(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 604 958 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
05.02.2020 Bulletin 2020/06

(21) Application number: **18894646.1**

(22) Date of filing: **31.03.2018**

(51) Int Cl.:
F24F 11/65 *(2018.01)* ***F24F 11/86*** *(2018.01)*
F24F 11/64 *(2018.01)* ***F24F 120/10*** *(2018.01)*

(86) International application number:
PCT/CN2018/081479

(87) International publication number:
WO 2019/127967 (04.07.2019 Gazette 2019/27)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **28.12.2017 CN 201711464713**

(71) Applicants:
- **GD Midea Air-Conditioning Equipment Co., Ltd.**
Foshan, Guangdong 528311 (CN)
- **Midea Group Co., Ltd.**
Foshan, Guangdong 528311 (CN)

(72) Inventor: **QU, Jinxiang**
Foshan, Guangdong 528311 (CN)

(74) Representative: **RGTH**
Patentanwälte PartGmbB
Neuer Wall 10
20354 Hamburg (DE)

(54) WIND-SENSELESS CONTROL METHOD AND DEVICE, READABLE STORAGE MEDIUM, AND AIR CONDITIONER

(57) The present disclosure provides a method for controlling a breezeless mode, including the following operations: detecting whether there is a human body in a target area after a fan is in the breezeless mode; obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area; obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan; determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs. The present disclosure also provides a device for controlling a breezeless mode and a readable storage medium, and an air conditioner. The present disclosure realizes more precise control of the fan in the breezeless mode by combining the activity state of the human, and provides a better breezeless experience.

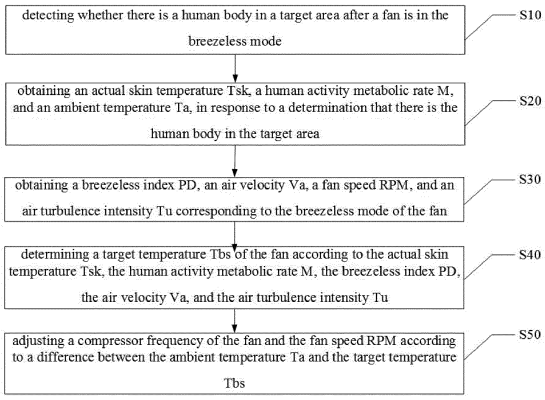


FIG. 2

EP 3 604 958 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of air conditioner, and in particular, to a method and a device for controlling a breezeless mode, and a readable storage medium, and an air conditioner.

BACKGROUND

[0002] People are of increasingly demanding of quality of life with the improvement of living standards. In many technical fields closely related to people's quality of life, such as air conditioners and other household appliances, person's activities often need to be accurately identified. However the current air conditioners with function for controlling the breezeless mode further need to provide a more accurate breezeless control mode on the basis of user's activities, for providing a much more comfortable environment.

[0003] The above contents are only used to assist in understanding the technical solutions of the present disclosure, and do not constitute the prior arts.

SUMMARY

[0004] The main objective of the present disclosure is to provide a method and a device for controlling a breezeless mode, and a readable storage medium, and an air conditioner, aiming to provide a breezeless control mode that is more precise and comfortable for the user's activity state.

[0005] In order to achieve the above objective, the present disclosure provides a method for controlling a breezeless mode, the method includes the following operations:

detecting whether there is a human body in a target area after a fan is in the breezeless mode;
obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area;
obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan;
determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and
adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

[0006] Optionally, the operation of "detecting whether there is a human body in a target area after a fan is in the breezeless mode" includes:

scanning the target area by an infrared sensor to obtain temperature scan data of the target area after the fan is in the breezeless mode; and
determining whether there is the human body in the target area according to the temperature scan data.

[0007] Optionally, the operation of "obtaining an actual skin temperature Tsk" includes:

measuring the actual skin temperature Tsk according to the temperature scan data;
the operation of "obtaining a human activity metabolic rate M" includes:
determining human activity information and an ambient temperature value of the target area according to the temperature scan data;
calculating a theoretical skin temperature value according to the ambient temperature value; and
determining the human activity metabolic rate M according to the actual skin temperature Tsk, the theoretical skin temperature value, and the human activity information.

[0008] Optionally, the operation of "obtaining an ambient temperature Ta" includes:

detecting an outlet air temperature Tc of the fan, and determining the ambient temperature Ta according to the outlet air temperature Tc, and a preset correlation between the ambient temperature Ta and the outlet air temperature Tc; or
detecting an inlet air temperature Th of the fan, and determining the ambient temperature Ta according to the inlet

air temperature Th, and a preset correlation between the ambient temperature Ta and the inlet air temperature Th.

[0009] Optionally, the operation of "obtaining the fan speed RPM" includes:
calculating the fan speed RPM according to a preset correlation between the air velocity Va, the fan speed RPM, and the air velocity Va.

[0010] Optionally, the operation of "obtaining an air turbulence intensity Tu" includes:

determining a wind scale F corresponding to the breezeless mode of the fan; and
determining the air turbulence intensity Tu according to the wind scale F, and a preset correlation between the air turbulence intensity Tu and the wind scale F.

[0011] Optionally, the operation of "determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu" includes:

determining an expected target temperature Tas of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu;
obtaining a set temperature Ts of the fan; and
adjusting the expected target temperature Tas according to the air velocity Va or the set temperature Ts to obtain the target temperature Tbs.

[0012] Optionally, after the operation of "determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu", the method further includes:

obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs; and
obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency.

[0013] Besides, in order to achieve the above objective, the present disclosure further provides a device for controlling a breezeless mode including a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein:
the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of any one of the above.

[0014] Besides, in order to achieve the above objective, the present disclosure further provides a readable storage medium storing a program for controlling a breezeless mode, the program, when executed by a processor, implements operations of the method for controlling the breezeless mode as described above.

[0015] Besides, in order to achieve the above objective, the present disclosure further provides an air conditioner including the device for controlling the breezeless mode as described above.

[0016] The present disclosure provides a method and a device for controlling a breezeless mode, and a readable storage medium, and an air conditioner. The actual skin temperature Tsk, the ambient temperature Ta, the air velocity Va, the air turbulence intensity Tu, the human activity metabolic rate M, and the breezeless index PD are respectively obtained, and the expected target temperature Tas is calculated. The target temperature Tas is determined based on the set temperature Ts or the air velocity Va of the fan, thereby determining the target temperature Tbs. According to the difference between the target temperature Tbs and the ambient temperature Ta, the frequency of the compressor or the fan speed is adjusted accordingly, indirectly controlling the compressor frequency of the fan according to the relevant parameters of the activity state of the human (the actual skin temperature Tsk, the human activity metabolic rate M) and the ambient temperature Ta near the human. When the difference is not within the preset value range, the ambient temperature corresponding to the fan is also changed by adjusting the compressor frequency, so that the difference can be dynamically changed. As such, the breezeless mode of the fan is more precisely controlled by combining the activity state of the human, thereby providing a better breezeless experience.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic structural diagram of a device for controlling a breezeless mode in a hardware operating environment according to various embodiments of the present disclosure;

FIG. 2 is a schematic flow chart of a method for controlling a breezeless mode according to a first embodiment of the present disclosure;

FIG. 3 is a schematic flow chart of the operations of a method for controlling a breezeless mode according to a first embodiment of the present disclosure; and

FIG. 4 is a schematic flow chart of a method for controlling a breezeless mode according to a second embodiment of the present disclosure.

[0018] The realization of the objective, functional characteristics, advantages of the present disclosure are further described with reference to the accompanying drawings.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0019] It should be understood that the specific embodiments described herein are merely illustrative of the disclosure and are not intended to limit the disclosure.

[0020] For the existing air conditioner with the breezeless control function, it is necessary to further provide a breezeless control mode that is more precise and comfortable for the user's activity state. The present disclosure provides a method for controlling a breezeless mode, the method includes the following operations: detecting whether there is a human body in a target area after a fan is in the breezeless mode; obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area; obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan; determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

[0021] The device for controlling the breezeless mode according to the embodiment of the present disclosure may specifically be a fan, a breezeless air conditioner, or a device/apparatus with a micro control unit (MCU) or a central processing unit (CPU) in a fan or a breezeless air conditioner. It should be understood that the device implements control of the infrared sensing component/module for temperature field scanning of the spatial region.

[0022] As shown in FIG. 1, FIG. 1 is a schematic structural diagram of a device for controlling a breezeless mode in a hardware operating environment according to various embodiments of the present disclosure, which may specifically include: a processor 1001, such as a CPU, a network interface 1004, a user interface 1003, a memory 1005, and a communication bus 1002. The communication bus 1002 is configured to implement connection communication between these components. The user interface 1003 may include a display, an input unit such as a keyboard, and optionally, the user interface 1003 may also include a standard wired interface, and wireless interface. The network interface 1004 may optionally include a standard wired interface, a wireless interface (such as a WI-FI interface). The memory 1005 may be a high speed random access memory (RAM) memory or a non-volatile memory such as a disk memory. The memory 1005 may also optionally be a storage device independent of the aforementioned processor 1001.

[0023] Optionally, the device for controlling the breezeless mode may further include a camera, a Radio Frequency (RF) circuit, a sensor, an audio circuit, a WiFi module, and the like. The sensor may be such as a light sensor, a motion sensor, and other sensor. Those skilled in the art will understand that the operating environment illustrated in FIG. 1 does not constitute a limitation to the device for controlling the breezeless mode, and may include more or fewer components than those illustrated, or some component combinations, or different component arrangements.

[0024] As shown in FIG. 1, the memory 1005 as a storage medium may include an operating system, a network communication module, a user interface module, and a program for controlling a breezeless mode.

[0025] In the operating environment shown in FIG. 1, the network interface 1004 is mainly configured to connect to a server and perform data communication with the server. The user interface 1003 is mainly configured to connect to a client (user end) and perform data communication with the client. The processor 1001 may be configured to call the program for controlling the breezeless mode stored on the memory 1005 and perform the following operations:

detecting whether there is a human body in a target area after a fan is in the breezeless mode;

obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area;

obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan;

determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and

adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

[0026] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

scanning the target area by an infrared sensor to obtain temperature scan data of the target area after the fan is in the breezeless mode; and
determining whether there is the human body in the target area according to the temperature scan data.

[0027] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

measuring the actual skin temperature Tsk according to the temperature scan data;
the operation of "obtaining a human activity metabolic rate M" comprises:
determining human activity information and an ambient temperature value of the target area according to the temperature scan data;
calculating a theoretical skin temperature value according to the ambient temperature value; and
determining the human activity metabolic rate M according to the actual skin temperature Tsk, the theoretical skin temperature value, and the human activity information.

[0028] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

detecting an outlet air temperature Tc of the fan, and
determining the ambient temperature Ta according to the outlet air temperature Tc, and a preset correlation between the ambient temperature Ta and the outlet air temperature Tc.

[0029] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

detecting an outlet air temperature Tc of the fan, and determining the ambient temperature Ta according to the outlet air temperature Tc, and a preset correlation between the ambient temperature Ta and the outlet air temperature Tc; or
detecting an inlet air temperature Th of the fan, and determining the ambient temperature Ta according to the inlet air temperature Th, and a preset correlation between the ambient temperature Ta and the inlet air temperature Th.

[0030] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:
calculating the fan speed RPM according to a preset correlation between the air velocity Va, the fan speed RPM, and the air velocity Va.

[0031] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

determining a wind scale F corresponding to the breezeless mode of the fan; and
determining the air turbulence intensity Tu according to the wind scale F, and a preset correlation between the air turbulence intensity Tu and the wind scale F.

[0032] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory 1005, and also performs the following operations:

determining an expected target temperature Tas of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu;
obtaining a set temperature Ts of the fan; and
adjusting the expected target temperature Tas according to the air velocity Va or the set temperature Ts to obtain the target temperature Tbs.

[0033] Further, the processor 1001 may call the program for controlling the breezeless mode stored on the memory

1005, and also performs the following operations:

obtaining a variation of the compressor operating frequency according to a difference between a previous outlet temperature and a current outlet temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs; and
obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency.

[0034] In addition, an embodiment of the present disclosure further provides an air conditioner including the device for controlling the breezeless mode as described above. It should be understood that the air conditioner is a breezeless air conditioner with a breezeless control mode.

[0035] Referring to FIG. 2, a first embodiment of the present disclosure provides a method for controlling a breezeless mode, including the following operations:

Operation S10, detecting whether there is a human body in a target area after a fan is in a breezeless mode;
In the present embodiment, the breezeless mode indicates that the user feels minimum draft when using the fan. That is, the user feels comfortable in the breezeless mode. There are three types of breezeless modes corresponding to the fan, namely: upper breezeless mode, lower breezeless mode and complete breezeless mode. When the upper vertical air guiding strip of the fan is closed and the lower vertical air guiding strip is opened, it is the upper breezeless mode; when the upper vertical air guiding strip of the fan is opened and the lower vertical air guiding strip is closed, it is the lower breezeless mode; and when the upper vertical air guiding strip and the lower vertical air guiding strip of the fan are both closed, it is the complete breezeless mode. Whether there is the human body in a target area is detected after the fan is in the breezeless mode. The target area is a range area in which the human activity state judging means may perform temperature scanning, and specifically may be a front area of the judging means. It should be noted that the above fan may be understood as a component of the air conditioner or a separate device or apparatus.

[0036] Specially, obtaining temperature scan data of the target area to determine whether there is the human body in the target area. The target area may be periodically scanned by an infrared sensor disposed on the device, thereby acquiring temperature scan data of the target area. Based on the principle that the skin temperature and the ambient temperature are significantly different, determining the temperature distribution of the target area according to the temperature scan data of the target area, and determining whether there is a local area in the target area that is significantly different from the ambient background temperature; if yes, determining that there is a human body.

[0037] Operation S20, obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area;
When there is the human body in the target area, further obtaining the human activity information and the actual skin temperature Tsk, and calculating a theoretical skin temperature when the human is in a calm and inactive state (for example, sitting still). The human activity information includes the average activity speed of the human body in a certain period of time, which can be determined by infrared detection of the position change of the human heat source. According to the human activity information, the actual skin temperature Tsk and the theoretical skin temperature, the human metabolic rate M is determined by looking up the table. The table is the association table of human activity information and the actual skin temperature Tsk, the human surface temperature and the human activity metabolic rate M.

[0038] Further, the ambient temperature Ta refers in particular to the ambient temperature of the area near the human, and the implementation manner of obtaining the ambient temperature Ta includes:
detecting the outlet air temperature Tc of the fan, and determining the ambient temperature Ta according to the outlet air temperature Tc and a preset correlation between the ambient temperature Ta and the outlet air temperature Tc. The preset correlation between the ambient temperature Ta and the outlet air temperature Tc is as shown in the following formula (1): $Ta=m1*Tc+n1$, m1 and n1 are the relevant temperature parameters, respectively.

[0039] Alternatively, detecting the inlet air temperature Th of the fan, and determining the ambient temperature Ta according to the inlet air temperature Th and a preset correlation between the ambient temperature Ta and the inlet air temperature Th. The preset correlation between the ambient temperature Ta and the inlet air temperature Th is as shown in the following formula (2): $Ta=m1*Th+n1$, m1 and n1 are the relevant temperature parameters, respectively.

[0040] Operation S30, obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan;
After the fan is in different breezeless mode, the corresponding breezeless index PD is also different. The corresponding breezeless index PD is determined according to the breezeless mode selected by the user. The breezeless mode includes upper breezeless mode, lower breezeless mode and complete breezeless mode, the corresponding breezeless indexes are PD1, PD2, and PD3, respectively.

[0041] Further, for the fan that enters the breezeless mode for the first time after power on, the corresponding air velocity Va is a preset primary air velocity, for example, 0.2 m/s.

[0042] Since the air velocity Va is related to the air duct structure, the fan speed, and the like, for a particular air conditioner, it can be approximated that the air velocity Va is only related to the fan speed RPM. Therefore, the fan speed RPM may be calculated according to the air velocity Va. Specifically, the fan speed RPM is calculated according to a preset correlation between the air velocity Va, the fan speed RPM, and the air velocity Va.

[0043] Further, the air turbulence intensity Tu indicates the degree of change of air with time and space, and the operation of obtaining the air turbulence intensity Tu includes:

determining a wind scale F corresponding to the breezeless mode of the fan; and determining the air turbulence intensity Tu according to the wind scale F, and a preset correlation between the air turbulence intensity Tu and the wind scale F.

[0044] The correlation between the air turbulence intensity Tu and the wind scale F corresponding to the breezeless mode is as shown in the following formula (3): Tu=a*F^2+b*F+c. When the selected breezeless is the upper breezeless mode, a=a1, b=b1, c=c1; when the selected breezeless is the lower breezeless mode, a=a2, b=b2, c=c2; and when the breezeless is the complete breezeless mode, a=a2, b=b2, c=c2.

[0045] Operation S40, determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu;

Specially, the correlation between the actual skin temperature Tsk, the ambient temperature Ta, the air velocity Va, the air turbulence intensity Tu, the human activity metabolic rate M and the breezeless index PD is as shown in the following formula (4): PD=(Tsk-Ta)*[(Va-m1)^k]*[(m2+m3*Va*Tu)]*[1-m4*(M-70)], m1, m2, m3, m4 and k are all related constants. As such, the sixth parameter may be determined through any five parameters of the six parameters Tsk, Ta, Va, Tu, M and PD, which makes the calculation of each parameter more convenient. The expected target temperature Tas of the fan is calculated based on the acquired Tsk, M, PD, Va, Tu, and formula (4). A set temperature Ts of the fan is obtained, the set temperature Ts being a preset temperature. The expected target temperature Tas is adjusted according to the air velocity Va or the set temperature Ts to obtain the target temperature Tbs.

[0046] In a specific embodiment, the operation of "adjusting the expected target temperature Tas according to the air velocity Va to obtain the target temperature Tbs" includes:

(1) On the condition that the air velocity Va is greater than 0.3m/s, if the expected target temperature Tas is less than 23°C, the target temperature Tbs is determined to be 23°C; if the expected target temperature Tas is greater than 28°C, the target temperature Tbs is determined to be 28°C.

(2) On the condition that the air velocity Va is less than or equal to 0.3m/s, if the expected target temperature Tas is less than 24°C, the target temperature Tbs is determined to be 24°C; if the expected target temperature Tas is greater than 28°C and less than or equal to 29°C, the target temperature Tbs is determined to be 28°C; if the expected target temperature Tas is greater than 29°C, the target temperature Tbs is determined to be 29°C.

[0047] In another specific embodiment, the operation of "adjusting the expected target temperature Tas according to the set temperature Ts to obtain the target temperature Tbs" includes:

(1) On the condition that the set temperature Ts is less than 24°C, if the expected target temperature Tas is less than 23°C, the target temperature Tbs is determined to be 23°C; if the expected target temperature Tas is greater than 28°C, the target temperature Tbs is determined to be 28°C.

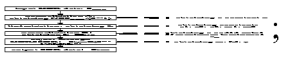
(2) On the condition that the set temperature Ts is greater than or equal to 24°C and less than or equal to 28°C, if the expected target temperature Tas is less than 24°C, the target temperature Tbs is determined to be 24°C; if the expected target temperature Tas is greater than 28°C and less than or equal to 29°C, the target temperature Tbs is determined to be 28°C.

(3) On the condition that the set temperature Ts is greater than 28°C, if the expected target temperature Tas is less than 24°C, the target temperature Tbs is determined to be 24°C; if the expected target temperature Tas is greater than 29°C, the target temperature Tbs is determined to be 29°C.

[0048] Operation S50, adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

In the present embodiment, the speed and the compressor frequency of the fan may be controlled through the difference between the ambient temperature Ta and the target temperature Tbs. Specially, when the target temperature Tbs is determined, calculating the difference between the target temperature Tbs and the current ambient temperature Ta, and obtaining a preset value range, the preset value range is a preset difference value range; when the difference between the target temperature Tbs and the current ambient temperature Ta is within the preset value range, it can be expressed as: $(T_{bs} - T_a) \in [-D,D]$, $[-D, D]$ is the preset value range, D is a positive number, Ta is the ambient temperature, and Tbs is the target temperature. Besides, when the difference between the target temperature Tbs and the current ambient

temperature Ta is not within the preset value range, which can be divided into two cases, the first one is that the difference between the target temperature and the current ambient temperature Ta is greater than the right limit of the preset value range, it can be expressed as $T_{bs} - T_a > D$; and the second one is that the difference between the target temperature and the current ambient temperature Ta is less than the left limit of the preset value range, it can be expressed as $T_{bs} - T_a < -D$. For example, if the value of D is 0.5, the preset value range is [-0.5, 0.5], when the difference between the target temperature and the current ambient temperature Ta is within the preset value range, it can be expressed as:



the difference between the target temperature and the current ambient temperature Ta is greater than the right limit of the preset value range, it can be expressed as $T_{bs} - T_a > 0.5$; the difference between the target temperature and the current ambient temperature Ta is less than the left limit of the preset value range, it can be expressed as $T_{bs} - T_a < -0.5$.

[0049] After the fan is in the breezeless mode, the wind speed Va corresponding to the fan is a preset primary wind speed, and the fan operates at the initial compressor frequency while the fan is in the breezeless mode. When the difference between the target temperature Tbs and the current ambient temperature Ta is within the preset value range, the first compressor frequency of the fan is obtained, the first compressor frequency indicates a frequency of the current compressor when the difference is within the preset value range; when the difference between the target temperature Tbs and the current ambient temperature Ta is within the preset value range, the fan is operated according to the first compressor frequency until the fan is not in the breezeless mode.

[0050] Further, when the difference between the target temperature Tbs and the current ambient temperature Ta is not within the preset value range, the second compressor frequency of the fan is calculated, the second compressor frequency indicates a frequency of the current compressor when the difference is not within the preset value range.

[0051] When the difference between the target temperature Tbs and the current ambient temperature Ta is greater than the right limit of the preset value range, that is $T_{bs} - T_a > 0.5$, the compressor decreases the preset frequency value each time. Since the frequency of the compressor is changed, the outlet air temperature Tc of the fan can be also changed, and the ambient temperature Ta corresponding to the fan can be also changed accordingly. If the preset frequency value is 1 Hz, the compressor is lowered by 1 Hz each time, and the decreased value of the compressor frequency is the second compressor frequency, the minimum value of the second compressor frequency is set to 20 Hz.

[0052] When the difference between the target temperature Tbs and the current ambient temperature Ta is greater than the right limit of the preset value range, and the second compressor frequency is greater than the minimum value, obtaining a preset time, and operating the fan according to the second compressor frequency within the preset time.

[0053] If the difference between the target temperature and the current ambient temperature Ta is greater than the right limit of the preset value range, and the second compressor frequency has decreased to a minimum value, the wind speed corresponding to the fan (i.e., the air velocity Va) is obtained. When the second compressor frequency is the minimum compressor frequency, the corresponding fan speed RPM is calculated by the obtained air velocity Va, and the fan is controlled to operate according to the fan speed RPM, thereby implementing control of the fan. When the air velocity Va is changed, the formula of controlling the air velocity Va is: $V_a(n + 1) = V_a(n) - C$. Va(n+1) represents an expected air velocity after the air velocity Va is changed, Va(n) represents an air velocity before the air velocity Va is changed, and C represents a preset constant value. When Va(n+1) is obtained, the current fan is always in a state of operating according to the lowest compressor frequency or according to the fan speed corresponding to Va(n); when Va(n+1) is calculated, the preset time is obtained, and the fan speed corresponding to the fan is calculated according to Va(n+1). When the fan is operated according to the minimum compressor frequency or according to the fan speed in a preset time, the fan is operated according to the fan speed corresponding to the second wind speed in the preset time, and the second compressor frequency is the lowest compressor frequency.

[0054] Further, when the difference between the target temperature Tbs and the current ambient temperature Ta is less than the left limit of the preset value range, that is $T_{bs} - T_a < -0.5$, the compressor increases the preset frequency value each time. Since the frequency of the compressor is changed, the outlet air temperature Tc of the fan will also change, and the ambient temperature Ta corresponding to the fan will also change. If the preset frequency value is 1 Hz, the compressor is increased by 1 Hz each time, and the increased value of the compressor frequency is the second compressor frequency. Specially, when the difference between the target temperature Tbs and the current ambient temperature Ta is less than the left limit of the preset value range, a preset time is obtained, and the fan is operated according to the second compressor frequency within a preset time.

[0055] A flowchart for implementing the operations of the embodiment is shown in FIG. 3.

[0056] In the present embodiment, the actual skin temperature Tsk, the ambient temperature Ta, the air velocity Va, the air turbulence intensity Tu, the human metabolic rate M, and the breezeless index PD are respectively obtained, and the expected target temperature Tas is calculated. The expected target temperature Tas is determined based on

the set temperature Ts or the air velocity Va of the present fan, thereby determining the target temperature Tbs. According to the difference between the target temperature Tbs and the ambient temperature Ta, the frequency of the compressor or the fan speed is adjusted accordingly, indirectly controlling the compressor frequency of the fan according to the relevant parameters of the activity state of the human (the actual skin temperature Tsk, the human activity metabolic rate M) and the ambient temperature Ta near the human. When the difference is not within the preset value range, the ambient temperature corresponding to the fan is also changed by adjusting the compressor frequency, so that the difference also dynamically changes. As such, the breezeless process of the fan is more precisely controlled by combining the activity state of the human, thereby providing a better breezeless experience.

[0057] Further, as shown in FIG. 4, after the operation of "determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu", the method further includes:

Operation S60, obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs; and

Operation S70, obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency.

[0058] After obtaining the target temperature Tbs, the required compressor operating frequency variation is obtained by combining the change of outlet temperature Tc and the change of the ambient temperature Ta and the target temperature Tbs, and the frequency value that the compressor needs to operate next is calculated according to the variation. Compared with the past according to the change of the set temperature and the ambient temperature, this scheme may control the compressor operating frequency to better match the changes in the ambient temperature, such that the ambient temperature change obtained after controlling the compressor to operate follows the corrected set temperature change more quickly, thereby further improving the user's comfort requirements.

[0059] The specific control rules are as follows:

detecting the outlet air temperature Tc of the fan real-time, and obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs. The obtaining process may be obtained by formula calculation or by using a look-up table method. For example, in the cooling mode, a part of the frequency variation ΔF(Hz) of the compressor is obtained by a look-up table method as follows:

		ambient temperature rise ← Tc(n-1)-Tc(n) → ambient temperature drop				
		-1.0	-0.5	0	+0.5	+1.0
Ta(n)-Tbs(n)	+0.5	28	22	8	4	-6
	0	12	8	0	-4	-12
	-0.5	5	-4	-8	-12	-14

[0060] In the above table, Ta(n)-Tbs(n) represents the difference between the current ambient temperature Ta and the determined target temperature Tbs (unit °C), and Tc(n-1)-Tc(n) represents the difference between the previous outlet temperature and the current outlet temperature d (unit °C). The difference between the two differences corresponds to different frequency variations Δf of the compressor. Compared with the frequency of the compressor was controlled according to the change of the ambient temperature and the set temperature value merely, the change of the ambient temperature before and after is increased to comprehensively obtain the frequency change of the compressor, thereby the obtained frequency adjustment amount of the compressor more accurate.

[0061] According to the frequency variation Δf of the compressor, the frequency f value that the compressor needs to operate next is obtained, which can be obtained by simple calculation such as f(n)=f(n-1)+Δf, F(n) is the next operating frequency value of the compressor, and F(n-1) is the current operating frequency value of the compressor. Alternatively, it can also be calculated in combination with the change of the operating frequency of the compressor before and after, such as f(n)=Δf×K+min(f(n-2), f(n-1)), f(n-2) is the previous operating frequency value of the compressor, and K is the correction factor of Δf, which needs to be determined by preliminary experiments. This scheme of calculating the operating frequency of the compressor takes into account the change before and after, so that the obtained frequency of the compressor is more accurate.

[0062] Besides, an embodiments of the present disclosure also provides a readable storage medium storing a program for controlling a breezeless mode, the program, when executed by a processor, implements the following operations:

detecting whether there is a human body in a target area after a fan is in the breezeless mode;
obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area;
obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan;
determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and
adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

[0063] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:

scanning the target area by an infrared sensor to obtain temperature scan data of the target area after the fan is in the breezeless mode;
determining whether there is the human body in the target area according to the temperature scan data.

[0064] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:

measuring the actual skin temperature Tsk according to the temperature scan data;
the operation of "obtaining a human activity metabolic rate M" comprises:
determining human activity information and an ambient temperature value of the target area according to the temperature scan data;
calculating a theoretical skin temperature value according to the ambient temperature value; and
determining the human activity metabolic rate M according to the actual skin temperature Tsk, the theoretical skin temperature value, and the human activity information.

[0065] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:

detecting an outlet air temperature Tc of the fan, and determining the ambient temperature Ta according to the outlet air temperature Tc, and a preset correlation between the ambient temperature Ta and the outlet air temperature Tc; or
detecting an inlet air temperature Th of the fan, and determining the ambient temperature Ta according to the inlet air temperature Th, and a preset correlation between the ambient temperature Ta and the inlet air temperature Th.

[0066] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:
calculating a fan speed RPM according to a preset correlation between the air velocity Va, the fan speed RPM, and the air velocity Va.

[0067] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:

determining a wind scale F corresponding to the breezeless mode of the fan; and
determining the air turbulence intensity Tu according to the wind scale F, and a preset correlation between the air turbulence intensity Tu and the wind scale F.

[0068] Further, the program for controlling the breezeless mode, when executed by the processor, implements the following operations:

determining an expected target temperature Tas of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu;
obtaining a set temperature Ts of the fan; and
adjusting the expected target temperature Tas according to the air velocity Va or the set temperature Ts to obtain the target temperature Tbs.

[0069] Further, the program for controlling the breezeless mode, when executed by the processor, implements the

following operations:

obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs; and
obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency.

[0070] It should be noted that in this document, the terms "including", "comprising", or any other variant thereof are intended to cover a non-exclusive inclusion, such that a process, method, article, or system that comprises a plurality of elements includes not only those elements but also other elements not specifically listed, or elements that are inherent to such a process, method, article, or system. An element defined by the phrase "comprising a ..." does not exclude the presence of additional equivalent elements in a process, method, article, or system that includes the element, without further limitation.

[0071] The serial numbers of the embodiments of the present disclosure are merely for the description, and do not represent the advantages and disadvantages of the embodiments.

[0072] Through the description of the above embodiments, those skilled in the art can clearly understand that the above embodiment method can be implemented by means of software plus a necessary general hardware platform, and of course, it can also be implemented by means of hardware, but in many cases, the former is a better implementation. On this basis, the technical solution of the present disclosure, which is essential or contributes to the prior art, can be embodied in the form of a software product. The computer software product is stored on a storage medium (e.g., ROM/RAM, disk, optical disk) as described above, and includes instructions for causing a terminal device to perform the methods described in various embodiments of the present disclosure.

[0073] The above are only preferred embodiments of the present disclosure, and thus do not limit the scope of the present disclosure. The equivalent structure or equivalent process transformations made by the present specification and the drawings are directly or indirectly applied to other related technical fields, and are included in the scope of the present disclosure.

Claims

1. A method for controlling a breezeless mode, **characterized in that**, the method comprises the following operations:

detecting whether there is a human body in a target area after a fan is in the breezeless mode;
obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area;
obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan;
determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu; and
adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs.

2. The method of claim 1, wherein the operation of "detecting whether there is a human body in a target area after a fan is in the breezeless mode" comprises:

scanning the target area by an infrared sensor to obtain temperature scan data of the target area after the fan is in the breezeless mode; and
determining whether there is the human body in the target area according to the temperature scan data.

3. The method of claim 2, wherein the operation of "obtaining an actual skin temperature Tsk" comprises:

measuring the actual skin temperature Tsk according to the temperature scan data;
wherein the operation of "obtaining a human activity metabolic rate M" comprises:

determining human activity information and an ambient temperature value of the target area according to the temperature scan data;
calculating a theoretical skin temperature value according to the ambient temperature value; and

determining the human activity metabolic rate M according to the actual skin temperature Tsk, the theoretical skin temperature value, and the human activity information.

4. The method of claim 1, wherein the operation of "obtaining an indoor temperature Ta" comprises:

detecting an outlet air temperature Tc of the fan, and determining the indoor temperature Ta according to the outlet air temperature Tc, and a preset correlation between the indoor temperature Ta and the outlet air temperature Tc; or
detecting an return air temperature Th of the fan, and determining the indoor temperature Ta according to the return air temperature Th, and a preset correlation between the indoor temperature Ta and the return air temperature Th.

5. The method of claim 1, wherein the operation of "obtaining an air turbulence intensity Tu" comprises:

determining a wind scale F corresponding to the current breezeless mode of the fan; and
determining the air turbulence intensity Tu according to the wind scale F, and a preset correlation between the air turbulence intensity Tu and the wind scale F.

6. The method of claim 1, wherein the operation of "determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu" comprises:

determining an expected target temperature Tas of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu;
obtaining a set temperature Ts of the fan; and
adjusting the expected target temperature Tas according to the air velocity Va or the set temperature Ts to obtain the target temperature Tbs.

7. The method of claim 1, wherein after the operation of "determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu", the method further comprises:

obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current indoor temperature Ta and the current target temperature Tbs; and
obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency.

8. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 1.

9. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 2.

10. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 3.

11. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 4.

12. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 5.

13. A device for controlling a breezeless mode, **characterized in that**, the device comprises a memory, a processor, and a program for controlling the breezeless mode stored on the memory and executable on the processor, wherein: the program, when executed by the processor, implements operations of the method for controlling the breezeless mode of claim 6.

14. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 1.

15. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 2.

16. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 3.

17. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 4.

18. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 5.

19. A readable storage medium, **characterized in that**, the readable storage medium stores a program for controlling the breezeless mode, wherein:
the program, when executed by a processor, implements operations of the method for controlling the breezeless mode of claim 6.

20. An air conditioner, **characterized in that**, the air conditioner comprises the device for controlling the breezeless mode of claim 8.

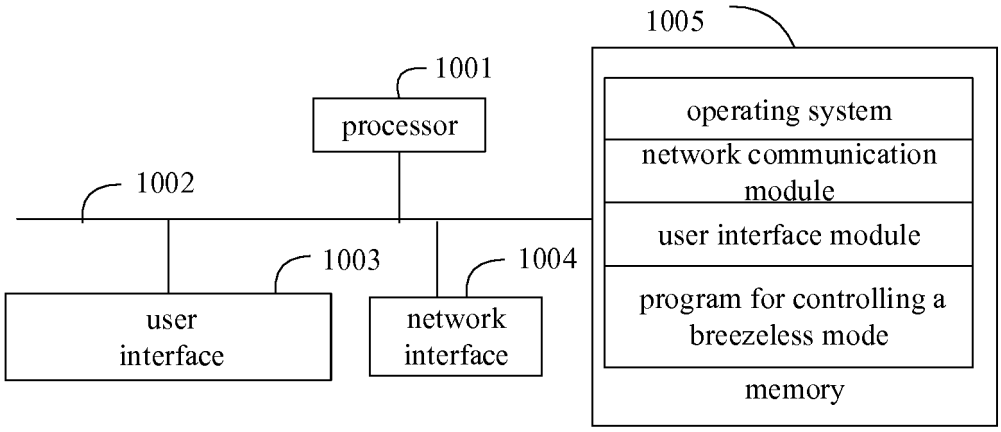

1005
1001
processor
operating system
network communication module
1002
user interface module
1003
1004
program for controlling a breezeless mode
user interface
network interface
memory

FIG. 1

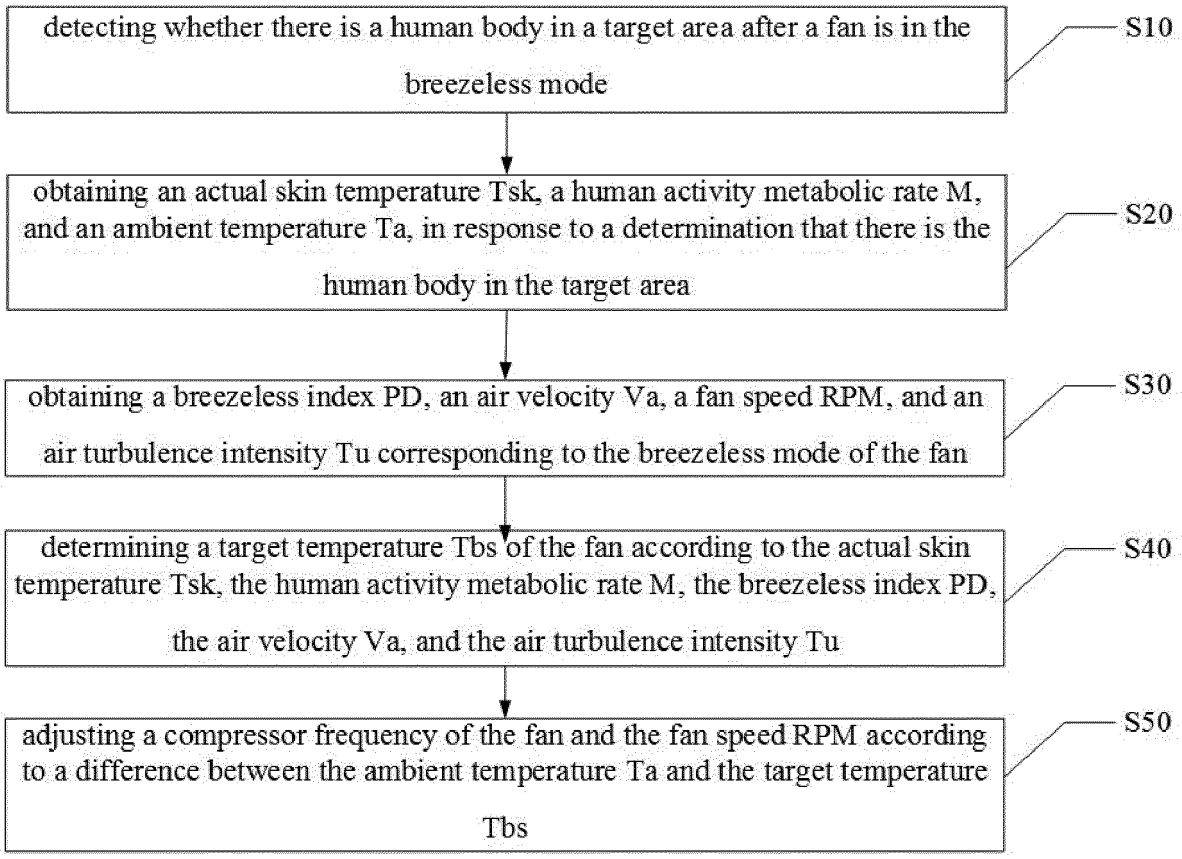

detecting whether there is a human body in a target area after a fan is in the breezeless mode
S10
obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area
S20
obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan
S30
determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu
S40
adjusting a compressor frequency of the fan and the fan speed RPM according to a difference between the ambient temperature Ta and the target temperature Tbs
S50

FIG. 2

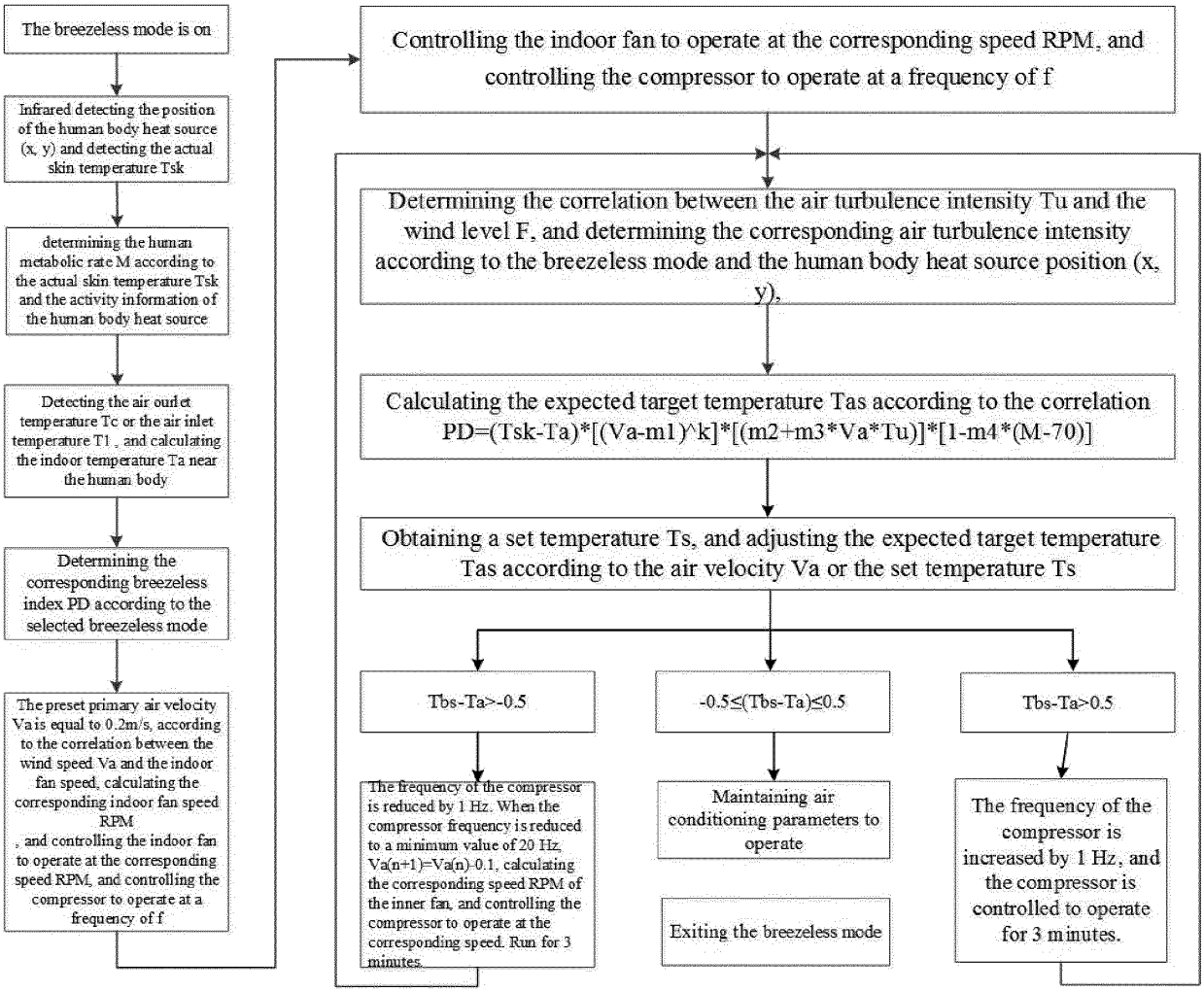

The breezeless mode is on
Infrared detecting the position of the human body heat source (x, y) and detecting the actual skin temperature Tsk
determining the human metabolic rate M according to the actual skin temperature Tsk and the activity information of the human body heat source
Detecting the air outlet temperature Tc or the air inlet temperature T1 , and calculating the indoor temperature Ta near the human body
Determining the corresponding breezeless index PD according to the selected breezeless mode
The preset primary air velocity Va is equal to 0.2m/s, according to the correlation between the wind speed Va and the indoor fan speed, calculating the corresponding indoor fan speed RPM , and controlling the indoor fan to operate at the corresponding speed RPM, and controlling the compressor to operate at a frequency of f
Controlling the indoor fan to operate at the corresponding speed RPM, and controlling the compressor to operate at a frequency of f
Determining the correlation between the air turbulence intensity Tu and the wind level F, and determining the corresponding air turbulence intensity according to the breezeless mode and the human body heat source position (x, y),
Calculating the expected target temperature Tas according to the correlation PD=(Tsk-Ta)*[(Va-m1)^k]*[(m2+m3*Va*Tu)]*[1-m4*(M-70)]
Obtaining a set temperature Ts, and adjusting the expected target temperature Tas according to the air velocity Va or the set temperature Ts
Tbs-Ta>-0.5
-0.5≤(Tbs-Ta)≤0.5
Tbs-Ta>0.5
The frequency of the compressor is reduced by 1 Hz. When the compressor frequency is reduced to a minimum value of 20 Hz, Va(n+1)=Va(n)-0.1, calculating the corresponding speed RPM of the inner fan, and controlling the compressor to operate at the corresponding speed. Run for 3 minutes.
Maintaining air conditioning parameters to operate
Exiting the breezeless mode
The frequency of the compressor is increased by 1 Hz, and the compressor is controlled to operate for 3 minutes.

FIG. 3

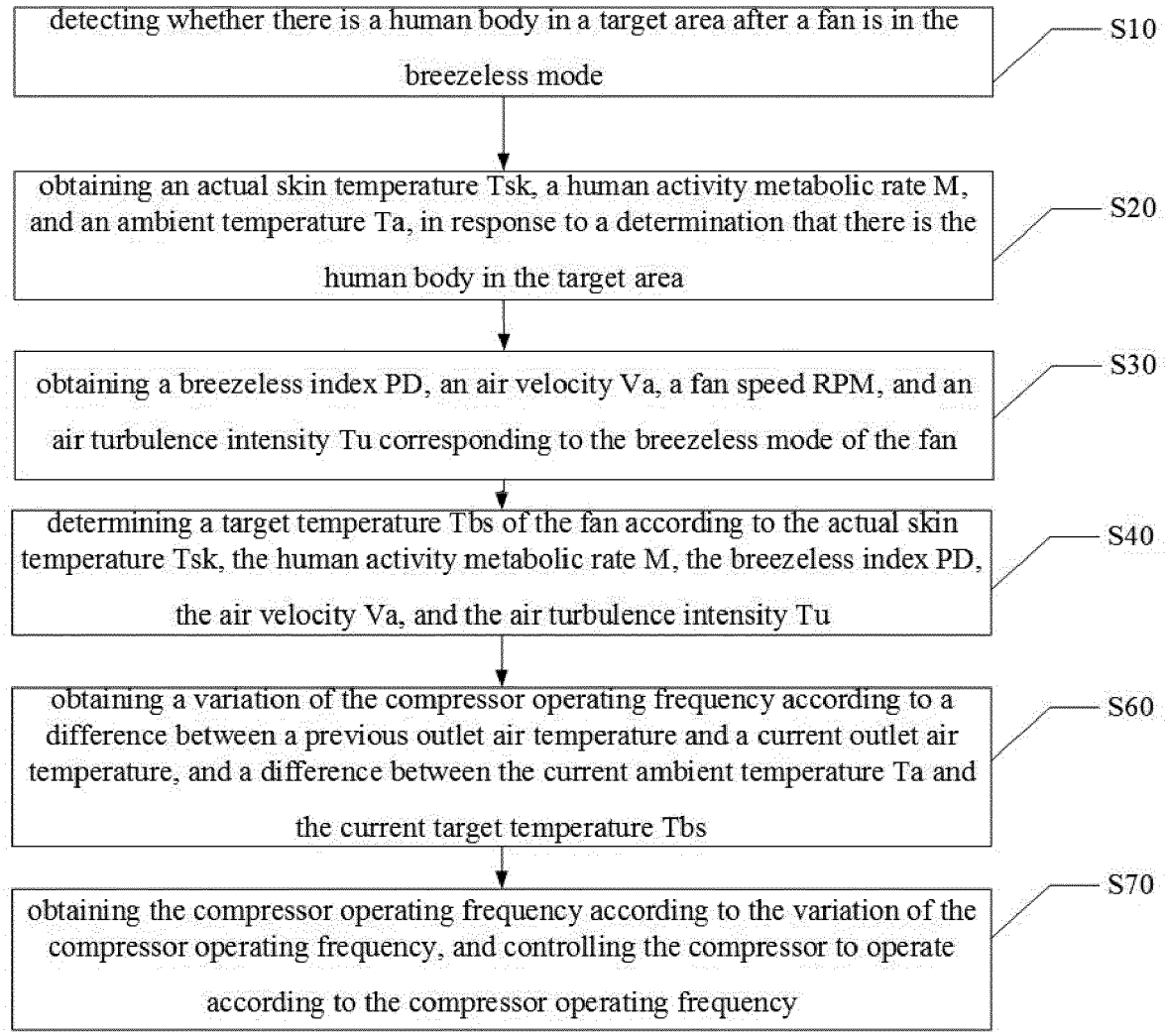

detecting whether there is a human body in a target area after a fan is in the breezeless mode
S10
obtaining an actual skin temperature Tsk, a human activity metabolic rate M, and an ambient temperature Ta, in response to a determination that there is the human body in the target area
S20
obtaining a breezeless index PD, an air velocity Va, a fan speed RPM, and an air turbulence intensity Tu corresponding to the breezeless mode of the fan
S30
determining a target temperature Tbs of the fan according to the actual skin temperature Tsk, the human activity metabolic rate M, the breezeless index PD, the air velocity Va, and the air turbulence intensity Tu
S40
obtaining a variation of the compressor operating frequency according to a difference between a previous outlet air temperature and a current outlet air temperature, and a difference between the current ambient temperature Ta and the current target temperature Tbs
S60
obtaining the compressor operating frequency according to the variation of the compressor operating frequency, and controlling the compressor to operate according to the compressor operating frequency
S70

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/081479

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/65(2018.01)i; F24F 11/86(2018.01)i; F24F 11/64(2018.01)i; F24F 120/10(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)

F24F11

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)

CNABS, SIPOABS, CNKI, CNTXT, VEN: 空调, 空气调节, 控制, 方法, 风机, 检测, 探测, 人体, 温度, 代谢, 转速, 流速, 压缩机, 频率, 温差, 温度差, 差值, 无风感指数, 紊流强度, air condition+, control+, method, fan, sens+, detect+, human body, temperature, metabolism, rotat+ speed, flow speed, compressor, frequency, temperature difference, windless index, turbulence intensity

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 106979596 A (GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 25 July 2017 (2017-07-25) description, paragraphs [0003], [0029]-[0032], and [0185]-[0192], and figures 1-10	1-20
Y	CN 103940043 A (MIDEA GROUP CO., LTD.) 23 July 2014 (2014-07-23) description, paragraphs [0084]-[0130]	1-20
A	CN 106989481 A (MIDEA GROUP WUHAN REFRIGERATION EQUIPMENT CO., LTD. ET AL.) 28 July 2017 (2017-07-28) entire document	1-20
A	CN 105020848 A (GUANGDONG MIDEA AIR-CONDITIONING EQUIPMENT CO., LTD. ET AL.) 04 November 2015 (2015-11-04) entire document	1-20
A	CN 106895484 A (GUANGDONG MIDEA AIR-CONDITIONING EQUIPMENT CO., LTD.) 27 June 2017 (2017-06-27) entire document	1-20

☑ 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	Date of mailing of the international search report
23 July 2018	**30 July 2018**

Name and mailing address of the ISA/CN	Authorized officer
State Intellectual Property Office of the P. R. China (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/081479

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20100052204 A (LG ELECTRONICS INC.) 19 May 2010 (2010-05-19) entire document	1-20

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/081479

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 106979596 A	25 July 2017	None	
CN 103940043 A	23 July 2014	None	
CN 106989481 A	28 July 2017	None	
CN 105020848 A	04 November 2015	CN 105020848 B	01 June 2018
CN 106895484 A	27 June 2017	None	
KR 20100052204 A	19 May 2010	None	

Form PCT/ISA/210 (patent family annex) (January 2015)