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(54) MULTI-LINE APPARATUS SYSTEM REFRIGERANT FLOW CONTROL METHOD AND DEVICE

(57) A method and a device for controlling refrigerant distribution of a multi-split air-conditioning system are disclosed in the present invention. The method includes: when the multi-split air-conditioning system enters a main heating mode, controlling the second electronic expansion valve to close; controlling an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment; when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches a maximum opening, calculating a target opening of the second electronic expansion valve according to a total opening and the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit; and controlling the second electronic expansion valve according to the target opening. With the method for controlling refrigerant distribution of the multi-split air-conditioning system in embodiments of the present disclosure, the cooling effect of the cooling indoor unit is ensured and the liquid strike on the compressor may be avoided under the main heating mode, and the compressor is ensured to operate safely and reliably.

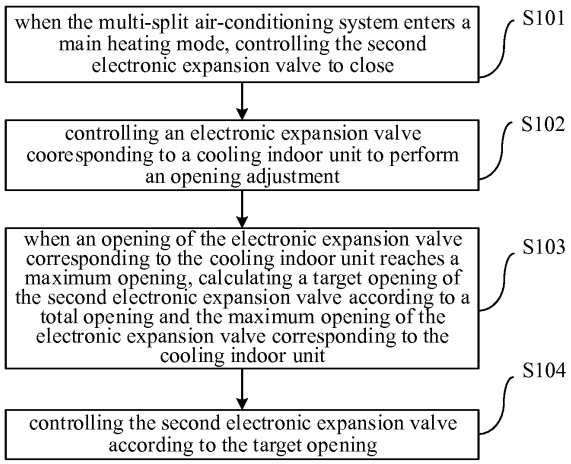

Fig. 1

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Description

FIELD

[0001] The present disclosure relates to air conditioner technology field, and more particularly to a method and a device for controlling refrigerant distribution of a multi-split air-conditioning system.

BACKGROUND

[0002] When a multi-split air-conditioning system with two-pipe heating recycle is operating under a main heating mode, refrigerant is recoolezd via a heat exchanger, and then parts of the recooled refrigerant enters a low pressure pipe of an outdoor unit via an electronic expansion valve and another heat exchanger, and the rest of the recooled refrigerant finally enters the low pressure pipe of the outdoor unit after entering a cooling indoor unit to absorb heat via another electronic expansion valve.

[0003] Refrigerant volume entering the cooling indoor unit and discharge superheat of the cooling indoor unit will be affected by an opening of the electronic expansion valve. When the refrigerant volume entering the cooling indoor unit is reduced because of the inappropriate opening of the electronic expansion valve, the cooling effect of the cooling indoor unit will be affected; and when the discharge superheat is reduced because of the inappropriate opening of the electronic expansion valve, the liquid strike on a compressor will be caused and the compressor is damaged.

SUMMAY

[0004] Embodiments of the present disclosure seek to solve at least one of the problems existing in the related art to at least some extent. Therefore, a first objective of the present disclosure is to provide a method for controlling refrigerant distribution of a multi-split air-conditioning system, which may ensure the cooling effect of the cooling indoor unit and may avoid the liquid strike on the compressor under the main heating mode, and ensure the compressor to operate safely and reliably.

[0005] A second objective of the present disclosure is to provide a device for controlling refrigerant distribution of a multi-split air-conditioning system.

[0006] According to a first aspect of embodiments of the present disclosure, a method for controlling refrigerant distribution of a multi-split air-conditioning system is provided. The multi-split air-conditioning system includes: a re-cooling system including a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve, and a flow distributing device. The method includes followings: when the multi-split air-conditioning system enters a main heating mode, controlling the second electronic expansion valve to close; controlling an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment; when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches a maximum opening, calculating a target opening of the second electronic expansion valve according to a total opening and the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit; and controlling the second electronic expansion valve according to the target opening.

[0007] With the method for controlling refrigerant distribution of a multi-split air-conditioning system in embodiments of the present disclosure, when the multi-split air-conditioning system enters the main cooling mode, first the second electronic expansion valve is controlled to close, the opening of the electronic expansion valve corresponding to the cooling indoor unit is controlled, and after the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the opening of the second electronic expansion valve is controlled according to the total opening. Therefore, the refrigerating capacity of the cooling indoor unit may be controlled by controlling the refrigerant volume flowing into the cooling indoor unit so as to ensure the cooling effect of the cooling indoor unit. Meanwhile, according to the control of the total opening, the discharge superheat is effectively controlled, such that the liquid strike on the compressor may be avoided, and the compressor is ensured to operate safely and reliably.

[0008] In addition, the method according to the above embodiments may further include additional technical features as follows.

[0009] In an embodiment of the present disclosure, the total opening is obtained according to following acts of: when the multi-split air-conditioning system enters a pure heating mode, obtaining a discharge superheat; and calculating the total opening using a PI (Proportional-Integral) algorithm according to the discharge superheat.

[0010] In an embodiment of the present disclosure, the target opening of the second electronic expansion valve is calculated by a formula of $\Delta EXV2 = EXV2(PI)-EV(cooling\ indoor)MAX*(A_{EV(cooling\ indoor)}/A_{EXV2})$, where, $\Delta EXV2$ is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(cooling\ indoor)}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating

area of the second electronic expansion valve.

[0011] According to a second aspect of embodiments of the present disclosure, a device for controlling refrigerant distribution of a multi-split air-conditioning system is provided. The multi-split air-conditioning system includes: a re-cooling system including a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve, and a flow distributing device. The device for controlling refrigerant distribution of a multi-split air-conditioning system includes: a first control module, configured to control the second electronic expansion valve to close when the multi-split air-conditioning system enters a main heating mode; a second control module, configured to control an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment; a calculating module, configured to calculate a target opening of the second electronic expansion valve according to a total opening and a maximum opening of the electronic expansion valve corresponding to the cooling indoor unit when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening; and a third control module, configured to control the second electronic expansion valve according to the target opening.

[0012] With the device for controlling refrigerant distribution of a multi-split air-conditioning system in embodiments of the present disclosure, when the multi-split air-conditioning system enters the main cooling mode, first the second electronic expansion valve is controlled to close, the opening of the electronic expansion valve corresponding to the cooling indoor unit is controlled, and after the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the opening of the second electronic expansion valve is controlled according to the total opening. Therefore, the refrigerating capacity of the cooling indoor unit may be controlled by controlling the refrigerant volume flowing into the cooling indoor unit so as to ensure the cooling effect of the cooling indoor unit. Meanwhile, according to the control of the total opening, the discharge superheat is effectively controlled, such that the liquid strike on the compressor may be avoided, and the compressor is ensured to operate safely and reliably.

[0013] In addition, the device according to the above embodiments may further include additional technical features as follows.

[0014] In an embodiment of the present disclosure, the total opening is obtained according to following acts of: when the multi-split air-conditioning system enters a pure heating mode, obtaining a discharge superheat; and calculating the total opening using a PI (Proportional-Integral) algorithm according to the discharge superheat.

[0015] In an embodiment of the present disclosure, the target opening of the second electronic expansion valve is calculated by a formula of $\Delta EXV2 = EXV2(PI)-EV(\text{cooling indoor})MAX*(A_{EV(\text{cooling indoor})}/A_{EXV2})$, where, $\Delta EXV2$ is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(\text{cooling indoor})}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating area of the second electronic expansion valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a flow chart of a method for controlling refrigerant distribution of a multi-split air-conditioning system according to an embodiment of the present disclosure.

Fig. 2 is a schematic diagram of a multi-split air-conditioning system according to an embodiment of the present disclosure.

Fig. 3 is a block diagram of a device for controlling refrigerant distribution of a multi-split air-conditioning system according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0017] Exemplary embodiments of the present disclosure will be described in detail herein, and examples thereof are illustrated in accompanying drawings. Throughout figures referred by the following description, the same reference number in different figures indicates the same or similar elements unless otherwise stated. The embodiments described herein with reference to accompanying drawings are explanatory, illustrative, and used to generally interprete the present disclosure, but shall not be construed to limit the present disclosure.

[0018] Fig. 1 is a flow chart of a method for controlling refrigerant distribution of a multi-split air-conditioning system according to an embodiment of the present disclosure.

[0019] In an embodiment of the present disclosure, as shown in Fig. 2, the multi-split air-conditioning system includes: a re-cooling system and a flow distributing device. The re-cooling system includes a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve.

[0020] As shown in Fig. 1, the method for controlling refrigerant distribution of a multi-split air-conditioning system includes followings.

[0021] In step S101, when the multi-split air-conditioning system enters a main heating mode, the second electronic expansion valve is controlled to close.

[0022] In step S102, an electronic expansion valve corresponding to a cooling indoor unit is controlled to perform an opening adjustment.

[0023] Generally, in a pure heating mode, the discharge superheat of an outdoor unit may be controlled by controlling an opening of the second electronic expansion valve. In the main heating mode, the discharge superheat of the outdoor unit and a refrigerant volume flowing into the cooling indoor unit are controlled by controlling the opening of the second electronic expansion valve and an opening of the electronic expansion valve corresponding to the cooling indoor unit. Specifically, the opening of the second electronic expansion valve and the opening of the electronic expansion valve corresponding to the cooling indoor unit may be calculated according to the refrigerant volume required by the cooling indoor unit for cooling. In an embodiment of the present disclosure, in the main heating mode, since the electronic expansion valve corresponding to the cooling indoor unit may also play the role of the second electronic expansion valve, i.e. the refrigerant through the cooling indoor unit, which is satisfied with the requirement of indoor cooling, will also obtain the superheat, such that the effect of avoiding the liquid strike on the compressor may be satisfied. Therefore the opening of the electronic expansion valve corresponding to the cooling indoor unit may be controlled preferentially in that mode, that is, in step S101, before controlling the electronic expansion valve corresponding to the cooling indoor unit to perform the opening adjustment, the second electronic expansion valve may be controlled to close, and then the control on the discharge superheat of the outdoor unit and the refrigerant volume flowing into the cooling indoor unit may also be realized.

[0024] In step S103, when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches a maximum opening, a target opening of the second electronic expansion valve is calculated according to a total opening and the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit.

[0025] When the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the discharge superheat of the outdoor unit may not be controlled. Then, the opening of the second electronic expansion valve needs to be adjusted to control the discharge superheat of the outdoor unit. Specifically, the target opening of the second electronic expansion valve is calculated by a formula of:

$$\Delta EXV2 = EXV2(PI)\text{-}EV(\text{cooling indoor})MAX*(A_{EV(\text{cooling indoor})}/A_{EXV2}) \qquad (1),$$

where, ΔEXV2 is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(\text{cooling indoor})}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating area of the second electronic expansion valve.

[0026] The total opening may be obtained by calculating in the pure heating mode. When the multi-split air-conditioning system enters the pure heating mode, the discharge superheat, the discharge temperature and the returned-gas superheat of the outdoor unit are controlled by the second electronic expansion valve, such that the reliability of the compressor is ensured and the liquid strike on the compressor is avoided. Specifically, when the multi-split air-conditioning system enters the pure heating mode, the discharge superheat is obtained; and the total opening is calculated using a PI algorithm according to the discharge superheat.

[0027] In step 104, the second electronic expansion valve is controlled according to the target opening.

[0028] The second electronic expansion valve is controlled according to the calculated target opening, such that the discharge superheat of the outdoor unit may be controlled.

[0029] With the method for controlling refrigerant distribution of a multi-split air-conditioning system in embodiments of the present disclosure, when the multi-split air-conditioning system enters the main cooling mode, first the second electronic expansion valve is controlled to close, the opening of the electronic expansion valve corresponding to the cooling indoor unit is controlled, and after the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the opening of the second electronic expansion valve is controlled according to the total opening. Therefore, the refrigerating capacity of the cooling indoor unit may be controlled by controlling the refrigerant volume flowing into the cooling indoor unit so as to ensure the cooling effect of the cooling indoor unit. Meanwhile, according to the control of the total opening, the discharge superheat is effectively controlled, such that the liquid strike on the compressor may be avoided, and the compressor is ensured to operate safely and reliably.

[0030] In order to realize the method for controlling refrigerant distribution of a multi-split air-conditioning system, a device for controlling refrigerant distribution of a multi-split air-conditioning system is also provided in the present disclosure.

[0031] Fig. 3 is a block diagram of a device for controlling refrigerant distribution of a multi-split air-conditioning system according to an embodiment of the present disclosure.

[0032] In an embodiment of the present disclosure, as shown in Fig. 2, the multi-split air-conditioning system includes: a re-cooling system and a flow distributing device. The re-cooling system includes a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve.

[0033] As shown in Fig. 3, the device for controlling refrigerant distribution of a multi-split air-conditioning system includes: a first control module 10, a second control module 20, a calculating module 30 and a third control module 40.

[0034] The first control module 10 is configured to control the second electronic expansion valve to close when the multi-split air-conditioning system enters a main heating mode. The second control module 20 is configured to control an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment.

[0035] Generally, in a pure heating mode, the discharge superheat of an outdoor unit may be controlled by controlling an opening of the second electronic expansion valve. In the main heating mode, the discharge superheat of the outdoor unit and a refrigerant volume flowing into the cooling indoor unit are controlled by controlling the opening of the second electronic expansion valve and an opening of the electronic expansion valve corresponding to the cooling indoor unit. Specifically, the opening of the second electronic expansion valve and the opening of the electronic expansion valve corresponding to the cooling indoor unit may be calculated according to the refrigerant volume required by the cooling indoor unit for cooling. In an embodiment of the present disclosure, in the main heating mode, since the electronic expansion valve corresponding to the cooling indoor unit may also play the role of the second electronic expansion valve, i.e. the refrigerant through the cooling indoor unit, which is satisfied with the requirement of indoor cooling, will also obtain the superheat, such that the effect of avoiding the liquid strike on the compressor may be satisfied. Therefore, the opening of the electronic expansion valve corresponding to the cooling indoor unit may be controlled by the second control module 20 preferentially in that mode, that is, before controlling by the second control module 20 the electronic expansion valve corresponding to the cooling indoor unit to perform the opening adjustment, the second electronic expansion valve may be controlled to close by the first control module 10, and then the control on the discharge superheat of the outdoor unit and the refrigerant volume flowing into the cooling indoor unit may also be realized.

[0036] The calculating module 30 is configured to calculate a target opening of the second electronic expansion valve according to a total opening and a maximum opening of the electronic expansion valve corresponding to the cooling indoor unit when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening.

[0037] When the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the discharge superheat of the outdoor unit may not be controlled. Then, the opening of the second electronic expansion valve needs to be adjusted to control the discharge superheat of the outdoor unit. Specifically, the target opening of the second electronic expansion valve is calculated by the calculating module 30 based on a formula of:

$$\Delta EXV2 = EXV2(PI)\text{-}EV(\text{cooling indoor})MAX*(A_{EV(\text{cooling indoor})}/A_{EXV2}) \qquad (1),$$

where, ΔEXV2 is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(\text{cooling indoor})}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating area of the second electronic expansion valve.

[0038] The total opening may be obtained by calculating in the pure heating mode. When the multi-split air-conditioning system enters the pure heating mode, the discharge superheat, the discharge temperature and the returned-gas superheat of the outdoor unit are controlled by the second electronic expansion valve, such that the reliability of the compressor is ensured and the liquid strike on the compressor is avoided. Specifically, when the multi-split air-conditioning system enters the pure heating mode, the discharge superheat is obtained; and the total opening is calculated using a PI algorithm according to the discharge superheat.

[0039] The third control module 40 is configured to control the second electronic expansion valve according to the target opening.

[0040] The second electronic expansion valve may be controlled according to the calculated target opening by the third control module 40, such that the discharge superheat of the outdoor unit may be controlled.

[0041] With the device for controlling refrigerant distribution of a multi-split air-conditioning system in embodiments of the present disclosure, when the multi-split air-conditioning system enters the main cooling mode, first the second electronic expansion valve is controlled to close, the opening of the electronic expansion valve corresponding to the cooling indoor unit is controlled, and after the opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening, the opening of the second electronic expansion valve is controlled according to the total opening. Therefore, the refrigerating capacity of the cooling indoor unit may be controlled by controlling the refrigerant volume flowing into the cooling indoor unit so as to ensure the cooling effect of the cooling indoor unit. Meanwhile, according to the control of the total opening, the discharge superheat is effectively controlled, such that the

liquid strike on the compressor may be avoided, and the compressor is ensured to operate safely and reliably.

[0042] In the specification, it is to be understood that terms such as "central," "longitudinal," "lateral," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," "counterclockwise," "axial", "radial" and "circumference" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present invention be constructed or operated in a particular orientation.

[0043] In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may comprise one or more of this feature. In the description of the present invention, "a plurality of" means two or more than two, unless specified otherwise.

[0044] In the present invention, unless specified or limited otherwise, the terms "mounted," "connected," "coupled," "fixed" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications of two elements, which can be understood by those skilled in the art according to specific situations.

[0045] In the present invention, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of" a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of" a second feature may include an embodiment in which the first feature is right or obliquely "below," "under," or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

[0046] Reference throughout this specification to phrases like "an embodiment," "some embodiments," "one embodiment", "another example," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the above phrases in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

[0047] Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that the above embodiments cannot be construed to limit the present disclosure, and changes, alternatives, and modifications can be made in the embodiments without departing from spirit, principles and scope of the present disclosure.

Claims

1. A method for controlling refrigerant distribution of a multi-split air-conditioning system, wherein, the multi-split air-conditioning system comprises a re-cooling system and a flow distributing device, the re-cooling system comprises a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve, and the method comprises:

   when the multi-split air-conditioning system enters a main heating mode, controlling the second electronic expansion valve to close;
   controlling an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment;
   when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches a maximum opening, calculating a target opening of the second electronic expansion valve according to a total opening and the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit; and
   controlling the second electronic expansion valve according to the target opening.

2. The method according to claim 1, wherein, the total opening is obtained according to following acts of:

   when the multi-split air-conditioning system enters a pure heating mode, obtaining a discharge superheat; and
   calculating the total opening using a Proportional-Integral PI algorithm according to the discharge superheat.

3. The method according to claim 1, wherein, the target opening of the second electronic expansion valve is calculated by a formula of:

$$\Delta EXV2 = EXV2(PI)\text{-}EV(\text{cooling indoor})MAX*(A_{EV(\text{cooling indoor})}/A_{EXV2}),$$

where, ΔEXV2 is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(\text{cooling indoor})}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating area of the second electronic expansion valve.

4. A device for controlling refrigerant distribution of a multi-split air-conditioning system, wherein, the multi-split air-conditioning system comprises a re-cooling system and a flow distributing device, the re-cooling system comprises a first heat exchanger, a second heat exchanger, a first electronic expansion valve and a second electronic expansion valve, and the device comprises:

a first control module, configured to control the second electronic expansion valve to close when the multi-split air-conditioning system enters a main heating mode;
a second control module, configured to control an electronic expansion valve corresponding to a cooling indoor unit to perform an opening adjustment;
a calculating module, configured to calculate a target opening of the second electronic expansion valve according to a total opening and a maximum opening of the electronic expansion valve corresponding to the cooling indoor unit when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches the maximum opening; and
a third control module, configured to control the second electronic expansion valve according to the target opening.

5. The device according to claim 4, wherein, the total opening is obtained according to following acts:

when the multi-split air-conditioning system enters a pure heating mode, obtaining a discharge superheat; and calculating the total opening using a PI algorithm according to the discharge superheat.

6. The device according to claim 4, wherein, the target opening of the second electronic expansion valve is calculated by a formula of:

$$\Delta EXV2 = EXV2(PI)\text{-}EV(\text{cooling indoor})MAX*(A_{EV(\text{cooling indoor})}/A_{EXV2}),$$

where, ΔEXV2 is the target opening of the second electronic expansion valve, EXV2(PI) is the total opening, EV(cooling indoor)MAX is the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit, $A_{EV(\text{cooling indoor})}$ is a valve circulating area of the electronic expansion valve corresponding to the cooling indoor unit, and A_{EXV2} is a valve circulating area of the second electronic expansion valve.

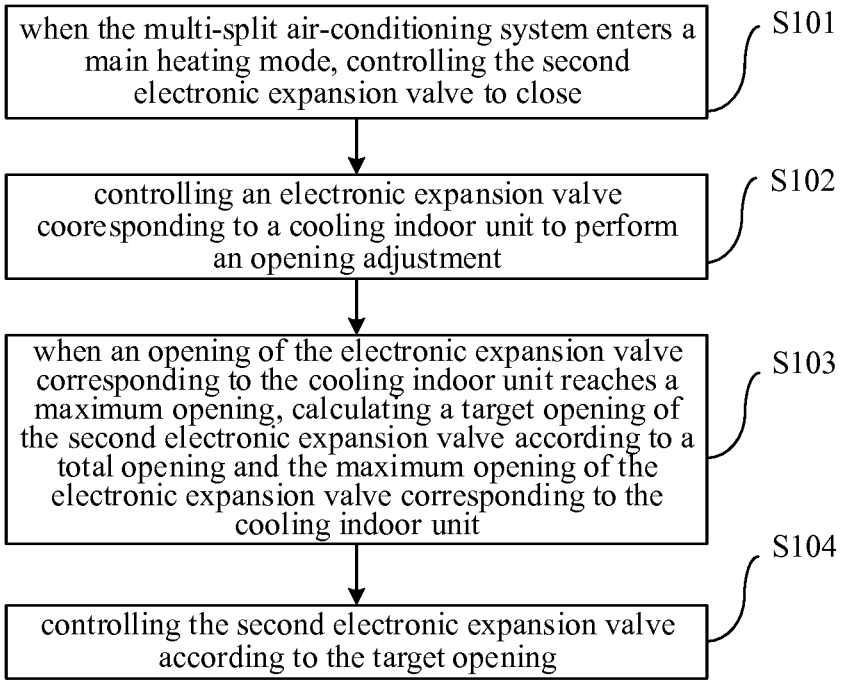
when the multi-split air-conditioning system enters a main heating mode, controlling the second electronic expansion valve to close
S101
controlling an electronic expansion valve cooresponding to a cooling indoor unit to perform an opening adjustment
S102
when an opening of the electronic expansion valve corresponding to the cooling indoor unit reaches a maximum opening, calculating a target opening of the second electronic expansion valve according to a total opening and the maximum opening of the electronic expansion valve corresponding to the cooling indoor unit
S103
controlling the second electronic expansion valve according to the target opening
S104

Fig. 1

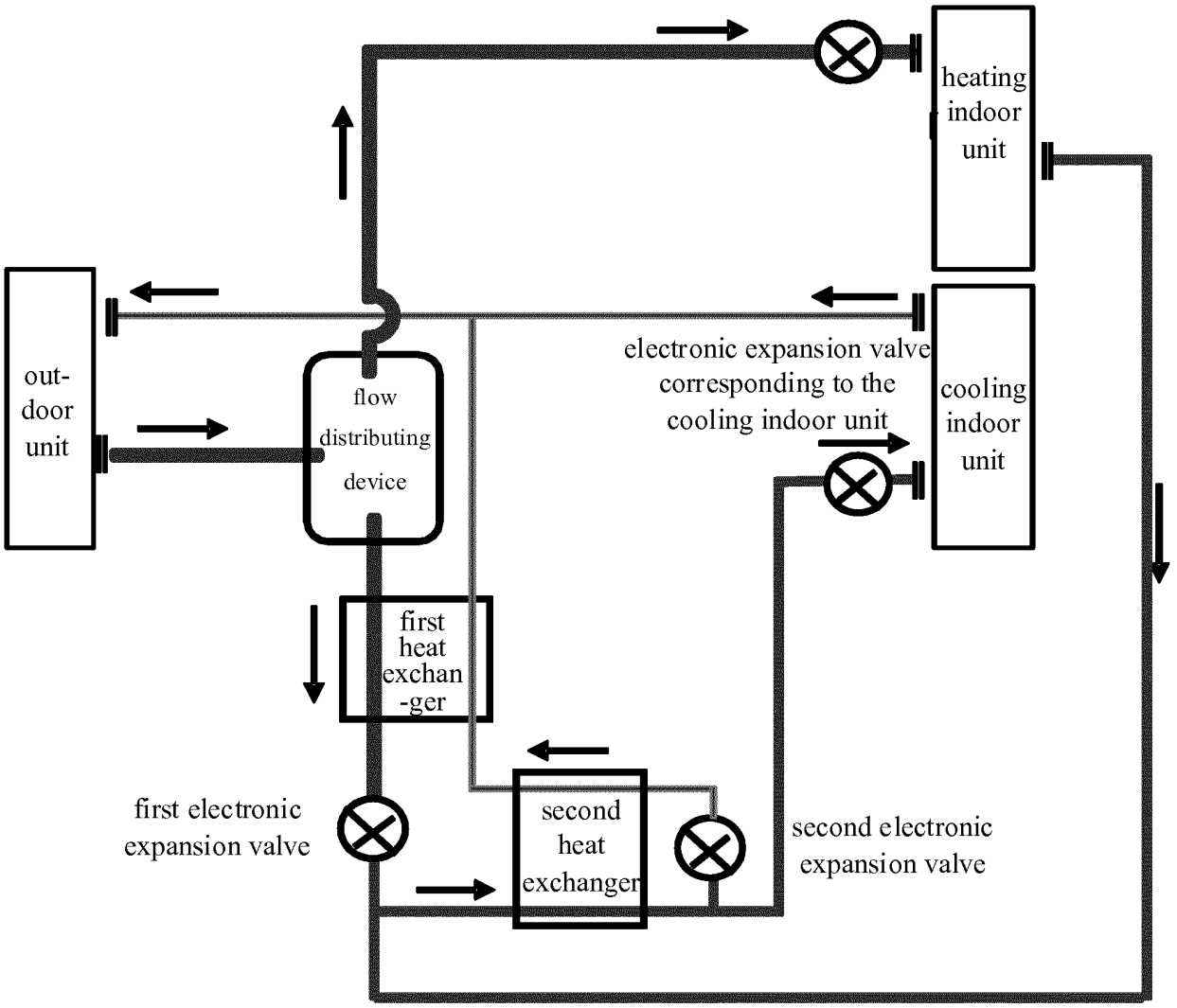
heating indoor unit
out-door unit
flow distributing device
electronic expansion valve corresponding to the cooling indoor unit
cooling indoor unit
first heat exchan-ger
first electronic expansion valve
second heat exchanger
second electronic expansion valve

Fig. 2

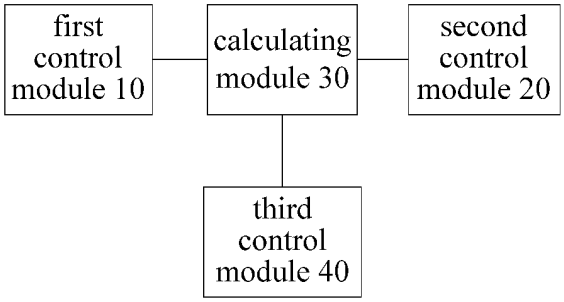
first control module 10
calculating module 30
second control module 20
third control module 40

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/080246

A. CLASSIFICATION OF SUBJECT MATTER

F25B 41/06 (2006.01) 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)

IPC: F25B 41; F25B 49

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

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

CNTXT, CNABS, CNKI, SIPOABS, VEN: refrigerant, diversion, main, heating, electron, expansion, valve, target, opening, degree, total, air, conditioning

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105115199 A (GUANGDONG MIDEA HEATING & VENTILATING et al.) 02 December 2015 (02.12.2015) description, paragraphs [0020]-[0047], and figures 1-3	1-6
A	CN 104748428 A (GUANGDONG MIDEA HEATING & VENTILATING et al.) 01 July 2015 (01.07.2015) description, paragraphs [0042]-[0057], and figures 1-6	1-6
A	WO 2014016865 A1 (MITSUBISHI ELECTRIC CORP. et al.) 30 January 2014 (30.01.2014) the whole document	1-6
A	CN 1763451 A (SAMSUNG ELECTRONICS CO., LTD.) 26 April 2006 (26.04.2006) the whole document	1-6

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

* Special categories of cited documents:

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 July 2016	02 August 2016
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