is communicated with an outdoor environment through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust air fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the exhaust air channel. The control method includes:

in response to receiving an instruction for starting a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, the first working state includes adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode;

in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, the second working state includes controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to an external circulation mode; and

in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode.

[0007] In an embodiment, the fresh air device operating in the internal circulation mode satisfying the first preset condition includes at least one of the following:

a duration of the fresh air device operating in the first working state reaching a first preset time; and

an indoor environmental parameter reaching a first target threshold.

[0008] In an embodiment, the fresh air device operating in the external circulation mode satisfying the second preset condition includes at least one of the following:

a duration of the fresh air device operating in the second working state reaching a second preset time; and

an indoor environmental parameter reaching a second target threshold.

[0009] In an embodiment, before the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode, the method includes:

obtaining rated speeds of the fresh air fan and the exhaust air fan; and

calculating the target rotation speeds based on the rated speeds and a preset adjustment coefficient, the target rotation speeds are greater than the rated speeds.

[0010] In an embodiment, the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode includes:

increasing the rotation speeds of the fresh air fan and the exhaust air fan to the preset target rotation speeds;

opening the bypass air valve, closing the fresh air valve and the exhaust air valve, and starting the

internal circulation mode; and
the controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to the external circulation mode includes:
opening the fresh air valve and the exhaust air valve, closing the bypass air valve, and switching to the external circulation mode.

[0011] In an embodiment, the fresh air device includes a first heat exchange system and a second heat exchange system, and after the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode, the method includes:

obtaining a set temperature and a current indoor temperature;
determining an operation mode of the fresh air device based on the set temperature and the current indoor temperature; and
setting operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device.

[0012] In an embodiment, the operation mode of the fresh air device includes a cooling mode and a heating mode, and the setting the operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device includes:

in response to the fresh air device being in the cooling mode, adjusting the first heat exchange system to the cooling mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system; and
in response to the fresh air device being in the heating mode, adjusting the first heat exchange system to the heating mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system.

[0013] In an embodiment, before controlling the fresh air device to operate in the first working state, the method further includes:

obtaining current control parameters of the fresh air device;
the controlling the fresh air device to exit the powerful mode or the deodorization mode includes:
controlling the fresh air device to exit is based on the current control parameters.

[0014] In addition, in order to achieve the above objective, the present application further provides a fresh air device, including: a fresh air dehumidification system and a control device.

[0015] In an embodiment, the fresh air dehumidification system includes an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with an indoor environment through an air duct, the fresh air channel is communicated with an outdoor environment through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust air fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the exhaust air channel.

[0016] In an embodiment, the fresh air fan, the exhaust air fan, the fresh air valve, the exhaust air valve, and the bypass air valve are all communicated with the control device, the control device includes a memory, a processor, and a program for controlling the fresh air device stored in the memory and executable on the processor, and the program implements the method for controlling the fresh air device as described above when executed by the processor.

[0017] In addition, in order to achieve the above objective, the present application further provides a storage medium, on which a program for controlling a fresh air device is stored. When the program for controlling the fresh air device is executed by a processor, the steps of the method for controlling the fresh air device as described above are implemented.

TECHNICAL EFFECT

[0018] The present application provides a method for controlling a fresh air device, which is based on a fresh air device provided with a fresh air channel and an exhaust air channel. The fresh air device includes an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with an indoor environment through an air duct, the fresh air channel is communicated with an outdoor environment through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust air fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the exhaust air channel. The method includes: in response to receiving an instruction for starting a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, the first working state includes adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode; in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, the second working state includes controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to an external

circulation mode; and in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode. Based on the solution of the present application, when the instruction for starting the powerful function or the deodorization function is received, the fresh air device is controlled to enter the internal circulation mode, and the full return air is used for rapid indoor temperature and humidity adjustment. The external circulation mode of the fresh air device is switched when the first target threshold is reached, and the fresh air treatment and air supply operation is performed, so as to achieve the effect of rapid indoor ventilation and deodorization. When the indoor temperature and humidity reach the second target threshold, the device is exited after a certain delay time, so as to reduce noise, blowing sensation and energy consumption, thereby achieving effective improvement of the overall performance of the current fresh air device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a schematic structural diagram of a fresh air device according to an embodiment of the present application.

FIG. 2 is another structural schematic diagram of the fresh air device according to an embodiment of the present application.

FIG. 3 is yet another structural schematic diagram of the fresh air device according to an embodiment of the present application.

FIG. 4 is a flowchart of a method for controlling a fresh air device according to an embodiment of the present application.

FIG. 5 is a flowchart of the method for controlling the fresh air device according to another embodiment of the present application.

[0020] The realization of the purposes, functional features and advantages of the present application will be further explained with reference to the accompanying drawings in combination with the embodiments.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] It should be understood that the specific embodiments described herein are only used to explain the present application and are not used to limit the present application.

[0022] The main solution of the embodiment of the present application is: a control method is provided based on a fresh air device, the fresh air device includes an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with an indoor environment through an air duct, the fresh air channel is communicated with an outdoor environment through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the exhaust air channel; the method includes: upon receiving an instruction for starting a powerful or deodorization mode, controlling the fresh air device to work in a first working state The fresh air device operates in the first working state, the first working state includes adjusting the rotational speeds of the fresh air fan and the exhaust fan to preset target rotational speeds, and controlling the fresh air valve, the exhaust air valve and the bypass air valve to start the internal circulation mode; when the fresh air device operates in the first working state and satisfies the first preset condition, the fresh air device is controlled to operate in the second working state, the second working state includes controlling the fresh air valve, the exhaust air valve and the bypass air valve to switch to the external circulation mode; when the fresh air device operates in the second working state and satisfies the second preset condition, the powerful or deodorization mode is exited.

[0023] Technical terms involved in the embodiments of the present application are as follows.

[0024] Compressor: an apparatus used to do work on the refrigerant and provide power for the refrigeration cycle, compressing the low-pressure refrigerant into a high-temperature refrigerant.

[0025] Throttle component: a device used to throttle and reduce the pressure of the refrigerant.

[0026] Heat exchanger: a device used for heat exchange between refrigerant and air, which cools and dehumidifies the air or heats and reheats it through refrigerants at different temperatures.

[0027] Fan: a device used to do work on the air and provide power for air circulation. The outdoor fan enables the outdoor air to exchange heat with the heat exchanger through convection, the fresh air fan enables the fresh air to exchange heat with the heat exchanger through convection, and the exhaust fan enables the indoor exhaust air to exchange heat with the heat exchanger through convection.

[0028] Precooling: refers to the process of cooling or dehumidifying the air by configuring the temperature of the refrigerant to a level lower than the temperature of the air before passing through the heat exchanger.

[0029] Dehumidification: refers to the process of cooling and dehumidifying the air by configuring the temperature of the refrigerant to a level lower than the dew point temperature of the air before passing through the heat exchanger.

[0030] Reheat: refers to the process of heating and reheating the air by configuring the temperature of the refrigerant to a level higher than the air temperature before passing through the heat exchanger.

[0031] Condensation reheat: refers to the process of heating and reheating air with high-temperature gas re-

frigerant, gas-liquid two-phase refrigerant, or liquid refrigerant.

[0032] Subcooling and reheating: refers to the process of heating and reheating the air with medium-temperature liquid refrigerant.

[0033] Level 1 system: a refrigeration cycle system used for cooling and reheating fresh air, precooling the heat exchanger to absorb heat and lower the temperature, and subcooling and reheating to heat the dehumidified air.

[0034] Level 2 system: a refrigeration cycle system used for fresh air dehumidification and reheating, dehumidifying the heat exchanger to adsorb heat and dehumidify, and condensing and reheating to heat the dehumidified air.

[0035] Direct Expansion Air Source Heat Pump: the refrigerant directly expands and cools the air for heat exchange, without the need for secondary heat exchange through a coolant.

[0036] Room temperature/humidity: the temperature/-humidity of the service space, which can be obtained through a return air temperature sensor or a sensor somewhere in the room.

[0037] Outlet air temperature/humidity: device supply air temperature/humidity, which can be set at the device supply air outlet, or somewhere after the heat exchanger and before the humidification device in the air supply channel.

[0038] Fresh air temperature/humidity: the inhaled fresh air temperature/humidity can be set at the entrance of the fresh air inlet channel, or somewhere before the heat exchanger in the fresh air inlet channel.

[0039] Temperature/humidity before reheating: the temperature/humidity before reheating after the fresh air is cooled and dehumidified, mainly used to monitor the effect after cooling/dehumidification.

[0040] Temperature/humidity after reheating: the temperature/humidity after the fresh air is cooled and dehumidified and reheated, mainly used to monitor the effect after reheating.

[0041] External circulation mode: fresh air supply.

[0042] Internal circulation mode: full return air supply.

[0043] Air-cooled unit: when cooling, outdoor air is directly used to cool the high-temperature side refrigerant.

[0044] Air-cooled direct expansion unit: the refrigerant directly expands and refrigerates and exchanges heat with the air or the terminal, without the need for secondary heat exchange through a coolant.

[0045] Air-cooled hot and cold water unit: when cooling, the outdoor air is directly used to cool the high-temperature side refrigerant to produce cold water. When heating, the refrigerant directly absorbs heat from the outdoor air to produce hot water.

[0046] Room temperature/humidity: the temperature/-humidity of the service space can be obtained through a return air temperature sensor or a sensor somewhere in the room.

[0047] Radiant air conditioning system: an air conditioning system that transfers heat through radiation.

[0048] Radiation end: a heat transfer end form, fluid with a certain temperature is passed into the interior of the radiation end, the heat is transferred to the outer surface of the end, and then the heat is exchanged with the external air or objects by radiation and natural convection. Common radiation ends include: capillary network, preset radiation panel, floor heating pipe, radiator, etc.

[0049] Pump: a device that uses the operation of a motor to do work on a fluid, allowing the fluid to flow.

[0050] Valve: a part with on-off function.

[0051] Buffer water tank: a device that can adjust the water capacity of the water system, which can store cold or heat, effectively solving the load fluctuation and frequent host startup problems caused by a small system, thereby extending the life of the device and saving energy.

[0052] Hydraulic module: a fluorine-water heat exchange device in a split-type chiller that produces cold water and hot water.

[0053] In the related art, the heat and humidity load processing energy consumption of the fresh air device is large, the air volume is limited, the cooling and dehumidification are slow, and it cannot respond quickly when there is a powerful mode or deodorization mode demand indoor, resulting in the overall performance of the fresh air device being relatively poor.

[0054] The present application provides the above-mentioned solution, aiming at improving the response performance of the fresh air device to powerful or deodorization instructions, so as to achieve the objective of quickly adjusting the indoor temperature and humidity and quickly deodorization.

[0055] The present application provides a fresh air device, as shown in FIG. 1 to FIG. 3, the fresh air device has the following three structural forms.

[0056] As shown in FIG. 1, the fresh air device has an exhaust air channel 16 and a fresh air channel 15, and the exhaust air channel 16 can be communicated with the indoor environment and the fresh air channel 15 can be communicated with the outdoor through air ducts. There are a tube-fin heat exchanger 9 and an exhaust fan 13 in the exhaust air channel. The fresh air channel includes a tube-fin heat exchangers 11 and a heat exchanger 6 independent and uncommunicated with the tube-fin heat exchanger 11, a fresh air fan 12, and a humidifier 17. The heat exchanger in the exhaust air channel is communicated with a heat exchanger (the heat exchanger 11) in the fresh air channel through a pipe to form a circulation system 2. The heat exchanger 6 in the fresh air channel that is not communicated with the exhaust air channel heat exchanger is communicated with the outdoor heat exchanger 3 through a pipe to form a circulation system 1. The humidifier 17 is provided between the fresh air fan and the fresh air heat exchanger, and can be a wet film. Both the fresh air channel 15 and the exhaust air channel 16 are provided with adjustable air valves, which are

provided at the upstream of the fresh air channel. The fresh air channel 15 can control the channel switches by the fresh air valve 20 and the exhaust air channel 16 can control the channel switches by the exhaust air valve 19. A bypass air valve 18 is provided between the fresh air channel and the exhaust air channel. The bypass air valve 18 is provided downstream of the exhaust side heat exchanger 9 and upstream of the fresh air heat exchanger. By opening the bypass air valve, the exhaust air can be bypassed to the fresh air side to mix air, and the fresh air ratio can be adjusted to save energy.

[0057] The fresh air device includes two sets of direct expansion air source heat pump systems. The heat pump system 1 includes a compressor 1, an outdoor heat exchanger 1, a throttle component 1, and fresh air heat exchanger 2. The heat pump system 2 includes a compressor 2, a heat recovery heat exchanger 3, a throttle component 2, and a fresh air heat exchanger 4. The fresh air passes through the heat exchanger 2 of system 1 and the heat exchanger 4 of system 2 for secondary heat exchange, and the exhaust air passes through the heat exchanger 3 of the system 2 for heat recovery.

[0058] As shown in FIG. 2, the fresh air device includes an exhaust channel 20 and a fresh air channel 19. The exhaust channel 20 can be communicated with the indoor environment through air ducts, and the fresh air channel 19 can be communicated with the outdoor through air ducts, and there are a tube-fin heat exchanger 11 and an exhaust fan 17 in the exhaust channel, and there are more than two independent tube-fin heat exchangers and a fresh air fan 16 in the fresh air channel. The heat exchanger 11 in the exhaust air channel is communicated with the two heat exchangers in the fresh air channel through a pipe to form a circulation system 2, and the heat exchanger in the fresh air channel that is not communicated with the exhaust air channel heat exchanger is communicated with the outdoor heat exchanger through a pipe to form a circulation system 1. More than three throttle components are provided in the system, where two throttle components are provided in the system 2, which are respectively provided on the connection pipe between the exhaust air channel heat exchanger and the fresh air channel heat exchanger, and on the connection pipe between the two heat exchangers in the fresh air channel, and one or more throttle components are provided on the connection pipe between the fresh air channel heat exchanger in the system 1 and the outdoor duct heat exchanger. The heat exchangers of system 1 and system 2 are provided alternately in the fresh air channel. Both system 1 and system 2 are provided with four-way valves for switching between cooling and heating modes, where the four-way valve of system 2 is provided at the connection pipe between the heat exchanger of the exhaust air channel and the heat exchanger of the fresh air channel, and the four-way valve of system 1 is provided at the connection pipe between the outdoor heat exchanger and the heat exchanger of the fresh air channel. Both the fresh air channel and the exhaust air channel are provided with adjustable air valves, which are provided upstream of the fresh air channel. The fresh air channel can be controlled by the fresh air valve and the exhaust air channel can be controlled by the exhaust air valve to control the channel switch. A bypass air valve is provided between the fresh air channel and the exhaust air channel, which is provided downstream of the exhaust side heat exchanger and upstream of the fresh air heat exchanger. By opening the bypass air valve, the exhaust air can be bypassed to the fresh air side to mix air, and the fresh air ratio can be adjusted to save energy.

[0059] This fresh air device includes two sets of direct expansion air source heat pump systems. The heat pump system 1 includes a compressor 1, an outdoor heat exchanger 1, a fresh air heat exchanger 2 and a heat exchanger 3, a throttle component 1, a throttle component 2. The heat pump system 2 includes a compressor 2, a heat recovery heat exchanger 4, a fresh air heat exchanger 5 and a fresh air heat exchanger 6, a throttle component 3, a throttle component 4. The fresh air passes through the heat exchanger 2 and the heat exchanger 3 of the system 1, and the heat exchanger 5 and the heat exchanger 6 of system 2 for 4 heat exchanges, and exhaust air passes through the heat exchanger 4 of system 2 for heat recovery. Both the system 1 and the system 2 are provided with four-way valves for switching between cooling and heating modes, so that exhaust heat recovery in cooling and heating modes under all working conditions throughout the year can be realized. Since the heat recovery system of the fresh air device is in the form of a heat pump, the heat recovery in cooling mode of system 2 is sensible heat recovery, and the heat recovery in heating mode of system 2 is full heat (sensible heat + latent heat) recovery. The fresh air device is provided with a plurality of alternately provided heat exchangers in the fresh air heat exchange channels of system 1 and system 2 to respectively realize condensation heat recovery and reheat recovery, thereby improving the system subcooling of system 1 and system 2 respectively.

[0060] As shown in FIG. 3, the fresh air device has an exhaust channel 20 and a fresh air channel 19, and the exhaust channel 20 is communicated with the indoor environment through the exhaust air valve 22 and the fresh air channel 19 is communicated with outdoor through the fresh air valve 23. There are a tube-fin heat exchanger 11 and an exhaust fan 17 in the exhaust channel 20, and there are two tube-fin heat exchangers 13 and 15 and a fresh air fan 16 in the fresh air channel. The heat exchanger 11 in the exhaust channel 20 is communicated with the two heat exchangers 13 and 15 in the fresh air channel through a pipe to form a circulation system. Two throttle components 12 and 14 are provided in the system, which are respectively provided on the connection pipes between the exhaust channel heat exchanger and the fresh air channel heat exchanger, and on the connection pipes between the two

heat exchangers in the fresh air channel. The system is provided with a four-way valve 10, which switches the cooling and heating modes with the compressor 9. Both the fresh air channel and the exhaust air channel are provided with adjustable air valves. The fresh air valve is provided upstream of the fresh air channel. The channel switches of the fresh air channel and the exhaust air channel can be controlled by the fresh air valve and the exhaust air valve respectively. A bypass air valve is provided between the fresh air channel and the exhaust air channel. The bypass air valve is provided downstream of the exhaust side heat exchanger and upstream of the fresh air heat exchanger. By opening the bypass air valve, the exhaust air can be bypassed to the fresh air side to mix air, and the fresh air ratio can be adjusted to save energy.

[0061] The fresh air device includes one set of direct expansion air source heat pump system, the heat pump system includes a compressor 2, a heat recovery heat exchanger 4, a fresh air heat exchanger 5 and a fresh air heat exchanger 6, a throttle component 3 and a throttle component 4. The fresh air passes through heat exchanger 2 and heat exchanger 3 of system 1, and heat exchanger 5 and heat exchanger 6 of system 2 for 4 heat exchanges, and the exhaust air passes through heat exchanger 4 of the system for heat recovery. A four-way valve is provided in the system to switch between cooling and heating modes, so that exhaust heat recovery in cooling and heating modes under all working conditions throughout the year can be achieved. Since the heat recovery system of the fresh air device is in the form of a heat pump, the heat recovery in the cooling mode of the system is sensible heat recovery, and the heat recovery in the heating mode of the system is full heat (sensible heat + latent heat) recovery. The fresh air device is provided with multiple heat exchangers in the system and fresh air heat exchange channel to achieve reheat recovery, thereby improving the system subcooling.

[0062] In an embodiment, the device for controlling the fresh air device may include: a processor (such as a central process unit (CPU)), a memory, a timer, etc. The components in the control device are connected via a communication bus. The memory may be a high-speed random-access memory (RAM) or a stable memory (non-volatile memory), such as a disk memory. The memory may also be a storage device independent of the aforementioned processor 1001.

[0063] The memory as a storage medium may include a program for controlling the fresh air device. In the device for controlling the fresh air device, the processor may be used to call the program for controlling the fresh air device stored in the memory and execute the relevant steps of the method for controlling the fresh air device in the following embodiments.

[0064] In an embodiment, the present application further provides a method for controlling a fresh air device, which is applied to any one of the fresh air devices summarized in the above embodiments.

[0065] As shown in FIG. 4, an embodiment of a method for controlling a fresh air device of the present application is provided. In an embodiment, the method for controlling the fresh air device includes:

[0066] Step S10, in response to receiving an instruction for starting a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, the first working state includes adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode.

[0067] It should be noted that the target speed here is greater than the rated speed of the fresh air fan and the exhaust fan. By increasing the speed of the two fans, the working efficiency of the fresh air device is improved, and the fresh air device can quickly respond to the needs of the powerful mode or deodorization mode. The internal circulation mode refers to the fresh air device adopting the full return air supply mode to work. When the fresh air device is in the state of the internal circulation mode, through the operation of the compressor, the high-temperature and high-pressure gas enters the condenser to cool and becomes a low-temperature and high-pressure gas, and then through the interception of the capillary, the gas becomes a low-temperature and low-pressure liquid, and finally evaporates and absorbs heat through the evaporator, returns to the compressor to become a low-temperature and low-pressure gas, and so on. The cycle is repeated, and the indoor air temperature and humidity can be adjusted as quickly as possible. Based on the structure of the fresh air device provided in the above embodiment, the internal circulation mode can be turned on by opening the bypass air valve and closing the fresh air valve and the exhaust air valve.

[0068] Step S20, in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, the second working state includes controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to an external circulation mode; and

[0069] Step S30, in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode.

[0070] It should be noted that the fresh air device operating in the internal circulation mode satisfying the first preset condition includes at least one of the following:

a duration of the fresh air device operating in the first working state reaching a first preset time; and

an indoor environmental parameter reaching a first target threshold.

[0071] The fresh air device operating in the external circulation mode satisfying the second preset condition

includes at least one of the following:

a duration of the fresh air device operating in the second working state reaching a second preset time; and

an indoor environmental parameter reaching a second target threshold.

[0072] In an embodiment, the first preset time and the second preset time refer to the time when the fresh air device needs to maintain the first working state and the time when the fresh air device needs to maintain the second working condition, respectively. After reaching the first preset time and the second preset time, it is considered that the fresh air device needs to enter the next working state based on the current one. The indoor environmental parameters mainly refer to the current indoor temperature and humidity (which can be collected and fed back to the fresh air device by the temperature and humidity sensor installed indoors). The first target threshold refers to the threshold for switching the fresh air device to the external circulation mode. The threshold represents an indoor temperature and humidity. When this threshold is reached, it is considered that the indoor temperature and humidity adjustment has been preliminarily completed at this time, and the external circulation mode needs to be turned on for fresh air supply. Based on the structure of the fresh air device shown in the above embodiment, the fresh air device can be switched to the external circulation mode by closing the bypass air valve and opening the fresh air valve and the exhaust air valve. In the state of the external circulation mode, the outdoor humid air is sucked from the fresh air channel, dehumidified by the evaporator to become dry air, then dissipated by the condenser, and finally blown out from the exhaust air channel. It should be noted that at this time, the speed of the fan still maintains the target speed in the above step S10.

[0073] In an embodiment, the relationship between the first target threshold and the second target threshold is different according to the different cooling or heating requirements of the fresh air device. When the fresh air device is in cooling mode, the first target threshold is greater than the second target threshold, and when the fresh air device is in heating mode, the second target threshold is less than the first target threshold (as an example, assuming that the absolute value of the difference between the first target threshold and the second target threshold is a, then $a \geq -5$), that is, the first target threshold represents the process state of the fresh air device in the powerful or deodorization mode, and the second target threshold represents the result state of the fresh air device in the powerful or deodorization mode. The indoor temperature and humidity used for judgment can be a user-set value or a preset value, and the preset values include: return air humidity threshold: [5,14] g/kg, room humidity threshold: [5,14] g/kg; return air temperature threshold: cooling T1c $\in$ [15,32]°C, heating T1h $\in$ [12,32]°C; and room temperature threshold: cooling T1c $\in$ [15,32]°C, heating T1h $\in$ [12,32]°C.

[0074] Compared with the first target threshold mentioned above, the second target threshold represents that the fresh air device has completed the task in the powerful or deodorization mode, and the indoor temperature and humidity have reached the requirements. Therefore, when it is determined that the indoor temperature and humidity have reached the second target threshold, it is necessary to control the fresh air device to exit the powerful or deodorization mode and restore to the state before entering the powerful or deodorization mode.

[0075] Before the above step S10, in response to receiving an instruction for starting a powerful mode or a deodorization mode, the step of adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode, the method further includes:

obtaining rated speeds of the fresh air fan and the exhaust air fan; and calculating the target rotation speeds based on the rated speeds and a preset adjustment coefficient, the target rotation speeds are greater than the rated speeds.

[0076] In order to make the fresh air device effectively respond to the high power demand under the powerful or deodorization mode, it is necessary to pre-set the target speed of the fresh air fan and the exhaust fan under the powerful or deodorization mode. The target speed is relative to the rated speed of the fan. Therefore, it is necessary to first obtain the rated speed of the fresh air fan and the exhaust fan, and set an adjustment coefficient n (n represents the ratio of the target speed to the rated speed), where $n \geq 1.01$. As a preferred method, n $\in$ [1.1,1.6].

[0077] A method for controlling a fresh air device provided in the present application is based on a fresh air device provided with a fresh air channel and an exhaust air channel, where the fresh air channel and the exhaust air channel are communicated with the outdoor and the indoor respectively through air ducts, the fresh air channel includes a fresh air valve and a fresh air fan, the exhaust air channel includes an exhaust air valve and an exhaust fan, and the fresh air channel and the exhaust air channel are connected through a bypass air valve. The method includes: in response to receiving an instruction for starting a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, the first working state includes adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode; in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, the second working state includes controlling the fresh air valve, the exhaust

air valve, and the bypass air valve to switch to an external circulation mode, and in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode.

[0078] As shown in FIG. 5, based on the above embodiment, another embodiment of the fresh air device method for controlling the present application is provided. In the embodiment shown in FIG. 4, the fresh air device includes a first heat exchange system and a second heat exchange system, and after the step S10 of adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode, the method further includes:

Step A10, obtaining a set temperature and a current indoor temperature;

Step A20, determining an operation mode of the fresh air device based on the set temperature and the current indoor temperature; and

Step A30, setting operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device.

[0079] In an embodiment, the first heat exchange system refers to a refrigeration cycle system for cooling and reheating fresh air, which absorbs heat through a precooling heat exchanger to cool the air, and then heats the dehumidified air through subcooling and reheating. The second heat exchange system is actually a refrigeration cycle system for dehumidifying and reheating fresh air, which absorbs heat and dehumidifies the air through a dehumidification heat exchanger, and then heats the dehumidified air through condensation and reheating.

[0080] In an embodiment, the fresh air device determines the operation mode of the fresh air device according to the indoor temperature and the set temperature, including the cooling mode and the heating mode, and sets the operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device:

in response to the fresh air device being in the cooling mode, adjusting the first heat exchange system to the cooling mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system;

in response to the fresh air device being in the heating mode, adjusting the first heat exchange system to the heating mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system.

[0081] In an embodiment, according to the working mode of the fresh air device, the refrigerant temperature in the tube of the heat exchanger is controlled. When the working mode is the cooling mode, the refrigerant temperature in the tube is reduced, thereby reducing the outlet air temperature. When the working mode is the heating mode, the refrigerant temperature in the tube is increased, thereby increasing the outlet air temperature. In an embodiment, when the working mode is the dehumidification mode, the refrigerant temperature in the tube is controlled to be lower than the air dew point temperature, thereby reducing the outlet air humidity in the component for controlling the fresh air temperature and humidity.

[0082] When the indoor temperature is higher than the set temperature, the fresh air device is in cooling mode. Correspondingly, when the indoor temperature is lower than the set temperature, the fresh air device is in heating mode. The process of adjusting the cooling mode (or heating mode) of the first system or the second system can be achieved by changing the frequency of the compressor or increasing (or decreasing) the flow rate in the heat exchange tube, or adjusting the temperature of the supply liquid in the heat exchange tube.

[0083] In an embodiment, the set temperature and the current indoor temperature are obtained; based on the set temperature and the current indoor temperature, the operation mode of the fresh air device is determined; based on the operation mode of the fresh air device, the operation modes of the first heat exchange system and the second heat exchange system are set. Compared with the above embodiments, the present application provides a solution for enhancing the cooling or heating capacity of the fresh air device, thereby further improving the practical effect of the fresh air device.

[0084] Based on the above embodiment, another embodiment of the method for controlling the fresh air device of the present application is provided. In an embodiment, based on step S10 of the embodiment shown in FIG. 4, before the step of controlling the fresh air device to operate in the first working state, the method further includes:

Step S01, obtaining current control parameters of the fresh air device.

[0085] It should be noted that the current control parameters of the fresh air device here refer to the control parameters of the fresh air device before entering the powerful or deodorization mode. The control parameters mainly include the speed of the fan, the opening or closing relationship between multiple air valves, etc. The implementers of the present application should understand that after completing the powerful or deodorization function, the fresh air device needs to exit the powerful or deodorization mode and return to the normal operating state. Therefore, the purpose of obtaining the current control parameters of the fresh air device here is to return the fresh air device to the normal operating state.

[0086] Based on step S30 of the embodiment shown in

FIG. 4, the step of controlling the fresh air device to exit the powerful or deodorization mode includes:

Step S03: controlling the fresh air device to operate according to the control parameters.

[0087] As described in the above embodiment, when the second preset condition is reached, the fresh air device is controlled to exit the powerful or deodorization mode. The second preset condition includes: the time when the fresh air device operates in the second working state reaches the second preset time, or the indoor environmental parameters reach the second target threshold. The second preset time refers to the minimum time required for the fresh air device to achieve the powerful or deodorization effect after entering the powerful or deodorization function. If the current operation time cannot reach the preset delay time, that is, the fresh air device fails to cycle the preset duration in the powerful or deodorization mode, then the dehumidification effect cannot be guaranteed to meet the expected requirements. Therefore, it is necessary to control the fresh air device to maintain the current state, that is, to maintain the state in the external circulation mode, and continuously check the relationship between the current operation time and the delay time until the delay time is reached, or the collected indoor environmental parameters reach the second target threshold, and according to the control parameters stored in step S01, the air valve, fan, etc. of the fresh air device are restored to normal, which mainly includes adjusting the rotation speeds of the fresh air fan and the exhaust fan of the fresh air device to the initial rotation speeds, which is the rotation speed before receiving the powerful or deodorization mode instruction; adjusting the states of the fresh air valve, exhaust air valve and bypass air valve of the fresh air device to the initial state, which is the state before receiving the powerful or deodorization mode instruction, etc.

[0088] The method for controlling the fresh air device provided in the embodiment of the present application is based on the embodiment shown in FIG. 4, and before the step of controlling the fresh air device to operate in the first working state, the method further includes: obtaining current control parameters of the fresh air device; the step of controlling the fresh air device to exit the powerful or deodorization mode includes: when the operation time is longer than the preset delay time, controlling the operation of the fresh air device according to the control parameters. Based on the above solution, before the fresh air device of the present application enters the powerful or deodorization mode, the control parameters of the fresh air device are obtained, and after the fresh air device completes the powerful or deodorization function, the fresh air device is controlled according to the control parameters, so as to restore the working state of the fresh air device to the normal state. Compared with the above embodiments, this embodiment further improves the application scenario of the present application and improves the usability of the present application.

[0089] In addition, the present application further provides a storage medium, on which a program for controlling a fresh air device is stored. When the program for controlling the fresh air device is executed by a processor, the relevant steps of any embodiment of the method for controlling the fresh air device are implemented.

[0090] It should be noted that, in this document, the terms "include", "comprise" or any other variations thereof are intended to cover a non-exclusive inclusion, such that a process, method, article or system that includes a series of elements not only includes those elements, it further includes other elements not expressly listed or inherent in the process, method, article or system. Without further limitation, an element defined by the statement "comprises a..." does not exclude the presence of additional identical elements in a process, method, article or system that includes that element.

[0091] The above serial numbers of the embodiments of the present application are only for description and do not represent the advantages and disadvantages of the embodiments.

[0092] Through the above description of the embodiments, those skilled in the art can clearly understand that the methods of the above embodiments can be implemented by means of software plus the necessary general hardware platform. Of course, it can also be implemented by hardware, but in many cases the former is better implementation. Based on this understanding, the technical solution of the present application can be embodied in the form of a software product in essence or the part that contributes to the related art. The computer software product is stored in a storage medium (such as read-only memory (ROM)/RAM, disk, compact disc (CD)), including several instructions for a terminal device (which can be a mobile phone, computer, server, air conditioner, or network device, etc.) to execute the methods described in various embodiments of the present application.

[0093] The above descriptions are only some embodiments of the present application, and do not limit the scope of the present application. Any equivalent structural transformations made using the contents of the description and drawings of the present application, or direct/indirect application in other related technical fields, are included in the scope of the present application.

Claims

1. A method for controlling a fresh air device, wherein the fresh air device comprises an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with an indoor environment through an air duct, the fresh air channel is communicated with an outdoor environment through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust air fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the

exhaust air channel, the method comprises:

in response to receiving an instruction for starting a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, wherein the first working state comprises adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode;
in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, wherein the second working state comprises controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to an external circulation mode; and
in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode.

2. The method for controlling the fresh air device of claim 1, wherein the fresh air device operating in the internal circulation mode satisfying the first preset condition comprises at least one of the following:

a duration of the fresh air device operating in the first working state reaching a first preset time; and
an indoor environmental parameter reaching a first target threshold.

3. The method for controlling the fresh air device of claim 1, wherein the fresh air device operating in the second working state satisfying the second preset condition comprises at least one of the following:

a duration of the fresh air device operating in the second working state reaching a second preset time; and
an indoor environmental parameter reaching a second target threshold.

4. The method for controlling the fresh air device of claim 1, wherein before the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode, the method comprises:

obtaining rated speeds of the fresh air fan and the exhaust air fan; and
calculating the target rotation speeds based on the rated speeds and a preset adjustment coefficient, wherein the target rotation speeds are greater than the rated speeds.

5. The method for controlling the fresh air device of claim 1, wherein the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode comprises:

increasing the rotation speeds of the fresh air fan and the exhaust air fan to the preset target rotation speeds;
opening the bypass air valve, closing the fresh air valve and the exhaust air valve, and starting the internal circulation mode, and
wherein the controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to the external circulation mode comprises:
opening the fresh air valve and the exhaust air valve, closing the bypass air valve, and switching to the external circulation mode.

6. The method for controlling the fresh air device of claim 1, wherein the fresh air device comprises a first heat exchange system and a second heat exchange system, and after the adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start the internal circulation mode, the method comprises:

obtaining a set temperature and a current indoor temperature;
determining an operation mode of the fresh air device based on the set temperature and the current indoor temperature; and
setting operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device.

7. The method for controlling the fresh air device of claim 6, wherein the operation mode of the fresh air device comprises a cooling mode and a heating mode, and the setting the operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device comprises:

in response to the fresh air device being in the cooling mode, adjusting the first heat exchange system to the cooling mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system;

and
in response to the fresh air device being in the heating mode, adjusting the first heat exchange system to the heating mode, increasing an operation frequency of the first heat exchange system, or shutting down or reducing a frequency of the second heat exchange system.

8. The method for controlling the fresh air device of claim 7, wherein before controlling the fresh air device to operate in the first working state, the method further comprises: obtaining current control parameters of the fresh air device, and
wherein the controlling the fresh air device to exit the powerful mode or the deodorization mode comprises: controlling the fresh air device to operate based on the current control parameters.

9. A fresh air device, comprising:

a fresh air dehumidification system; and
a control device,
wherein the fresh air dehumidification system comprises an exhaust air channel and a fresh air channel, the exhaust air channel is communicated with indoor through an air duct, the fresh air channel is communicated with outdoor through an air duct, the fresh air channel is provided with a fresh air fan and an adjustable fresh air valve, the exhaust air channel is provided with an exhaust air fan and an adjustable exhaust air valve, and an adjustable bypass air valve is provided between the fresh air channel and the exhaust air channel;
the fresh air fan, the exhaust air fan, the fresh air valve, the exhaust air valve, and the bypass air valve are all communicated with the control device, the control device comprises a memory, a processor, and a program for controlling the fresh air device stored in the memory and executable on the processor, and the program, when executed by the processor, results in performance of the method for controlling the fresh air device of any one of claims 1 to 8.

10. A storage medium, having a program for controlling a fresh air device stored therein which, when executed by a processor, results in performance of the method for controlling the fresh air device of any one of claims 1 to 8.

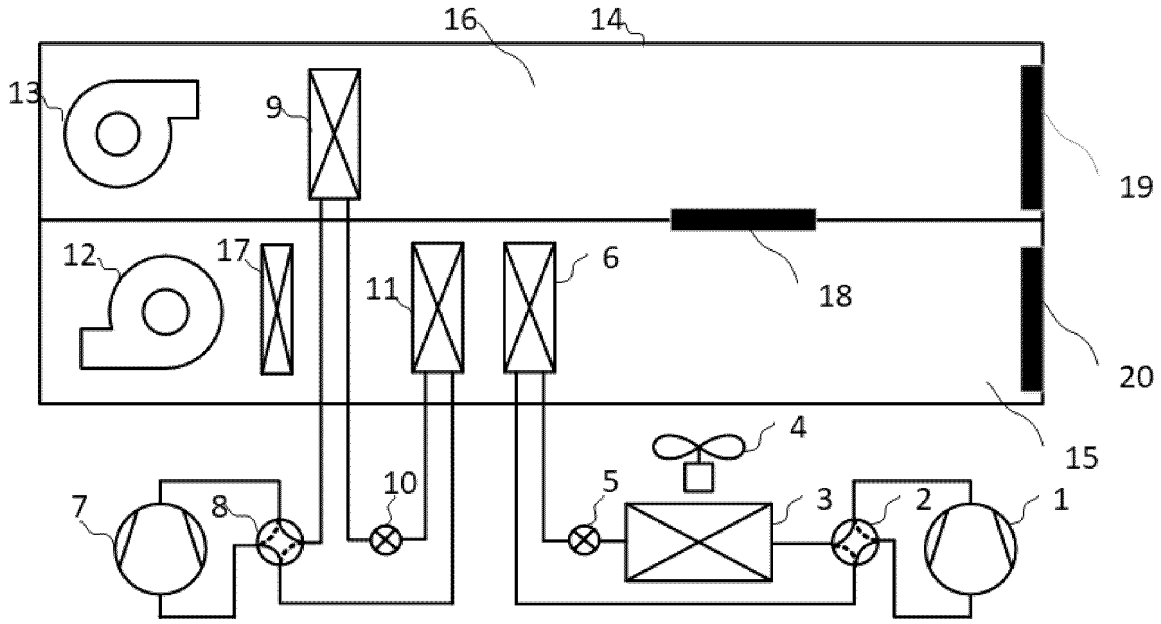
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FIG. 1

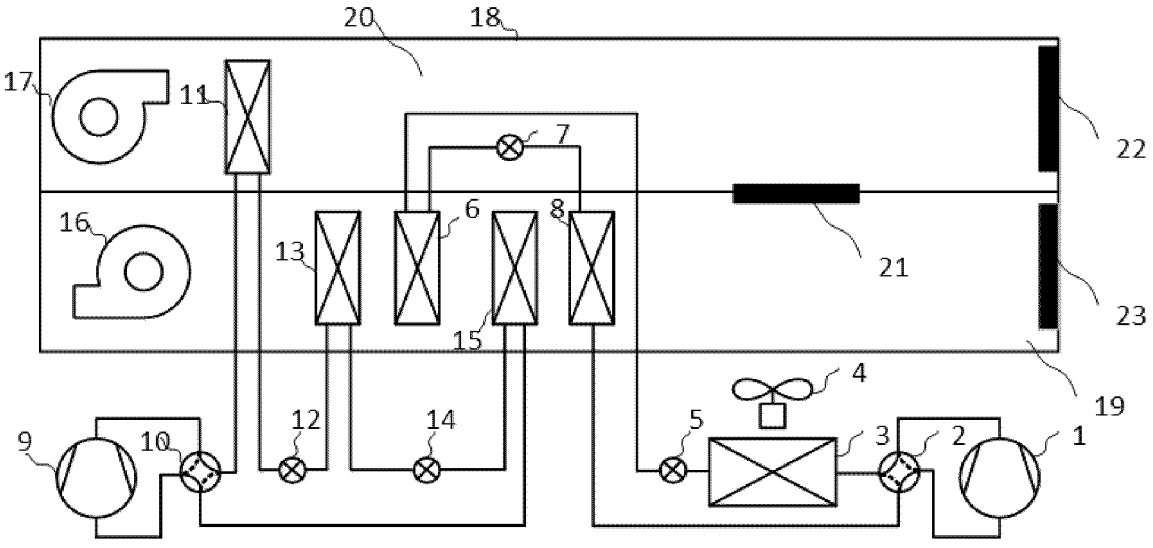
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FIG. 2

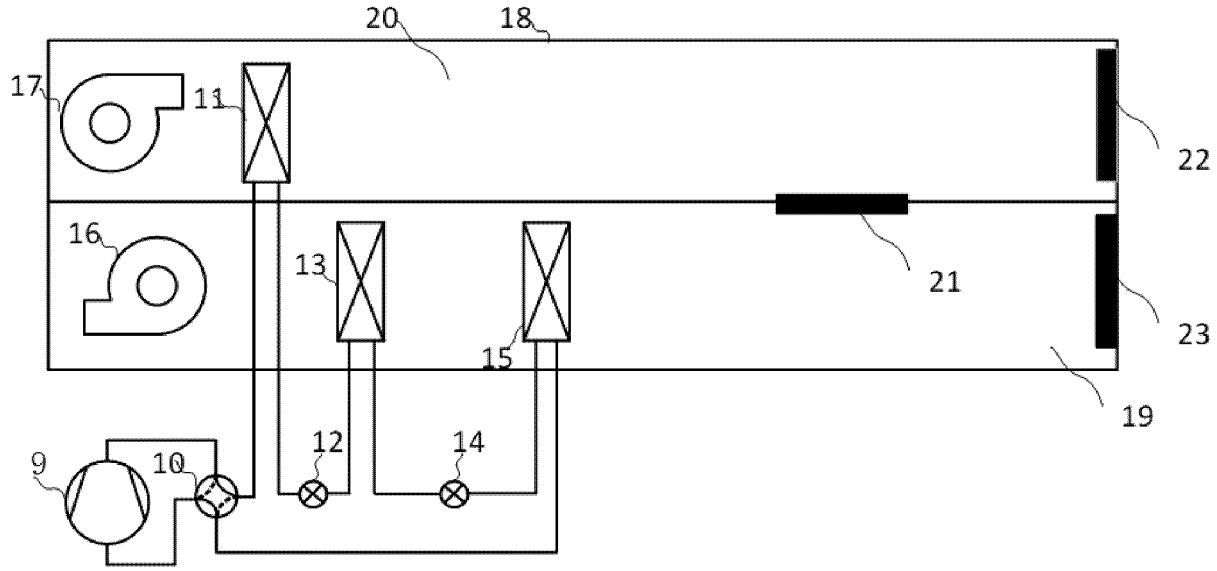

FIG. 3

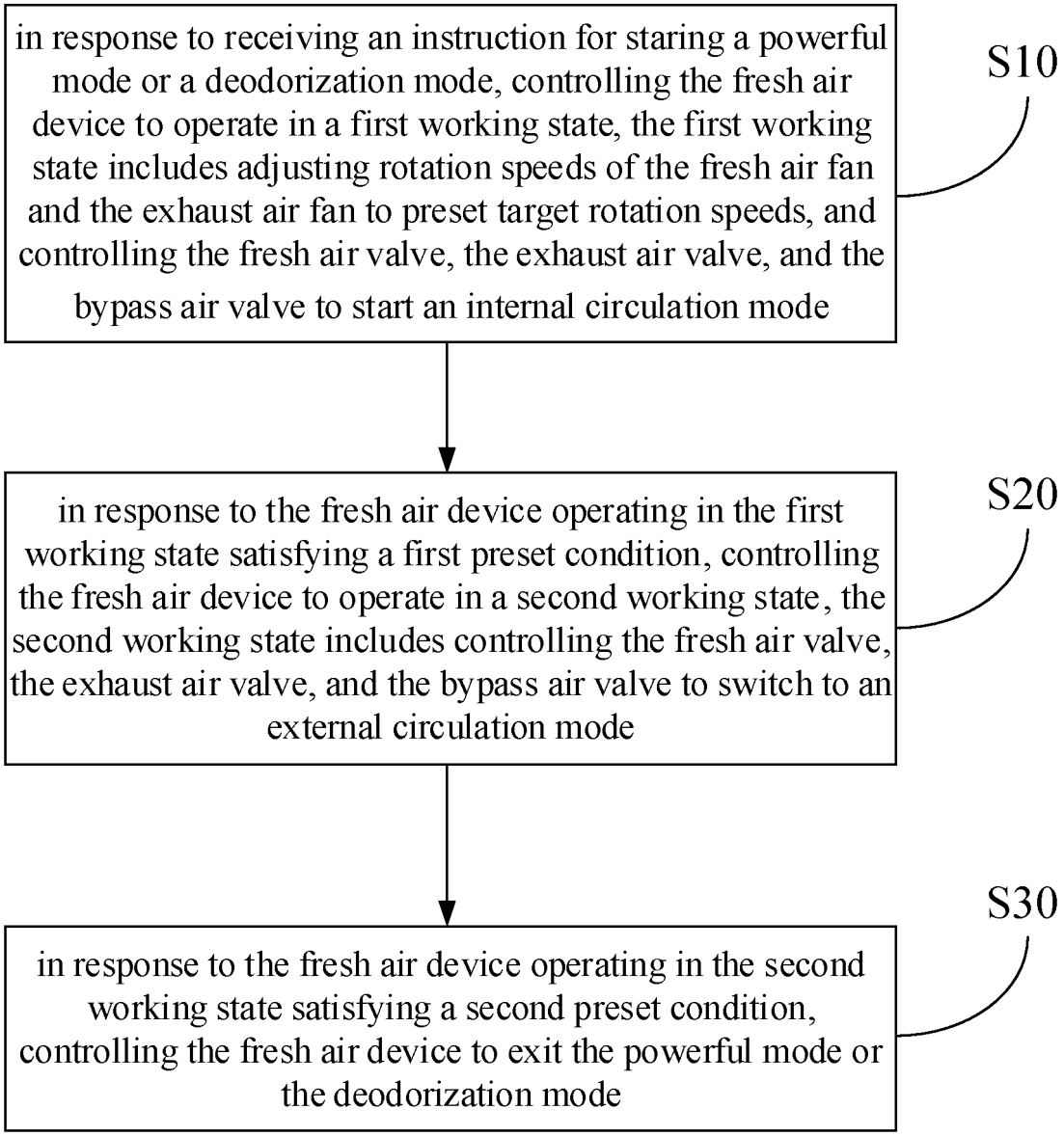
in response to receiving an instruction for staring a powerful mode or a deodorization mode, controlling the fresh air device to operate in a first working state, the first working state includes adjusting rotation speeds of the fresh air fan and the exhaust air fan to preset target rotation speeds, and controlling the fresh air valve, the exhaust air valve, and the bypass air valve to start an internal circulation mode
S10
in response to the fresh air device operating in the first working state satisfying a first preset condition, controlling the fresh air device to operate in a second working state, the second working state includes controlling the fresh air valve, the exhaust air valve, and the bypass air valve to switch to an external circulation mode
S20
in response to the fresh air device operating in the second working state satisfying a second preset condition, controlling the fresh air device to exit the powerful mode or the deodorization mode
S30

FIG. 4

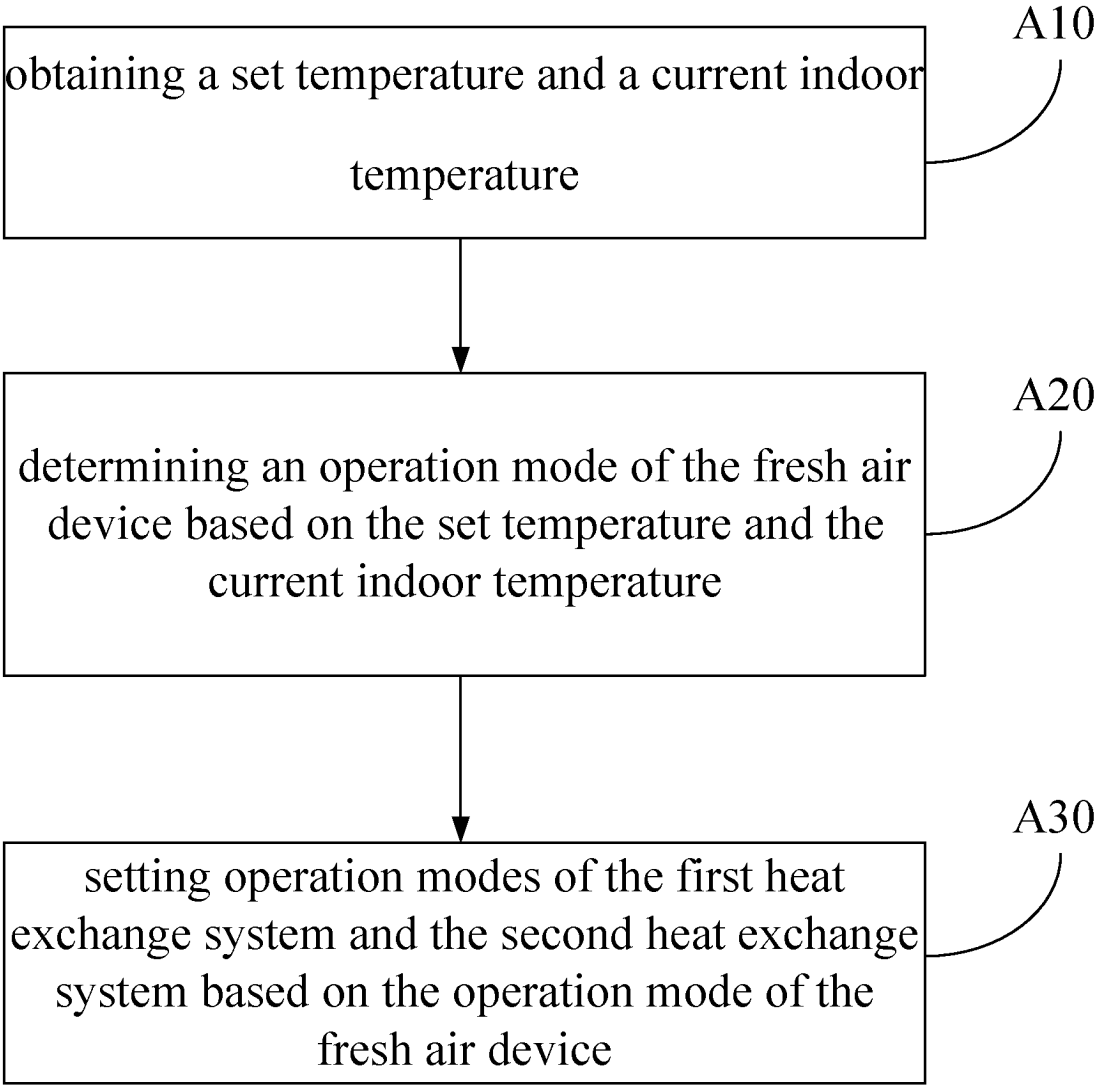
A10
obtaining a set temperature and a current indoor temperature
A20
determining an operation mode of the fresh air device based on the set temperature and the current indoor temperature
A30
setting operation modes of the first heat exchange system and the second heat exchange system based on the operation mode of the fresh air device

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/109960

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/32(2018.01)i; F24F11/56(2018.01)i; F24F11/64(2018.01)i; F24F11/65(2018.01)i; F24F11/72(2018.01)i; F24F11/74(2018.01)i

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)

F24F

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

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

CNTXT, ENTXTC, VEN, DWPI: 新风, 控制, 方法, 新风风道, 排风风道, 风机, 风阀, 旁通, 内循环, 外循环, 运行, 风机, 风扇, 转速, fresh air, control, method, humidity, fresh air duct, exhaust air duct, air valve, internal circulation, external circulation, operat+, fan, blower, rotat+ speed

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 113932370 A (WUHAN REFRIGERATION EQUIPMENT CO., LTD. OF MIDEA GROUP et al.) 14 January 2022 (2022-01-14) description, pages 3-11, and figures 1-7	1-10
X	CN 111380157 A (HISENSE (SHANDONG) AIR-CONDITIONING CO., LTD.) 07 July 2020 (2020-07-07) description, pages 3-18, and figures 1-6	1-10
X	CN 111380158 A (HISENSE (SHANDONG) AIR-CONDITIONING CO., LTD.) 07 July 2020 (2020-07-07) description, pages 3-18, and figures 1-6	1-10
X	CN 114061111 A (WUHAN REFRIGERATION EQUIPMENT CO., LTD. OF MIDEA GROUP et al.) 18 February 2022 (2022-02-18) description, pages 3-11, and figures 1-8	1-10
X	WO 2016078483 A1 (ZTE CORP.) 26 May 2016 (2016-05-26) description, pages 4-8, and figures 1-5	1-10

☑ 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
"D" document cited by the applicant in the international application
"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	Date of mailing of the international search report
05 September 2023	**07 September 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/109960

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017118213 A1 (ZTE CORPORATION) 13 July 2017 (2017-07-13) description, pages 3-11, and figures 1-6	1-10
A	WO 2018000988 A1 (CHIFEN TECHNOLOGY CO., LTD. et al.) 04 January 2018 (2018-01-04) entire document	1-10
A	WO 2018018989 A1 (ZOU JIANHAN) 01 February 2018 (2018-02-01) entire document	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/109960

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 113932370 A	14 January 2022	None	
CN 111380157 A	07 July 2020	None	
CN 111380158 A	07 July 2020	None	
CN 114061111 A	18 February 2022	None	
WO 2016078483 A1	26 May 2016	None	
WO 2017118213 A1	13 July 2017	None	
WO 2018000988 A1	04 January 2018	None	
WO 2018018989 A1	01 February 2018	None	

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202211147960 **[0001]**