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(54) # REFRIGERANT FLOW CONTROL METHOD AND DEVICE FOR AIR CONDITIONER AND COMPUTER STORAGE MEDIUM

(57) The present application discloses a refrigerant flow control method and device for air conditioner and a computer storage medium, relating to the technical field of intelligent household electrical appliance. An air conditioner comprises an outdoor unit and at least two indoor units, each indoor unit is connected with the outdoor unit by means of a corresponding throttling device; the method comprises: acquiring a suction temperature of a compressor in the outdoor unit and acquiring coil temperatures of the indoor units; when a first temperature difference between the suction temperature and the average coil temperature is greater than a preset one, adjusting parameters of at least one throttling device so as to increase the refrigerant flow in the throttling device, the average coil temperature being an average value of the coil temperatures; when the first temperature difference is less than the preset one, adjusting parameters of at least one throttling device so as to reduce the refrigerant flow in the throttling device. Thus, the unification of single-split type indoor unit and multi-split type indoor unit is realized and the resources are saved.

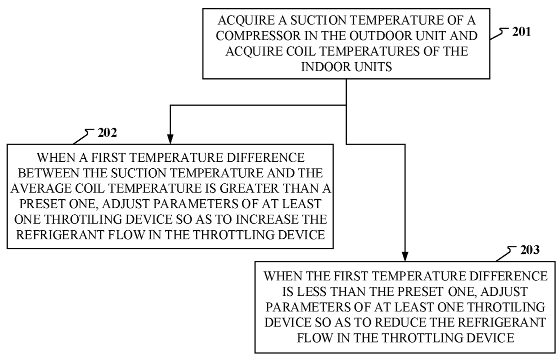

Fig. 2

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The application is based upon and claims priority to Chinese Patent Application No. 201811084930.4, filed September 18, 2018, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of intelligent household appliance technologies, and more particularly, to a method and a device for controlling refrigerant flow of an air conditioner and a computer storage medium.

BACKGROUND

[0003] With the improvement of living standards, air conditioners have become a necessity in people's daily life. A household central air conditioner includes a one-to-multiple air conditioner, that is, one outdoor unit of the air conditioner corresponds to multiple indoor units of the air conditioner, a compressor of the outdoor unit drives all indoor units, branch pipes are provided on system pipelines, and all indoor units share a main pipe to connect to the outdoor unit.

[0004] In a household central air conditioning system, each indoor unit generally includes four temperature sensors, that is, an environment temperature sensor, an inner coil temperature sensor, an evaporator inlet sensor and an evaporator outlet sensor, and thus, an inlet temperature can be obtained by the evaporator inlet sensor and an outlet temperature can be obtained by the evaporator outlet sensor, and a refrigerant flow flowing through each indoor unit can be adjusted according to a temperature difference between the inlet temperature and the outlet temperature. However, most of the current indoor units have only two temperature sensors, that is, the environment temperature sensor and the inner coil temperature sensor, and if the current indoor units are used in the household central air conditioning system, the evaporator inlet sensor and the evaporator outlet sensor need to be provided on a pipeline of the outdoor unit.

[0005] During the implementation of embodiments of the present disclosure, it is found that at least the following problems exist in related arts:
the addition of the sensors to the outdoor unit leads to complex connection lines and easy line connection problems. It can be seen that the process and connection of the household central air conditioning system compatible with existing indoor units are relatively complicated.

SUMMARY

[0006] In order to have a basic understanding of some aspects of disclosed embodiments, a brief summary is given below. The summary is not a general comment, nor is it intended to identify key/important constituent elements or to describe the scope of protection of these embodiments, but serves as a preamble to the following detailed description.

[0007] Embodiments of the present disclosure provide a method for controlling refrigerant flow of an air conditioner.

[0008] In some embodiments, the air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, and the method includes:

> obtaining a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit;
> adjusting parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
> adjusting the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0009] Embodiments of the present disclosure provide a device for controlling refrigerant flow of an air conditioner.

[0010] In some embodiments, the air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, and the device includes:

> an obtaining unit configured to obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit;
> a first adjusting unit configured to adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
> a second adjusting unit configured to adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0011] Embodiments of the present disclosure provide a device for controlling refrigerant flow of an air conditioner, applied for the air conditioner.

[0012] In some embodiments, the air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, and the device includes:

a processor; and
a memory for storing instructions executable by the processor;
wherein the processor is configured to:
obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit;
adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0013] Embodiments of the present disclosure provide an electronic device.

[0014] In some embodiments, the electronic device includes:

at least one processor; and
a memory communicatively connected to the at least one processor; wherein,
the memory stores instructions that can be executed by the at least one processor, and when the instructions are executed by the at least one processor, the at least one processor performs the above-mentioned method for controlling refrigerant flow of the air conditioner.

[0015] Embodiments of the present disclosure provide a computer readable storage medium.

[0016] In some embodiments, the computer readable storage medium stores computer executable instructions, and the computer executable instructions are configured to execute the above-mentioned method for controlling refrigerant flow of the air conditioner.

[0017] Embodiments of the present disclosure provide a computer program product.

[0018] In some embodiments, the computer program product includes a computer program stored on a computer readable storage medium, the computer program includes program instructions, and when the program instructions are executed by a computer, the computer performs the above-mentioned method for controlling refrigerant flow of the air conditioner.

[0019] Some technical solutions provided by the embodiments of the present disclosure may achieve the following technical effects.

[0020] In the embodiments of the present disclosure, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit and the environment temperature without obtaining an outlet temperature and inlet temperature of an evaporator, and thus there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor on the indoor unit and the outdoor unit, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources.

[0021] The above general description and the following description are exemplary and explanatory only and are not intended to limit the present application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] One or more embodiments are exemplarily described by corresponding accompanying drawings. These exemplary descriptions and drawings do not limit the embodiments. Elements with same reference numerals in the drawings are shown as similar elements. The drawings do not constitute a scale limitation, and in which:

Fig. 1 is a schematic structural diagram illustrating an air conditioner according to an embodiment of the present disclosure;
Fig. 2 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an embodiment of the present disclosure;
Fig. 3 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an embodiment of the present disclosure;
Fig. 4 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an embodiment of the present disclosure;
Fig. 5 is a block diagram illustrating a device for controlling refrigerant flow of an air conditioner according to an embodiment of the present disclosure;
Fig. 6 is a block diagram illustrating a device for controlling refrigerant flow of an air conditioner according to an embodiment of the present disclosure; and
Fig. 7 is a schematic structural diagram illustrating an electronic device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0023] To provide a more detailed understanding of features and technical contents of embodiments of the present disclosure, implementation of the embodiments of the present disclosure is described below in detail in conjunction with the drawings. The drawings are provided for reference only and are not intended to limit the embodiments of the present disclosure. In the following technical description, for convenience of explanation, various details are used to provide a full understanding of the disclosed embodiments. However, in the absence of these details, one or more embodiments may still be implemented. In other cases, well-known structures and devices may be shown simplistically in order to simplify the drawings.

[0024] In a one-to-multiple air conditioner, a refrigerant flow flowing through a corresponding indoor unit can be adjusted according to a difference between an evaporator inlet temperature and an evaporator outlet temperature, and thus the evaporator inlet sensor and the evaporator outlet sensor are needed to obtain corresponding temperatures. In the embodiments of the present disclosure, in the one-to-multiple air conditioner, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit and the environment temperature, and thus the indoor unit in the air conditioner is the same as that in the one-to-one air conditioner, that is, only the environment temperature sensor and the inner coil temperature sensor are required, and there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources.

[0025] In the embodiments of the present disclosure, the air conditioner includes an outdoor unit and at least two indoor units, wherein each indoor unit is connected to the outdoor unit through a corresponding throttle device.

[0026] Fig. 1 is a schematic structural diagram illustrating an air conditioner according to an exemplary embodiment. As shown in Fig. 1, in the present embodiment, the air conditioner includes an outdoor unit 100, a first indoor unit 200 and a second indoor unit 300, wherein an evaporator in the first indoor unit 200 is connected to a condenser in the outdoor unit 100 through a throttle device 1, and an evaporator in the second indoor unit 300 is connected to the condenser in the outdoor unit 100 through a throttle device 2. In each indoor unit, there are only a corresponding inner environment temperature sensor and a corresponding inner coil sensor, wherein the sensors are temperature sensors for detecting corresponding temperatures. It can be seen that, the indoor unit in the one-to-multiple air conditioner is the same as that in the one-to-one air conditioner, the connection between the indoor unit and the outdoor unit is relatively simple, and there is no need to connect to the evaporator inlet sensor or the evaporator outlet sensor.

[0027] Here, there are only two indoor units, the structures of three indoor units, four indoor units and n indoor units are the same as that of the two indoor units. Each indoor unit only needs to have two corresponding temperature sensors, and each indoor unit is connected to the outdoor unit through a corresponding throttle device, the specific examples are not listed one by one.

[0028] In the above-mentioned air conditioner, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit and the environment temperature.

[0029] Fig. 2 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an exemplary embodiment. As shown in Fig. 2, the method for controlling refrigerant flow of the air conditioner includes following steps.

[0030] Step 201, a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit are obtained.

[0031] As shown in Fig. 1, the compressor in the outdoor unit is provided with a suction sensor, so that the suction temperature Ts of the compressor in the outdoor unit can be obtained through the suction sensor. Similarly, the indoor units are provided with inner coil sensors, through which the inner coil temperatures Tm1, Tm2, ..., Tmn corresponding to each indoor unit can be obtained, that is, if there are n indoor units, there are corresponding n inner coil temperatures.

[0032] Of course, the present disclosure is not limited to the temperature sensor, and other detection devices that can obtain the temperatures can also be applied to the present disclosure, or the temperature calculated through software or formulas can also be applied thereto.

[0033] Step 202, parameters of at least one throttle device are adjusted to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature.

[0034] Step 203, the parameters of the at least one throttle device are adjusted to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0035] The inner coil temperatures Tm1, Tm2, ..., Tmn of each indoor unit have been obtained, and the inner coil average temperature ΔTm can be obtained. The inner coil average temperature is the average value obtained by summing each inner coil temperature, i.e., $\Delta Tm=(Tm1+Tm2+... +Tmn)/n$.

[0036] Then, the first temperature difference Tsh between the suction temperature Ts and the inner coil average temperature ΔTm is obtained, i.e., $Tsh=Ts-\Delta Tm$. The preset temperature difference TshO can be obtained through multiple tests according to a model of the air conditioner, that is, the preset temperature difference TshO can be set in advance, and thus when the first temperature difference is greater than the preset temperature difference, parameters of at least one throttle device are adjusted to increase the refrigerant flow flowing through the throttle device; and when the first temperature difference is less than the preset temperature difference, the parameters of the at least one throttle device are adjusted to reduce the refrigerant flow flowing through the throttle device.

[0037] In the embodiment, when the throttle device is an electronic expansion valve, if Tsh>Tsh0, a valve of at least one electronic expansion valve can be adjusted to increase the refrigerant flow flowing through the electronic expansion valve, thereby increasing the refrigerant flow flowing through corresponding indoor unit; and if Tsh<Tsh0, the valve of at least one electronic expansion valve can be adjusted to reduce the refrigerant flow flowing through the electronic expansion valve, thereby reducing the refrigerant flow flowing through corresponding indoor unit. The adjustment of other throttle valves can also be the same, if Tsh>Tsh0, the parameters of at least one throttle device can be adjusted to increase the refrigerant flow flowing through the throttle device, and if Tsh<Tsh0, the parameters of the at least one throttle device can be adjusted to reduce the refrigerant flow flowing through the throttle device, thereby changing the refrigerant flow flowing through the corresponding indoor unit.

[0038] It can be seen that in the embodiment of the present disclosure, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit and the environment temperature, and thus the indoor unit in the air conditioner is the same as that in the one-to-one air conditioner, that is, only the environment temperature sensor and the inner coil temperature sensor are required, and there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources.

[0039] Of course, in the embodiment of the present disclosure, there are many ways to adjust the parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device. For example, the parameters of one, two or more throttle devices can be randomly adjusted to increase the refrigerant flow flowing through the throttle device. Preferably, the adjusting the parameters according to the inner coil temperature of each indoor unit includes: comparing the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is greater than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and adjusting parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

[0040] For example, Tm1, Tm2, ..., Tmn are compared with ΔTm respectively, if Tm2>ΔTm, a 2nd indoor unit corresponding to Tm2 can be determined as the first indoor unit, the throttle device 2 corresponding to the 2nd indoor unit can be determined as the first throttle device, and the parameters of the throttle device 2 are adjusted to increase the refrigerant flow flowing through throttle device 2. If the throttle device 2 is the electronic expansion valve, the valve of the electronic expansion valve can be turned up, and the number of steps for turning up the valve can be determined according to [Tsh-Tsh0]. Similarly, if Tm3, Tm6, ..., Tmn are respectively greater than ΔTm, the corresponding 3rd indoor unit, 6th indoor unit, ..., nth indoor unit can be determined as the first indoor unit, the corresponding throttle device 3, throttle device 6, ..., throttle device n can be determined as the first throttle device, and the parameters of the first throttle device can be adjusted to increase the refrigerant flow flowing through the first throttle device.

[0041] Similarly, in the embodiment of the present disclosure, there are many ways to adjust the parameters of at least one throttle device to reduce the refrigerant flow flowing through the throttle device. For example, the parameters of one, two or more throttle devices can be randomly adjusted to reduce the refrigerant flow flowing through the throttle device. Preferably, the adjusting the parameters according to the inner coil temperature of each indoor unit includes: comparing the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is less than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and adjusting parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

[0042] For example, Tm1, Tm2, ..., Tmn are compared with ΔTm respectively, if Tm1<ΔTm, a 1st indoor unit corresponding to Tm1 can be determined as the first indoor unit, the throttle device 1 corresponding to the 1st indoor unit can be determined as the second throttle device, and the parameters of throttle device 1 can be adjusted to reduce the refrigerant flow flowing through throttle device 1. If the throttle device 1 is the electronic expansion valve, the valve of the electronic expansion valve can be turned down, and the number of steps for turning down the valve can be determined according to [Tsh-Tsh0]. Similarly, if Tm4, Tm5, ... are all less than ΔTm, the corresponding 4th indoor unit and 5th indoor unit can be determined as the second indoor unit, and the corresponding throttle device 4 and throttle device 5, ..., can be determined as the second throttle device, and the parameters of the second throttle device can be adjusted to reduce the refrigerant flow flowing through the second throttle device.

[0043] It can be seen that in the one-to-multiple air conditioner, when the first temperature difference is greater than the preset temperature difference, that is, when an actual superheat is relatively large, the refrigerant flow of the system needs to be increased. Preferably, a refrigerant flow of an indoor unit with high inner coil temperature can be increased. When the first temperature difference is less than the preset temperature difference, that is, when the actual superheat is relatively small, the refrigerant flow of the system needs to be reduced. Preferably, a refrigerant flow of an indoor unit with low inner coil temperature can be reduced, so that a temperature control of an area where each indoor unit is located will be more balanced, and the human body will feel more comfortable.

[0044] When the first temperature difference is equal to the preset temperature difference, that is, the actual superheat is consistent with a target superheat, the refrigerant flow of the system does not need to be increased. However, the refrigerant flow flowing through some indoor units may be too much, and the refrigerant flow flowing through some indoor units may be too little, that is, the distribution of the refrigerant is uneven, a bias flow adjustment can be performed at this time. In another embodiment of the present disclosure, the bias flow adjustment can be performed, which specifically includes: determining a second temperature difference between an environment temperature of each indoor unit and the inner coil temperature when the first temperature difference is equal to the preset temperature difference; determining an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determining an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and adjusting parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjusting parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

[0045] As shown in Fig. 1, each indoor unit is provided with an inner environment temperature sensor, so that environment temperatures Tail, Tai2, ..., Tain corresponding to each indoor unit can be obtained through the inner environment temperature sensors, and thus when Tsh=TshO, the second temperature difference between the environment temperature of each indoor unit and the inner coil temperature can be determined, that is, the second temperature difference ΔTw1=Tai1-Tm1, ΔTw2=Tai2-Tm2, ..., ΔTwn=Tain-Tmn. Then, the relative difference between the maximum second temperature difference and the minimum second temperature difference is compared with the set value, when the relative difference is greater than the set value, the indoor unit corresponding to the maximum second temperature difference can be determined as the third indoor unit, and the indoor unit corresponding to the minimum second temperature difference can be determined as the fourth indoor unit. Finally, the parameters of the third throttle device corresponding to the third indoor unit are adjusted to increase the refrigerant flow flowing through the third throttle device, and the parameters of the fourth throttle device corresponding to the fourth indoor unit are adjusted to reduce the refrigerant flow flowing through the fourth throttle device.

[0046] For example, in ΔTw1, ΔTw2, ..., ΔTwn, ΔTw2 is the largest, and ΔTwn is the smallest, and thus when |ΔTw2-ΔTwn|>A, where A is a natural number greater than zero, and can be set according to the model and an operating environment of the air conditioner to determine the uneven distribution of the refrigerant flow; at this time, the 2nd indoor unit can be determined as the third indoor unit, the nth indoor unit can be determined as the fourth indoor unit, the throttle device 2 corresponding to the 2nd indoor unit can be determined as the third throttle device, and the throttle device n corresponding to the nth indoor unit is determined as the fourth throttle device. The parameters of the throttle device 2 are adjusted to increase the refrigerant flow flowing through the throttle device 2, and the parameters of the throttle device n are adjusted to reduce the refrigerant flow flowing through the throttle device n. If the throttle device is the electronic expansion valve, the valve of the electronic expansion valve can be turned up, and preferably, the number of steps for turning up the valve can be determined according to A/2. The valve of the electronic expansion valve can be turned down, and preferably, the number of the steps for turning down the valve can also be determined according to A/2.

[0047] It can be seen that when the first temperature difference is equal to the preset temperature difference, the refrigerant flow of the system does not need to be adjusted, however, the bias flow adjustment can be performed to further improve the balance of the refrigerant flow flowing through each indoor unit, so that a temperature in an action area of each indoor unit is relatively balanced and the user experience is further improved.

[0048] Of course, in the embodiment of the present disclosure, when the refrigerant flow is controlled, only a superheat adjustment can be performed, that is, the superheat adjustment can be performed according to the first temperature difference; or, only the bias flow adjustment can be performed, that is, the bias flow adjustment can be performed according to the second temperature difference; or, both the superheat adjustment and the bias flow adjustment can be performed, and preferably, the superheat adjustment can be performed first and then the bias flow adjustment can be performed.

[0049] Fig. 3 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an exemplary embodiment. As shown in Fig. 3, the method for controlling refrigerant flow of the air conditioner includes following steps.

[0050] Step 301, a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit are obtained.

[0051] As shown in Fig. 1, the compressor in the outdoor unit is provided with a suction sensor, so that the suction temperature Ts of the compressor in the outdoor unit can be obtained through the suction sensor. Similarly, the indoor units are provided with inner coil sensors, through which the inner coil temperatures Tm1, Tm2, ..., Tmn corresponding to each indoor unit can be obtained, that is, if there are n indoor units, there are corresponding n inner coil temperatures.

[0052] Step 302, a second temperature difference between an environment temperature of each indoor unit and the inner coil temperature is determined when a first temperature difference between the suction temperature and an inner coil average temperature is equal to a preset temperature difference.

[0053] The inner coil temperatures Tm1, Tm2, ..., Tmn of each indoor unit have been obtained, and the inner coil average temperature ΔTm can be obtained. The inner coil average temperature is the average value obtained by summing each inner coil temperature, i.e., ΔTm=(Tm1+Tm2+... +Tmn)/n. The first temperature difference Tsh between the suction temperature Ts and the inner coil average temperature ΔTm is obtained, a preset temperature difference TshO can be set in advance, and thus when the first temperature difference is equal to the preset temperature difference, the refrigerant flow of the system does not need to be changed at this time, however, a bias flow adjustment needs to be performed.

[0054] As shown in Fig. 1, each indoor unit is provided with an inner environment temperature sensor, so that environment temperatures Tail, Tai2, ..., Tain corresponding to each indoor unit can be obtained through the inner environment temperature sensors, and thus when Tsh=TshO, the second temperature difference between the environment temperature of each indoor unit and the inner coil temperature can be determined, that is, the second temperature difference ΔTw1=Tai1-Tm1, ΔTw2=Tai2-Tm2, ..., ΔTwn=Tain-Tmn.

[0055] Step 303, an indoor unit corresponding to the maximum second temperature difference is determined as a third indoor unit, and an indoor unit corresponding to the minimum second temperature difference is determined as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value.

[0056] For example, in ΔTw1, ΔTw2, ..., ΔTwn, ΔTw2 is the largest, and ΔTwn is the smallest, and thus when |ΔTw2-ΔTwn|>A, where A is a natural number greater than zero, and can be set according to the model and an operating environment of the air conditioner to determine the uneven distribution of the refrigerant flow; at this time, the second indoor unit can be determined as the third indoor unit, and the nth indoor unit can be determined as the fourth indoor unit.

[0057] Step 304, parameters of a third throttle device corresponding to the third indoor unit are adjusted to increase the refrigerant flow flowing through the third throttle device, and parameters of a fourth throttle device corresponding to the fourth indoor unit are adjusted to reduce the refrigerant flow flowing through the fourth throttle device.

[0058] For example, the 2nd indoor unit is the third indoor unit, and the nth indoor unit is the fourth indoor unit; and then, the throttle device 2 corresponding to the 2nd indoor unit can be determined as the third throttle device, and the throttle device n corresponding to the nth indoor unit can be determined as the fourth throttle device. The parameters of the throttle device 2 are adjusted to increase the refrigerant flow flowing through the throttle device 2, and the parameters of the throttle device n are adjusted to reduce the refrigerant flow flowing through the throttle device n. If the throttle device is the electronic expansion valve, the valve of the electronic expansion valve can be turned up, and preferably, the number of steps for turning up the valve can be determined according to A/2. The valve of the electronic expansion valve can be turned down, and preferably, the number of the steps for turning down the valve can also be determined according to A/2.

[0059] It can be seen that in the embodiment, a bias flow control of the refrigerant flow flowing through the indoor unit can be performed only by obtaining the inner coil temperature of the indoor unit and the environment temperature, and thus the indoor unit in the air conditioner is the same as that in the one-to-one air conditioner, that is, only the environment temperature sensor and the inner coil temperature sensor are required, and there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources. In addition, the flow balance in each indoor unit can be further improved through the bias flow control, so that a temperature in an active area of each indoor unit is relatively balanced, and the user experience is further improved.

[0060] Of course, in the embodiment of the present disclosure, when the refrigerant flow is controlled, not only the bias flow adjustment can be performed, but also the superheat adjustment can be performed, that is, the adjustment can be performed according to the first temperature difference, which specifically includes: adjusting parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when the first temperature difference is greater than the preset temperature difference; and adjusting the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0061] Preferably, the adjusting parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device includes: comparing the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is greater than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and adjusting parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

[0062] Preferably, the adjusting the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device includes: comparing the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is less than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and adjusting parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

[0063] The superheat adjustment, that is, the specific process of adjusting the superheat according to the first temperature difference, may be the same as the foregoing embodiments, which will not be described again.

[0064] The operation procedures are integrated into specific embodiments to illustrate the control method provided by the embodiment of the present disclosure.

[0065] In the embodiment of the present disclosure, the air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding electronic expansion valve, so that both the superheat adjustment and the bias flow adjustment can be performed when the refrigerant flow of the air conditioner is controlled. A preset temperature difference TshO and a set value A are saved.

[0066] Fig. 4 is a flowchart illustrating a method for controlling refrigerant flow of an air conditioner according to an exemplary embodiment. As shown in Fig. 4, the method for controlling refrigerant flow of the air conditioner includes following steps.

[0067] Step 401, a suction temperature of a compressor in the outdoor unit and an inner coil temperature and an environment temperature of each indoor unit are obtained.

[0068] In the air conditioner, the compressor in the outdoor unit is provided with a suction sensor, so that the suction temperature Ts of the compressor in the outdoor unit can be obtained through the suction sensor. Similarly, the indoor units are provided with inner coil sensors and inner environment temperature sensors, the inner coil temperatures Tm1, Tm2, .., Tmn corresponding to each indoor unit can be obtained through the inner coil sensors, and environment temperatures Tail, Tai2, ..., Tain corresponding to each indoor unit can be obtained through the inner environment temperature sensors.

[0069] Step 402, it is determined whether Tsh>Tsh0. If yes, step 403 is executed; otherwise, step 407 is executed.

[0070] An inner coil average temperature ΔTm=(Tm1+Tm2+...+Tmn)/n, and thus, Tsh=Ts-ΔTm. If Tsh>Tsh0, it is determined that an actual superheat is relatively high, and step 403 is executed.

[0071] Step 403, an indoor unit is determined as a current indoor unit.

[0072] An indoor unit can be determined as the current indoor unit according to preset rules.

[0073] Step 404, it is determined whether a current inner coil temperature Tmd of the current indoor unit is greater than ΔTm, i.e., Tmd>ΔTm. If yes, step 405 is executed; otherwise, step 406 is executed.

[0074] Step 405, the current indoor unit is determined as a first indoor unit, and a valve of a first electronic expansion valve corresponding to the first indoor unit is turned up.

[0075] The number of steps for turning up the valve of the first electronic expansion valve can be determined according to [Tsh-Tsh0].

[0076] Step 406, whether all indoor units are determined as current indoor units? If yes, the process ends; otherwise, the process returns to step 403.

[0077] Step 407, it is determined whether Tsh<Tsh0. If yes, step 408 is executed; otherwise, step 412 is executed.

[0078] Step 408, an indoor unit is determined as the current indoor unit.

[0079] An indoor unit can be determined as the current indoor unit according to the preset rules.

[0080] Step 409, it is determined whether the current inner coil temperature Tmd of the current indoor unit is less than ΔTm, i.e., Tmd<ΔTm. If yes, step 410 is executed; otherwise, step 411 is executed.

[0081] Step 410, the current indoor unit is determined as a second indoor unit, and a valve of a second electronic expansion valve corresponding to the second indoor unit is turned down.

[0082] The number of steps for turning down the valve of the second electronic expansion valve can be determined according to [Tsh-Tsh0].

[0083] Step 411, whether all indoor units are determined as current indoor units? If yes, the process ends; otherwise, the process returns to step 408.

[0084] Step 412, a second temperature difference between the environment temperature and the inner coil temperature of each indoor unit is determined.

[0085] Here, Tsh=Tsh0, the second temperature difference between the environment temperature and the inner coil temperature of each indoor unit can be determined, that is, the second temperature difference ΔTw1=Tai1-Tm1, ΔTw2=Tai2-Tm2, ..., ΔTwn=Tain-Tmn.

[0086] Step 413, whether a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than A? If yes, step 414 is executed; otherwise, the process ends.

[0087] Step 414, an indoor unit corresponding to the maximum second temperature difference is determined as a third indoor unit, and an indoor unit corresponding to the minimum second temperature difference is determined as a fourth indoor unit.

[0088] Step 415, a valve of a third electronic expansion valve corresponding to the third indoor unit is turned up, and a valve of a fourth electronic expansion valve corresponding to the fourth indoor unit is turned down.

[0089] Preferably, the number of steps for turning up the valve can be determined according to A/2, and the number of the steps for turning down the valve can also be determined according to A/2.

[0090] It can be seen that in the embodiment of the present disclosure, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit and the environment temperature, and thus the indoor unit in the air conditioner is the same as that in the one-to-one air conditioner, that is, only the environment temperature sensor and the inner coil temperature sensor are required, and there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources. In addition, the balance of the refrigerant flow flowing through each indoor unit can be further improved through superheat control and bias flow control, so that a temperature in an action area of each indoor unit is relatively balanced and the user experience is further improved.

[0091] According to the above-mentioned method of controlling the refrigerant flow of the air conditioner, a device for controlling refrigerant flow of an air conditioner can be constructed.

[0092] Fig. 5 is a block diagram illustrating a device for controlling refrigerant flow of an air conditioner according to an exemplary embodiment. The air conditioner includes an outdoor unit and at least two indoor units, wherein each indoor unit is connected to the outdoor unit through a corresponding throttle device. As shown in Fig. 5, the device may include an obtaining unit 510, a first adjusting unit 520 and a second adjusting unit 530.

[0093] The obtaining unit 510 is configured to obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit.

[0094] The first adjusting unit 520 is configured to adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature.

[0095] The second adjusting unit 530 is configured to adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0096] In an embodiment of the present disclosure, the first adjusting unit 520 is configured to compare the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is greater than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and adjust parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

[0097] In an embodiment of the present disclosure, the second adjusting unit 530 is configured to compare the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is less than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and adjust parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

[0098] In an embodiment of the present disclosure, the device further includes:

a third adjusting unit configured to determine a second temperature difference between an environment temperature of each indoor unit and the inner coil temperature when the first temperature difference is equal to the preset temperature difference; determine an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determine an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and adjust parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjust parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

[0099] It can be seen that in the present embodiment, the refrigerant flow flowing through the indoor unit can be controlled only by obtaining the inner coil temperature of the indoor unit without obtaining an outlet temperature and inlet temperature of an evaporator, and thus there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor on the indoor unit and the outdoor unit, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources.

[0100] In an embodiment of the present disclosure, there is provided device for controlling refrigerant flow of an air conditioner, applied for the air conditioner, wherein the air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, and the device includes:

a processor; and
a memory for storing instructions executable by the processor;
wherein the processor is configured to:
obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit;
adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0101] An embodiment of the present disclosure provides a computer readable storage medium having computer instructions stored thereon, wherein, when the instructions are executed by a processor, the steps of the above-mentioned method are implemented.

[0102] Fig. 6 is a block diagram illustrating a device for controlling refrigerant flow of an air conditioner according to an exemplary embodiment. The air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device. As shown in Fig. 6, the device may include an obtaining unit 610 and a third adjusting unit 620.

[0103] The obtaining unit 610 is configured to obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit.

[0104] The third adjusting unit 620 is configured to determine a second temperature difference between an environment temperature of each indoor unit and the inner coil temperature when a first temperature difference between the suction temperature and an inner coil average temperature is equal to the preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; determine an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determine an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and adjust parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjust parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

[0105] In an embodiment of the present disclosure, the device further includes:

a first adjusting unit configured to adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference is greater than a preset temperature difference; and
a second adjusting unit configured to adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

[0106] In an embodiment of the present disclosure, the first adjusting unit is specifically configured to compare the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is greater than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and adjust parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

[0107] In an embodiment of the present disclosure, the second adjusting unit is specifically configured to compare the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is less than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and adjust parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

[0108] It can be seen that in the embodiment, a bias flow control of the refrigerant flow flowing through the indoor unit can be performed only by obtaining the inner coil temperature of the indoor unit and the environment temperature, and thus the indoor unit in the air conditioner is the same as that in the one-to-one air conditioner, that is, only the environment temperature sensor and the inner coil temperature sensor are required, and there is no need to provide the evaporator inlet sensor and the evaporator outlet sensor, which reduces temperature sensors in a household central air conditioner, i.e., a one-to-multiple air conditioner, and is compatible with the existing indoor unit, thereby realizing the unification of one-to-one indoor unit and one-to-multiple indoor unit, that is, improving the compatibility of the one-to-multiple air conditioner and saving resources. In addition, the flow balance in each indoor unit can be further improved through the bias flow control, so that a temperature in an active area of each indoor unit is relatively balanced, and the user experience is further improved.

[0109] In an embodiment of the present disclosure, there is provided a device for controlling refrigerant flow of an air conditioner, applied for the air conditioner. The air conditioner includes an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, and the device includes:

a processor; and
a memory for storing instructions executable by the processor;
wherein the processor is configured to:
obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit;
determine a second temperature difference between an environment temperature of each indoor unit and the inner coil temperature when a first temperature difference between the suction temperature and an inner coil average temperature is equal to the preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature;
determine an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determine an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and
adjust parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjust parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

[0110] An embodiment of the present disclosure provides a computer readable storage medium having computer instructions stored thereon, wherein, when the instructions are executed by a processor, the steps of the above-mentioned method are implemented.

[0111] In an embodiment of the present disclosure, there is provided a computer program product including a computer program stored on a computer readable storage medium, the computer program includes program instructions, and when the program instructions are executed by a computer, the computer performs the above-mentioned method for controlling refrigerant flow of the air conditioner.

[0112] The above computer readable storage medium can be a transitory computer readable storage medium or a non-transitory computer readable storage medium.

[0113] An embodiment of the present disclosure provides an electronic device, the structure of which is shown in Fig. 7. The electronic device includes:
at least one processor 700, taking one processor 700 as an example in Fig. 7; a memory 701; and further includes a communication interface 702 and a bus 703. The processor 700, the communication interface 702, and the memory 701 may communicate with each other through the bus 703. The communication interface 702 may be used for information transmission. The processor 700 may call logical instructions in the memory 701 to execute the methods in the above embodiments.

[0114] In addition, logic instructions in the above-mentioned memory 701 may be implemented in the form of software functional units and may be stored in a computer readable storage medium when sold or used as an independent product.

[0115] As a computer readable storage medium, the memory 701 may be configured to store a software program and a computer executable program, such as a program instruction/module corresponding to the methods in the embodiments of the present disclosure. The processor 700 executes functional applications and data processing by running the software program, instruction, and module that are stored in the memory 701, thereby implementing the methods in the method embodiments mentioned above.

[0116] The memory 701 may include a program storage area and a data storage area. The program storage area may store an operating system and an application program required by at least one function. The data storage area may store data created according to use of the terminal, and the like. In addition. In addition, the memory 701 may include a high speed random access memory, and may also include a non-volatile memory.

[0117] The technical solutions of the embodiments of the present disclosure may be embodied in the form of a software product, the computer software product is stored in a storage medium and includes one or more instructions to enable a computer device (may be a personal computer, a server, or a network device, etc.) to perform all or part of the steps of the methods described in the embodiments of the present disclosure. The above-mentioned storage medium may be a non-transitory storage medium, including a U disk, a removable hard disk, a read-only memory (ROM), a random access memory (RAM), a magnetic disk, an optical disk and other media that may store program codes, or may be a transitory storage medium.

[0118] The above description and accompanying drawings fully illustrate the embodiments of the present disclosure to enable those skilled in the art to practice them. Other embodiments may include structural, logical, electrical, procedural and other changes. The embodiments represent only possible variations. Individual components and functions are optional unless explicitly required, and the sequence of operations may vary. Parts and features of some embodiments may be included in or substituted for parts and features of other embodiments. The scope of the embodiments of the present disclosure includes the full scope of the claims, as well as all available equivalents of the claims. When used in the present application, although terms "first", "second", etc. may be used in the present application to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, without changing the meaning of the description, a first element may be called a second element, and similarly, the second element may be called the first element as long as all occurrences of the "first element" are renamed consistently and all occurrences of the "second element" are renamed consistently. The first element and the second element are both elements, but may not be the same element. Moreover, the words used in present application are only used to describe the embodiments and are not used to limit the claims. As used in the description of the embodiments and the claims, singular forms "a", "an" and "the" are intended to include plural forms as well unless the context clearly indicates. Similarly, as the term "and/or" used in the present application refers to any and all possible combinations including one or more associated listings. In addition, when used in present application, the term "comprise" and variations thereof "comprises" and/or "comprising" and the like refer to the presence of stated features, entireties, steps, operations, elements, and/or components, but do not exclude the presence or addition of one or more other features, entireties, steps, operations, elements, components, and/or groups thereof. Without further restrictions, the element defined by the statement "include a ..." does not exclude the presence of another identical element in the process, method or device that includes the element. In this document, each embodiment may highlight its differences from other embodiments, and same or similar parts between various embodiments may be referred to each other. For the method, the product and the like disclosed in the embodiments, if it corresponds to the method part disclosed in the embodiments, relevant parts may refer to the description in the method part.

[0119] Those skilled in the art may recognize that the elements and algorithm steps of the examples described in the embodiments disclosed herein may be implemented by electronic hardware, or a combination of computer software and electronic hardware. Whether these functions are implemented by hardware or software depends on the specific application and design constraints of the technical solutions. Those skilled may use different methods to implement the described functions for each specific application, but such implementation should not be considered beyond the scope of the embodiments of the present disclosure. Those skilled may clearly understand that for convenience and conciseness of description, the specific work processes of the above-mentioned systems, devices and units may refer to corresponding processes in the above-mentioned method embodiments and will not be repeated herein.

[0120] In the embodiments disclosed herein, the disclosed methods and products (including but not limited to devices, equipment, etc.) may be implemented in other ways. For example, the device embodiments described above are only schematic. For example, the division of the units may be only a logical function division, and there may be other division manners in actual implementation. For example, a plurality of units or components may be combined or integrated into another system, or some features may be ignored or not implemented. In addition, the mutual coupling, direct coupling or communication connection shown or discussed may be indirect coupling or communication connection through some interfaces, devices or units, and may be in electrical, mechanical or other forms. The units described as separate components may or may not be physically separated, and the components displayed as units may or may not be physical units, i.e., may be located in one place or may be distributed to a plurality of network units. Some or all of the units may be selected to implement the embodiments according to actual needs. In addition, each functional unit in the embodiments of the present disclosure may be integrated in one processing unit, or each unit may exist separately physically, or two or more units may be integrated in one unit.

[0121] The flowcharts and block diagrams in the drawings show the architecture, functions and operations of possible implementations of systems, methods and computer program products according to the embodiments of the present disclosure. In this regard, each block in the flowcharts or block diagrams may represent a module, program segment, or portion of code that includes one or more executable instructions for implementing specified logical functions. In some alternative implementations, the functions noted in the blocks may also occur in an order different from that noted in the drawings. For example, two consecutive blocks may actually be executed substantially in parallel, and they may sometimes be executed in a reverse order, depending on the function involved. In the description corresponding to the flowcharts and block diagrams in the drawings, operations or steps corresponding to different blocks may also occur in orders different from that disclosed in the description, and sometimes there is no specific order between different operations or steps. For example, two consecutive operations or steps may actually be executed substantially in parallel, and they may sometimes be executed in a reverse order, depending on the function involved. Each block in the block diagrams and/or flowcharts, and combinations of blocks in the block diagrams and/or flowcharts, may be implemented by special hardware-based systems that perform specified functions or actions, or may be implemented by combinations of special hardware and computer instructions.

Claims

1. A method for controlling refrigerant flow of an air conditioner, wherein the air conditioner comprises an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, the method comprising:

obtaining a suction temperature of a compressor in the outdoor unit and an inner coil temperature of the each indoor unit;
adjusting parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
adjusting the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

2. The method according to claim 1, wherein the adjusting parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device comprises:

comparing the inner coil temperature with the inner coil average temperature;
if a current inner coil temperature is greater than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and
adjusting parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

3. The method according to claim 1, wherein the adjusting the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device comprises:

comparing the inner coil temperature with the inner coil average temperature;
if a current inner coil temperature is less than the inner coil average temperature, determining an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and
adjusting parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

4. The method according to claim 1, 2 or 3, wherein the method further comprises:

determining a second temperature difference between an environment temperature of the each indoor unit and the inner coil temperature when the first temperature difference is equal to the preset temperature difference;
determining an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determining an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and
adjusting parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjusting parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

5. A device for controlling refrigerant flow of an air conditioner, wherein the air conditioner comprises an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, the device comprising:

an obtaining unit configured to obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of the each indoor unit;
a first adjusting unit configured to adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
a second adjusting unit configured to adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

6. The device according to claim 5, wherein the first adjusting unit is configured to compare the inner coil temperature with the inner coil average temperature; if a current inner coil temperature is greater than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a first indoor unit; and adjust parameters of a first throttle device corresponding to the first indoor unit to increase the refrigerant flow flowing through the first throttle device.

7. The device according to claim 5, wherein the second adjusting unit is configured to compare the inner coil temperature with the inner coil average temperature;

if a current inner coil temperature is less than the inner coil average temperature, determine an indoor unit corresponding to the current inner coil temperature as a second indoor unit; and adjust parameters of a second throttle device corresponding to the second indoor unit to reduce the refrigerant flow flowing through the second throttle device.

8. The device according to claim 5, 6 or 7, wherein the device further comprises:
a third adjusting unit configured to determine a second temperature difference between an environment temperature of the each indoor unit and the inner coil temperature when the first temperature difference is equal to the preset temperature difference; determine an indoor unit corresponding to the maximum second temperature difference as a third indoor unit, and determine an indoor unit corresponding to the minimum second temperature difference as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value; and adjust parameters of a third throttle device corresponding to the third indoor unit to increase the refrigerant flow flowing through the third throttle device, and adjust parameters of a fourth throttle device corresponding to the fourth indoor unit to reduce the refrigerant flow flowing through the fourth throttle device.

9. A device for controlling refrigerant flow of an air conditioner, applied for the air conditioner, wherein the air conditioner comprises an outdoor unit and at least two indoor units, each indoor unit is connected to the outdoor unit through a corresponding throttle device, the device comprising:

a processor; and
a memory for storing instructions executable by the processor;
wherein the processor is configured to:

obtain a suction temperature of a compressor in the outdoor unit and an inner coil temperature of the each indoor unit;
adjust parameters of at least one throttle device to increase the refrigerant flow flowing through the throttle device when a first temperature difference between the suction temperature and an inner coil average temperature is greater than a preset temperature difference, wherein the inner coil average temperature is an average value obtained by summing the inner coil temperature; and
adjust the parameters of the at least one throttle device to reduce the refrigerant flow flowing through the throttle device when the first temperature difference is less than the preset temperature difference.

10. A computer readable storage medium having computer instructions stored thereon, wherein, when the instructions are executed by a processor, the steps of the method according to any one of claims 1 to 4 are implemented.

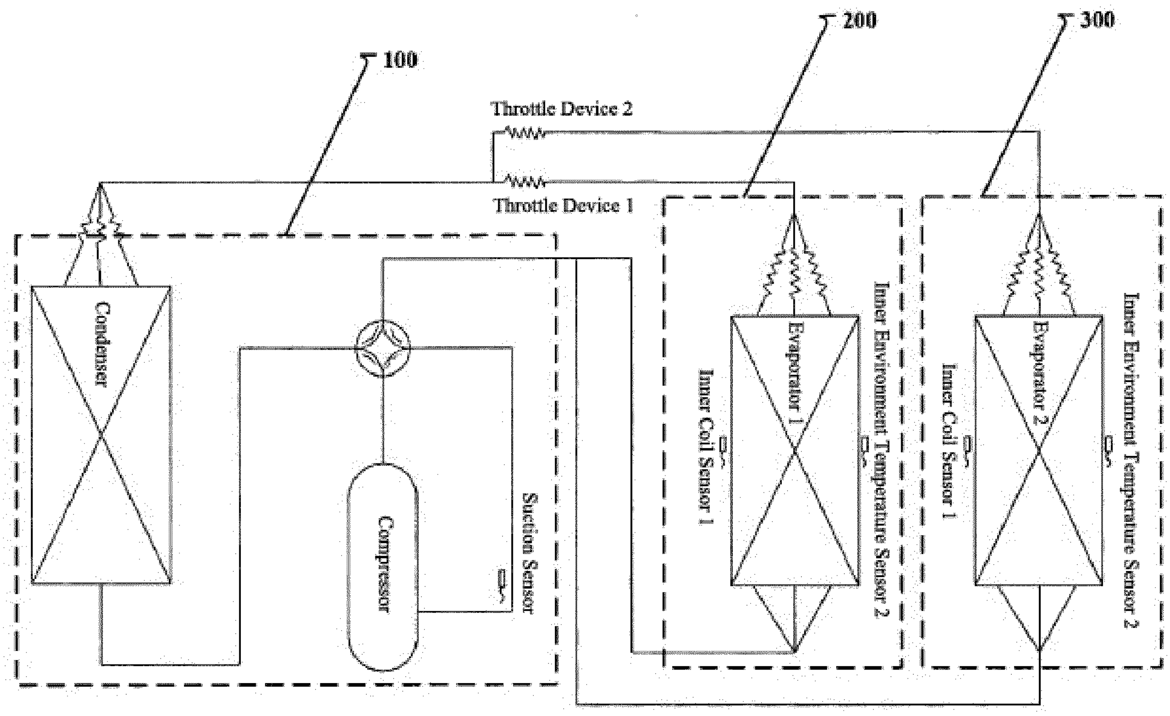
100
200
300
Throttle Device 2
Throttle Device 1
Condenser
Compressor
Suction Sensor
Evaporator 1
Inner Coil Sensor 1
Inner Environment Temperature Sensor 2
Evaporator 2
Inner Coil Sensor 1
Inner Environment Temperature Sensor 2

Fig. 1

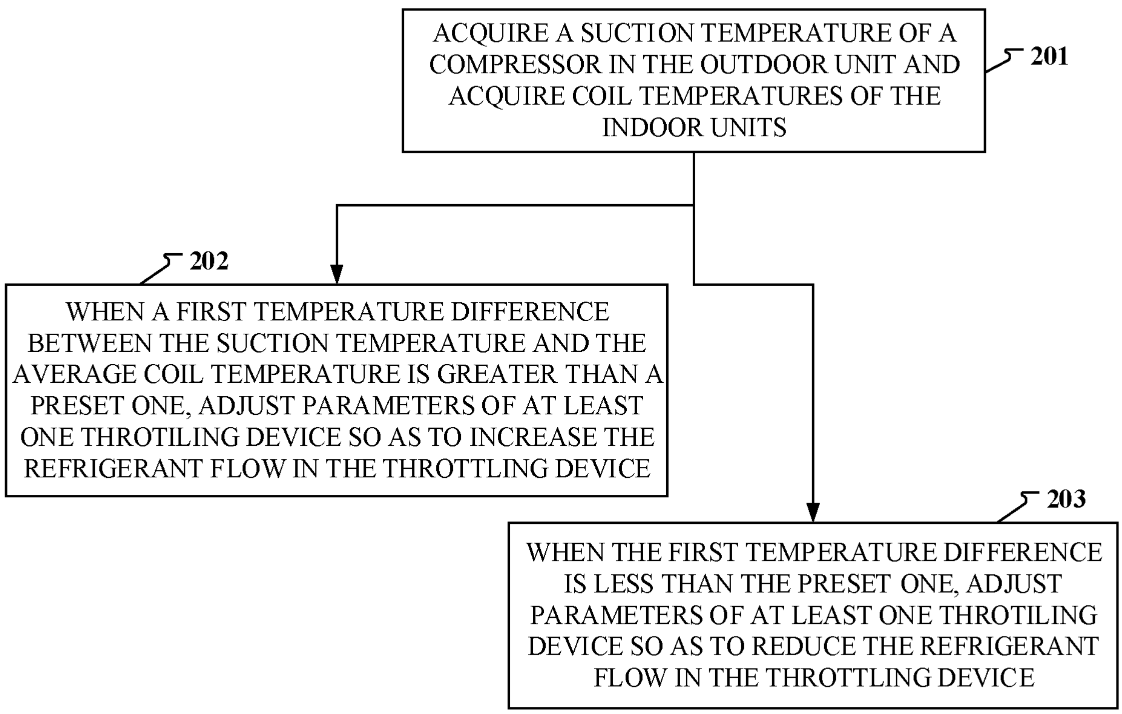
ACQUIRE A SUCTION TEMPERATURE OF A COMPRESSOR IN THE OUTDOOR UNIT AND ACQUIRE COIL TEMPERATURES OF THE INDOOR UNITS
201
202
WHEN A FIRST TEMPERATURE DIFFERENCE BETWEEN THE SUCTION TEMPERATURE AND THE AVERAGE COIL TEMPERATURE IS GREATER THAN A PRESET ONE, ADJUST PARAMETERS OF AT LEAST ONE THROTILING DEVICE SO AS TO INCREASE THE REFRIGERANT FLOW IN THE THROTTLING DEVICE
203
WHEN THE FIRST TEMPERATURE DIFFERENCE IS LESS THAN THE PRESET ONE, ADJUST PARAMETERS OF AT LEAST ONE THROTILING DEVICE SO AS TO REDUCE THE REFRIGERANT FLOW IN THE THROTTLING DEVICE

Fig. 2

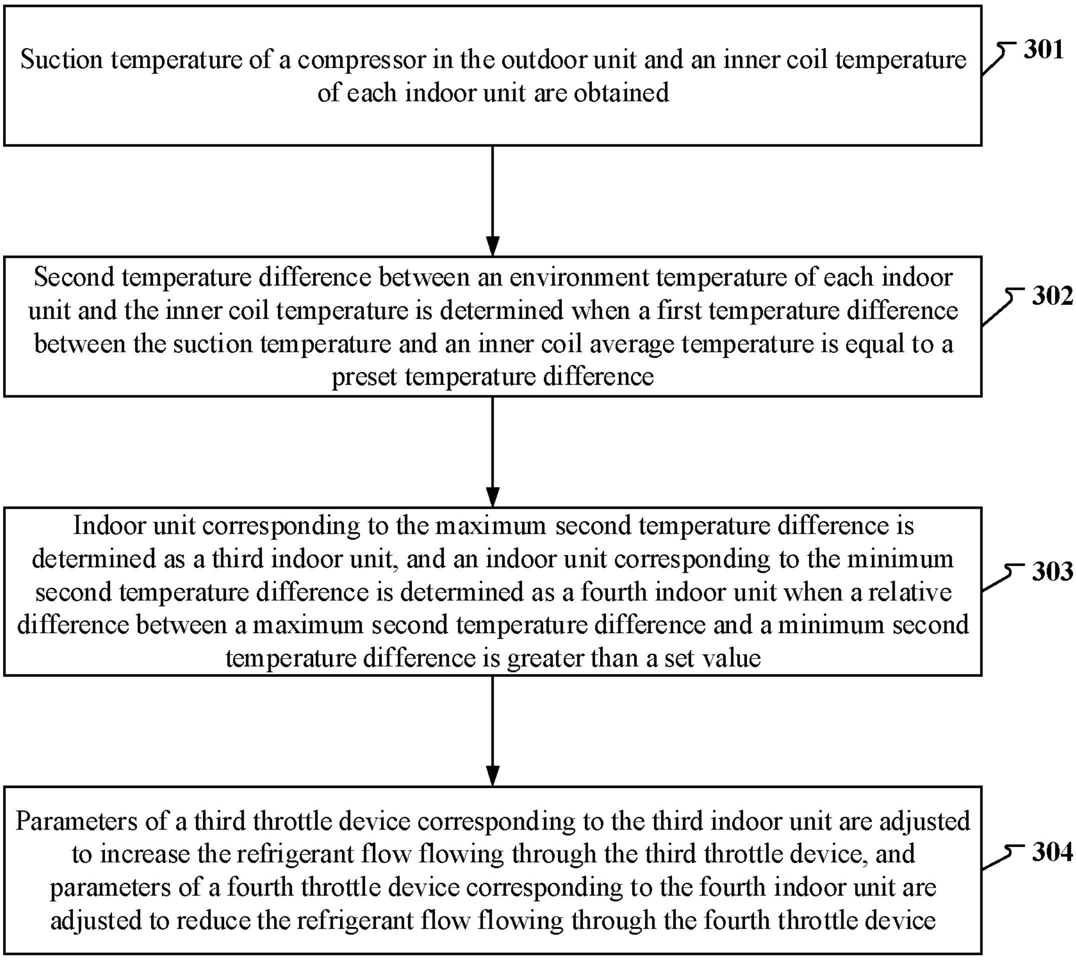
Suction temperature of a compressor in the outdoor unit and an inner coil temperature of each indoor unit are obtained
301
Second temperature difference between an environment temperature of each indoor unit and the inner coil temperature is determined when a first temperature difference between the suction temperature and an inner coil average temperature is equal to a preset temperature difference
302
Indoor unit corresponding to the maximum second temperature difference is determined as a third indoor unit, and an indoor unit corresponding to the minimum second temperature difference is determined as a fourth indoor unit when a relative difference between a maximum second temperature difference and a minimum second temperature difference is greater than a set value
303
Parameters of a third throttle device corresponding to the third indoor unit are adjusted to increase the refrigerant flow flowing through the third throttle device, and parameters of a fourth throttle device corresponding to the fourth indoor unit are adjusted to reduce the refrigerant flow flowing through the fourth throttle device
304

Fig. 3

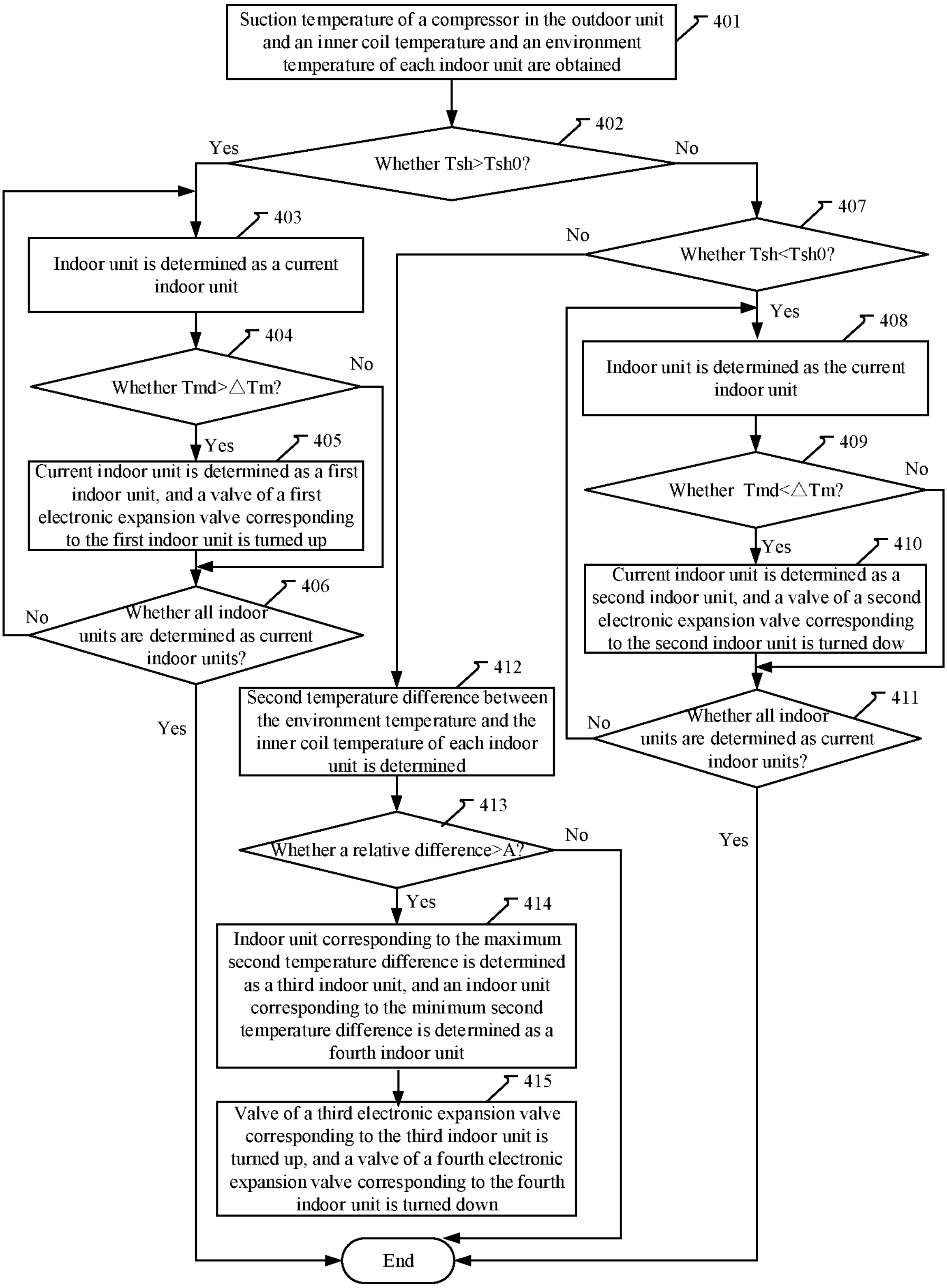
Suction temperature of a compressor in the outdoor unit and an inner coil temperature and an environment temperature of each indoor unit are obtained
401
Whether Tsh>Tsh0?
402
Yes
No
Indoor unit is determined as a current indoor unit
403
Whether Tmd>△Tm?
404
No
Yes
Current indoor unit is determined as a first indoor unit, and a valve of a first electronic expansion valve corresponding to the first indoor unit is turned up
405
Whether all indoor units are determined as current indoor units?
406
No
Yes
Whether Tsh<Tsh0?
407
No
Yes
Indoor unit is determined as the current indoor unit
408
Whether Tmd<△Tm?
409
No
Yes
Current indoor unit is determined as a second indoor unit, and a valve of a second electronic expansion valve corresponding to the second indoor unit is turned dow
410
Whether all indoor units are determined as current indoor units?
411
No
Yes
Second temperature difference between the environment temperature and the inner coil temperature of each indoor unit is determined
412
Whether a relative difference>A?
413
No
Yes
Indoor unit corresponding to the maximum second temperature difference is determined as a third indoor unit, and an indoor unit corresponding to the minimum second temperature difference is determined as a fourth indoor unit
414
Valve of a third electronic expansion valve corresponding to the third indoor unit is turned up, and a valve of a fourth electronic expansion valve corresponding to the fourth indoor unit is turned down
415
End

Fig. 4

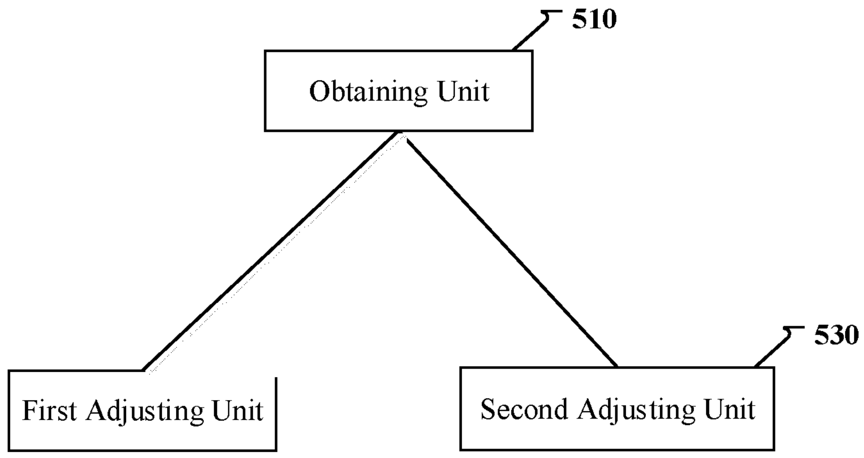
510
Obtaining Unit
530
First Adjusting Unit
Second Adjusting Unit

Fig. 5

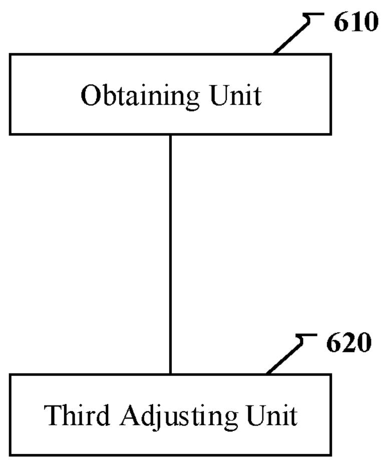
610
Obtaining Unit
620
Third Adjusting Unit

Fig. 6

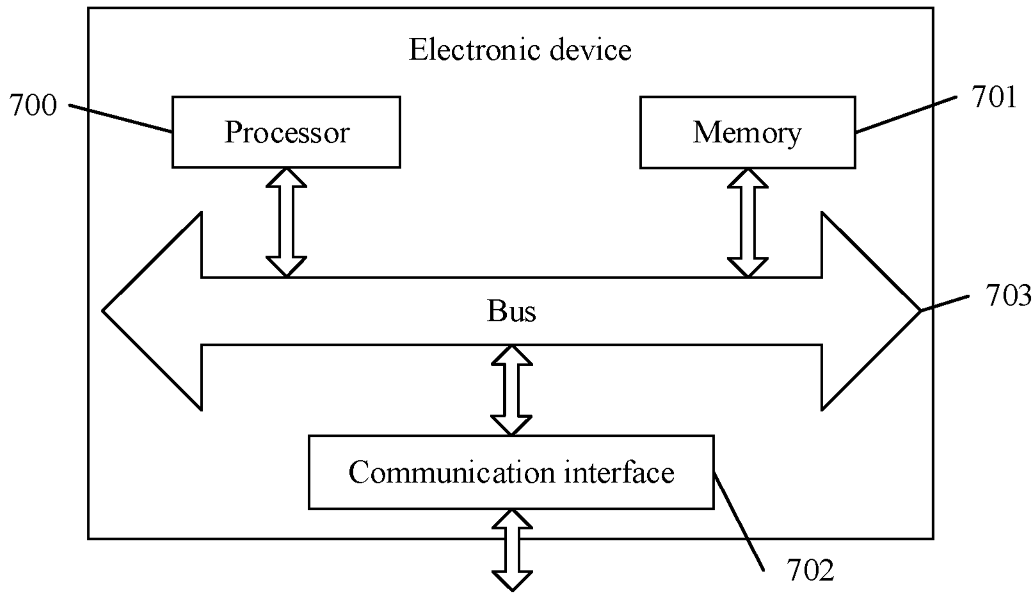
Electronic device
700
Processor
Memory
701
Bus
703
Communication interface
702

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/088489

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/64(2018.01)i; F24F 140/20(2018.01)n

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)

CNABS; CNTXT; VEN; USTXT; WOTXT; EPTXT; CNKI; SIPOABS; JPABS: 马韵华, 顾超, 国德防, 一拖多, 多联机, 压缩机, 吸气温度, 回气温度, 温度, 温差, 平均, 环温, 环境温度, 室温, 室内温度, 管温, 盘管, 换热器, 热交换器, 蒸发器, 阀, 节流, 毛细管, 偏流, 冷媒, 制冷剂, 致冷剂, 工质, 不均, 均匀, 开度, 过热度, suction 4d temperature, compressor?, average 4d temperature, throttle?, expansion 2d valve?, superheat+, medium, outdoor unit, indoor unit, coil?, temperature difference, refrigerant

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102353121 A (TCL AIR CONDITIONER (ZHONGSHAN) CO., LTD.) 15 February 2012 (2012-02-15) description, paragraphs 26-40, and figure 1	1-3, 5-7, 9, 10
Y	CN 102353121 A (TCL AIR CONDITIONER (ZHONGSHAN) CO., LTD.) 15 February 2012 (2012-02-15) description, paragraphs 26-40, and figure 1	4, 8
Y	CN 207635547 U (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 20 July 2018 (2018-07-20) description, paragraphs 26-48	4, 8
PX	CN 109028494 A (QINGDAO HAIER AIR CONDITIONER ELECTRIC CO., LTD.) 18 December 2018 (2018-12-18) claims 1-10	1-10
PX	CN 109028495 A (QINGDAO HAIER AIR CONDITIONER ELECTRIC CO., LTD.) 18 December 2018 (2018-12-18) claims 1-10, and description, paragraphs 1-155	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
"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
12 July 2019	**31 July 2019**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/088489

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20090070000 A (DAEWOO ELECTRONICS CORPORATION) 01 July 2009 (2009-07-01) entire document	1-10

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/088489

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	102353121	A	15 February 2012	CN	102353121	B	28 August 2013
CN	207635547	U	20 July 2018		None		
CN	109028494	A	18 December 2018		None		
CN	109028495	A	18 December 2018		None		
KR	20090070000	A	01 July 2009		None		

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

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- CN 201811084930 **[0001]**