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(54) MULTI-SPLIT AIR CONDITIONING SYSTEM AND SWITCHING CONTROL METHOD FOR OPERATING MODE OF INDOOR UNITS THEREOF

(57) A multi-split air conditioning system and a switching control method for an operating mode of indoor units thereof. The method comprises the following steps: when any indoor unit (21, 22, 23, 24) in multiple indoor units (21, 22, 23, 24) receives a mode switching instruction, the indoor unit (21, 22, 23, 24) sends the mode switching instruction to a shunt device (30) (S1); the shunt device (30) performs switching control on a heating control valve or a refrigeration control valve corresponding to the indoor unit (21, 22, 23, 24) according to the received mode switching instruction, releases pressure by controlling a second throttling assembly (34), a first control valve, and a bypass valve in order to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit (21, 22, 23, 24), obtains a switching flag bit of a four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit (21, 22, 23, 24) and the four-way valve according to the switching flag bit of the four-way valve (S2).

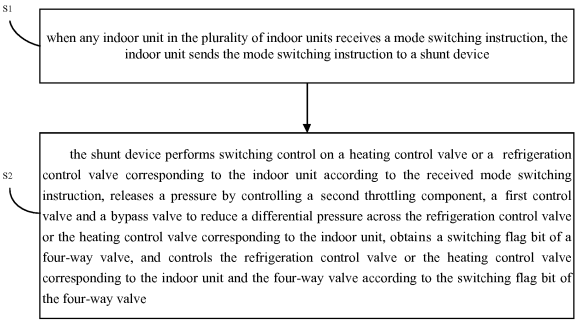

Fig. 2

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Description

FIELD

[0001] The present disclosure relates to air conditioning technology field, and more particularly, to a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system and a multi-split air conditioning system.

BACKGROUND

[0002] A multi-split air conditioning system is a high-efficiency air conditioning unit that reasonably distributes the refrigerant in the high-pressure pipe and the low-pressure pipe of the outdoor unit to the corresponding indoor unit operating in the heating mode or indoor unit operating in the refrigeration mode through a plurality of control valves in the shunt device, to realize simultaneous heating and refrigerating.

[0003] In the related art, when the indoor unit performs the mode switching, and large mode switching (that is, the four-way valve in the outdoor unit does not need to be switched) is not involved, when the indoor unit receives a switching instruction for switching from a heating (refrigeration) mode to a refrigeration (heating) mode, the heating control valve (refrigeration control valve) corresponding to the indoor unit in the shunt device will be closed after delay of a tl time, and the refrigeration control valve (heating control valve) will be opened after delay of a (t1+t2) time, thus completing the mode switching of the indoor unit. However, in the switching process, when the refrigeration control valve (heating control valve) is opened, the differential pressure across both sides of the refrigeration control valve (heating control valve) is large, the impact of the refrigerant can cause large pipeline vibration, the corresponding pipe system has hidden dangers of cracking, and moreover, the large impact of the refrigerant will produce impact noise, which will affect noise quality of the product.

[0004] When the indoor unit performs the mode switching, and large mode switching (that is, the outdoor four-way valve in the outdoor unit needs to be switched) is involved, the four-way valve in the outdoor unit and the refrigeration control valve (heating control valve) in the shunt device are switched independently, that is, switching is performed twice, which will cause large impact on the corresponding pipe system twice, and generate refrigerant impact noise twice, such that the reliability of the pipe system and the noise quality of the product can be seriously affected.

SUMMARY

[0005] The present disclosure aims to solve at least one of the technical problems in the related art to at least some extent.

[0006] Accordingly, an objective of the present disclosure is to provide a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system, by controlling a second throttling component, a first control valve and a bypass valve to release pressure, a differential pressure across the refrigeration control valve or the heating control valve during mode switching can be reduced, and by controlling the refrigeration control valve, the heating control valve and the four-way valve according to the switching flag bit of the four-way valve, hidden dangers of pipe cracking caused by impact of refrigerant can be eliminated, the corresponding impact noise can be reduced, and the reliability and noise quality of the system can be effectively improved.

[0007] Another objective of the present disclosure is to provide a multi-split air conditioning system.

[0008] In order to achieve the above objectives, embodiments of an aspect of the present disclosure provide a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system. The multi-split air conditioning system includes an outdoor unit, a shunt device and a plurality of indoor units. The outdoor unit includes a compressor and a four-way valve. The shunt device includes: a first heat exchange component, a second heat exchange component, a first throttling component arranged between an outlet of a first heat exchange flow path of the first heat exchange component and an inlet of a first heat exchange flow path of the second heat exchange component, a second throttling component arranged between an outlet of a first heat exchange flow path of the second heat exchange component and an inlet of a second heat exchange flow path of the second heat exchange component, a bypass valve arranged between the outlet of the first heat exchange flow path of the second heat exchange component and a low pressure pipeline of the shunt device, and a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units. The first throttling component includes a first control valve. The method includes: when any indoor unit in the plurality of indoor units receives a mode switching instruction, sending, by the indoor unit, the mode switching instruction to the shunt device; performing, by the shunt device, switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releasing a pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtaining a switching flag bit of the four-way valve, and controlling the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

[0009] With the method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to embodiments of the

present disclosure, when any indoor unit in the plurality of indoor units receives the mode switching instruction, the indoor unit sends the mode switching instruction to the shunt device, the shunt device performs switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releases the pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce the differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtains the switching flag bit of the four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve, such that hidden dangers of pipe cracking caused by the impact of refrigerant can be eliminated, the corresponding impact noise can be reduced, and the reliability and the noise quality of the system can be effectively improved.

[0010] According to an embodiment of the present disclosure, the switching flag bit of the four-way valve includes 0 and 1. When the switching flag bit of the four-way valve is 0, the operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode. When the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to the pure refrigeration mode.

[0011] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the method includes: after delay of a first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, and controlling the refrigeration control valve corresponding to the indoor unit to be in an open state; or after delay of the first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, and controlling the refrigeration control valve corresponding to the indoor unit to be in the open state.

[0012] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the method includes: after delay of a first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, controlling the refrigeration control valve corresponding to the indoor unit to be in an open state, and controlling the four-way valve to switch; or after delay of the first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of the second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, controlling the refrigeration control valve corresponding to the indoor unit to be in the open state, and controlling the four-way valve to switch.

[0013] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the method includes: after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, and controlling the heating control valve corresponding to the indoor unit to be in an open state; or after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, controlling the second throttling component and the bypass valve to be in a closed state, and controlling the heating control valve corresponding to the indoor unit to be in the open state.

[0014] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the method includes: after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first con-

trol valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, controlling the heating control valve corresponding to the indoor unit to be in an open state, and controlling the four-way valve to switch; or after delay of the first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, controlling the heating control valve corresponding to the indoor unit to be in the open state, and controlling the four-way valve to switch.

[0015] In order to achieve the above objectives, embodiments of an aspect of the present disclosure provide a multi-split air conditioning system. The multi-split air conditioning system includes an outdoor unit, a plurality of indoor units and a shunt device. The outdoor unit includes a compressor and a four-way valve. The shunt device includes: a first heat exchange component, a second heat exchange component, a first throttling component arranged between an outlet of a first heat exchange flow path of the first heat exchange component and an inlet of a first heat exchange flow path of the second heat exchange component, a second throttling component arranged between an outlet of a first heat exchange flow path of the second heat exchange component and an inlet of a second heat exchange flow path of the second heat exchange component, a bypass valve arranged between the outlet of the first heat exchange flow path of the second heat exchange component and a low pressure pipeline of the shunt device, and a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units. The first throttling component includes a first control valve. When any indoor unit in plurality of indoor units receives a mode switching instruction, the indoor unit is configured to send the mode switching instruction to the shunt device. The shunt device further includes a control module. The control module is configured to: perform switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, release a pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtain a switching flag bit of the four-way valve, and control the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

[0016] With the multi-split air conditioning system according to embodiments of the present disclosure, when any indoor unit in plurality of indoor units receives a mode switching instruction, the indoor unit is configured to send the mode switching instruction to the shunt device, the control module in the shunt device is configured to perform switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, release a pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtain a switching flag bit of the four-way valve, and control the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve, such that hidden dangers of pipe cracking caused by the impact of refrigerant can be eliminated, the corresponding impact noise can be reduced, and the reliability and the noise quality of the system can be effectively improved.

[0017] According to an embodiment of the present disclosure, the switching flag bit of the four-way valve includes 0 and 1. When the switching flag bit of the four-way valve is 0, an operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode. When the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to a pure refrigeration mode.

[0018] According to an embodiment of the present disclosure, when the shunt device is configured to determine that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control module is configured to: after delay of a first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state; or after delay of the first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state.

[0019] According to an embodiment of the present disclosure, when the shunt device is configured to determine

that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to: after delay of a first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch; or after delay of the first preset time, control the heating control valve of corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch.

[0020] According to an embodiment of the present disclosure, when the shunt device is configured to determine that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control is configured to: after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the heating control valve corresponding to the indoor unit to be in an open state; or after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and control the heating control valve corresponding to the indoor unit to be in the open state.

[0021] According to an embodiment of the present disclosure, when the shunt device is configured to determine that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to: after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, control the heating control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch; or after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, control the heating control valve corresponding to the indoor unit to be in the open state, and control the four-way valve to switch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The above and/or additional aspects and advantages of embodiments of the present disclosure will become apparent and more readily appreciated from the following descriptions made with reference to the drawings, in which:

Fig. 1 is a schematic diagram of a multi-split air conditioning system according to an embodiment of the present disclosure;

Fig. 2 is a flow chart of a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to an embodiment of the present disclosure; and

Fig. 3 is a flow chart of a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to an embodiment of the present disclosure.

[0023] Reference numerals: outdoor unit 10, first indoor unit 21, second indoor unit 22, third indoor unit 23, fourth indoor unit 24, heating control valve SV1B, SV2B, SV3B and SV4B, refrigeration control valve SV1, SV2, SV3 and SV4, shunt device 30, first heat exchange component 31, second heat exchange component 32, first throttling component 33, second throttling component 34, bypass valve SVME, first control valve SVMC, first throttling element EXV2 and second control valve SVP.

DETAILED DESCRIPTION

[0024] Reference will be made in detail to embodiments of the present disclosure, examples of which will be shown in the drawings, in which the same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions. Embodiments described herein with reference to the drawings are explanatory, serve to explain the present disclosure, and are not construed to limit embodiments of the present disclosure.

[0025] A method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system and a multi-split air conditioning system according to embodiments of the present disclosure will be described below with reference to the accompanying drawings.

[0026] Fig. 1 is a schematic diagram of a multi-split air conditioning system according to an embodiment of the present disclosure.

[0027] As shown in Fig. 1, the multi-split air conditioning system includes an outdoor unit, a shunt device and a plurality of indoor units. The outdoor unit includes a compressor and a four-way valve. The shunt device includes: a first heat exchange component, a second heat exchange component, a first throttling component arranged between an outlet of a first heat exchange flow path of the first heat exchange component and an inlet of a first heat exchange flow path of the second heat exchange component, a second throttling component arranged between an outlet of a first heat exchange flow path of the second heat exchange component and an inlet of a second heat exchange flow path of the second heat exchange component, a bypass valve arranged between the outlet of the first heat exchange flow path of the second heat exchange component and a low pressure pipeline of the shunt device, and a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units. The first throttling component includes a first control valve.

[0028] Fig. 2 is a flow chart of a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to an embodiment of the present disclosure. As shown in Fig. 2, the method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system may include the followings.

[0029] At block S1, when any indoor unit in the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to a shunt device.

[0030] At block S2, the shunt device performs switching control on a heating control valve or a refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releases a pressure by controlling a second throttling component, a first control valve and a bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtains a switching flag bit of a four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

[0031] According to an embodiment of the present disclosure, the switching flag bit of the four-way valve includes 0 and 1. When the switching flag bit of the four-way valve is 0, the operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode. When the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to a pure refrigeration mode.

[0032] Specifically, the operating mode of the multi-split air conditioning system may include the main refrigeration mode, the main heating mode, the pure refrigeration mode and the pure heating mode. When the indoor unit in the multi-split air conditioning system performs the mode switching, the operating mode of the whole system (i.e., the operating mode of the outdoor unit) may be changed. For example, assuming that there are two indoor units in the multi-split air conditioning system, the indoor unit having a large refrigeration capacity operates in the heating mode, the indoor unit having a small refrigeration capacity operates in the refrigeration mode, and the multi-split air conditioning system operates in the main heating mode. When the user switches the operating mode of the indoor unit having the large refrigeration capacity to the refrigeration mode, the multi-split air conditioning system may switch from the main heating mode to the pure refrigeration mode, in this case, large mode switching is involved, i. e., the four-way valve in the outdoor unit needs to be switched, and the switching flag bit of the four-way valve is 1. When the user switches the operating mode of the indoor unit having the small refrigeration capacity to the heating mode, the multi-split air conditioning system may switch from the main heating mode to the pure heating mode, in this case, small mode switching is involved, i.e., the four-way valve in the outdoor unit does not need to be switched, and the switching flag bit of the four-way valve is 0. In other words, when the indoor unit performs the mode switching, it is also necessary to determine whether the operating mode of the system needs to be switched, when the operating mode of the system needs to be switched, the switching flag bit of the four-way valve is 1, and when the operating mode of the system does not need to be switched, the switching flag bit of the four-way valve is 0. Then, the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve are controlled according to the mode switching instruction and the switching flag bit of the four-way valve.

[0033] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from the heating mode to the refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the shunt device, after delay of a first preset time, controls the heating control valve corresponding to the indoor unit to close, and controls the second throttling component and the first control valve to be in an open state, after delay of a second preset time, the shunt device controls the second throttling component and the first control valve to be in a closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in the open state. Alternatively, the shunt device, after delay of the first preset time, controls the heating control valve corresponding to the indoor unit to close,

and controls the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, the shunt device controls the second throttling component and the bypass valve to be in a closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in the open state. The first preset time and the second preset time can be calibrated according to actual situations.

[0034] Specifically, as shown in Fig. 1, assuming that the first to the third indoor units operate in the heating mode (the refrigerant performs the heating cycle along the solid path), the fourth indoor unit operates in the refrigeration mode (the refrigerant performs the refrigeration cycle along the dotted line), and the multi-split air conditioning system operates in the main heating mode. When the first indoor unit (the indoor unit having a small refrigeration capacity) receives an instruction for switching from the heating mode to the refrigeration mode, the indoor unit sends the mode switching instruction to the shunt device, the shunt device determines that the multi-split air conditioning system is switched from the main heating mode to the main heating mode, i.e., the operating mode of system remains unchanged, in this case, the switching flag bit of the four-way valve is equal to 0.

[0035] After delay of the first preset time, the shunt device, controls the heating control valve corresponding to the indoor unit to close, and controls the second throttling component and the first control valve to be in the open state (or controls the second throttling component and the bypass valve to be in the open state), the refrigerant passes through the first control valve and the indoor units operating in the heating mode, and flows into the low pressure pipe of the shunt device through the second throttling component, the pressure at the low pressure pipe can be increased in a short time, such that the differential pressure across the refrigeration control valve corresponding to the first indoor unit can be reduced. Then, after delay of the second preset time, the shunt device controls the second throttling component and the first control valve to be in the closed state (or controls the second throttling component and the bypass valve to be in the closed state), and controls the refrigeration control valve corresponding to the indoor unit to be in the open state, and the four-way valve keeps the current state unchanged. By controlling the second throttling component, the first control valve and the bypass valve, the differential pressure across the refrigeration control valve can be effectively reduced, such that the instantaneous impact of the refrigerant on the corresponding pipe system can be effectively reduced, the noise caused by the impact of refrigerant can be reduced, and the reliability and noise quality of the system can be effectively improved.

[0036] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from the refrigeration mode to the heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the indoor unit to close, and controls the second throttling component and the first control valve to be in the open state, after delay of the second preset time, the shunt device controls the second throttling component and the first control valve to be in the closed state, and controls the heating control valve corresponding to the indoor unit to be in the open state. Alternatively, the shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the indoor unit to close, and controls the second throttling component and the bypass valve to be in the open state, after delay of the second preset time, the shunt device controls the second throttling component and the bypass valve to be in the closed state, and controls the heating control valve corresponding to the indoor unit to be in the open state.

[0037] Specifically, as shown in Fig. 1, assuming that the fourth indoor unit receives the mode switching instruction for switching from the refrigeration mode to the heating mode, the indoor unit sends the mode switching instruction to the shunt device, the shunt device determines that the multi-split air conditioning system is switched from the main heating mode to the pure heating mode, in this case, the switching flag bit of the four-way valve is 0.

[0038] After delay of the first preset time, the shunt device controls the refrigeration control valve corresponding to the fourth indoor unit to close, and controls the second throttling component and the first control valve to be in the open state (or controls the second throttling component and the bypass valve to be in the open state) to release pressure, to reduce the differential pressure across the heating control valve corresponding to the fourth indoor unit. Then, after delay of the second preset time, the shunt device controls the second throttling component and the first control valve to be in the closed state (or controls the second throttling component and the bypass valve to be in the closed state), and controls the heating control valve corresponding to the indoor unit to be in the open state, and the four-way valve keeps the current state unchanged. By controlling the second throttling component, the first control valve and the bypass valve, the differential pressure across the refrigeration control valve can be effectively reduced, such that the instantaneous impact of the refrigerant on the corresponding pipe system can be effectively reduced, the noise caused by the impact of refrigerant can be reduced, and the reliability and noise quality of the system can be effectively improved.

[0039] According to an embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from the heating mode to the refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the shunt device, after delay of the first preset time, controls the heating control valve corresponding to the indoor unit to close, and controls the second throttling

component and the first control valve to be in the open state, after delay of the second preset time, the shunt device controls the second throttling component and the first control valve to be in the closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in the open state and controls the four-way valve to switch. Alternatively, the shunt device, after delay of the first preset time, controls the heating control valve corresponding to the indoor unit to close, and controls the second throttling component and the bypass valve to be in the open state, after delay of the second time, the shunt device controls the second throttling component and the bypass valve to be in the closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in the open state and controls the four-way valve to switch.

[0040] Specifically, after a large number of tests and verifications, it is found that, when large mode switching is performed, the best time for switching the refrigeration control valve (heating control valve) is when the differential pressure across the refrigeration control valve (heating control valve) corresponding to the indoor unit in the shunt device is minimum. Therefore, when large mode switching is performed, the four-way valve and the refrigeration control valve (heating control valve) are operated simultaneously, which can effectively reduce the instantaneous impact of the refrigerant on the corresponding pipe system and reduce the noise caused by the impact of the refrigerant.

[0041] Specifically, as shown in Fig. 1, assuming that the second indoor unit (the indoor unit having a large refrigeration capacity) receives the mode switching instruction for switching from the heating mode to the refrigeration mode, the indoor unit sends the mode switching instruction to the shunt device, the shunt device determines that the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, in this case, the switching flag bit of the four-way valve is 1.

[0042] The shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the second indoor unit to close, and controls the second throttling component and the first control valve to be in the open state (or controls the second throttling component and the bypass valve to be in the open state) to release pressure, to reduce the differential pressure across the heating control valve corresponding to the second indoor unit. Then, after delay of the second time, the shunt device controls the second throttling component and the first control valve to be in the closed state (or controls the second throttling component and the bypass valve to be in the closed state), and controls the heating control valve corresponding to the indoor unit to be in the open state and simultaneously controls the four-way valve to switch, thereby effectively reducing the number of impacts of the refrigerant on the pipeline. In addition, when large mode switching is performed, the differential pressure across the refrigeration control valve is minimum, and the impact is minimum during switching, and by controlling the second throttling component, the first control valve and the bypass valve, the differential pressure across the refrigeration control valve can be reduced, such that the differential pressure across the refrigeration control valve is smaller, thereby significantly improving the impact of refrigerant caused by the mode switching of the indoor unit, reducing the impact noise caused by the impact of refrigerant, and effectively improving the reliability and the noise quality of the system.

[0043] According to another embodiment of the present disclosure, when the shunt device determines that the indoor unit is switched from the refrigeration mode to the heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the indoor unit to close, and controls the second throttling component and the first control valve to be in the open state, and after delay of the second time, the shunt device controls the second throttling component and the first control valve to be in the closed state, and controls the heating control valve corresponding to the indoor unit to be in the open state and controls the four-way valve to switch. Alternatively, the shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the indoor unit to close, and controls the second throttling component and the bypass valve to be in the open state, and after delay of the second time, the shunt device controls the second throttling component and the bypass valve to be in the closed state, and controls the heating control valve corresponding to the indoor unit to be in the open state and controls the four-way valve to switch.

[0044] Specifically, as shown in Fig. 1, assuming that the first to the third indoor units operate in the refrigeration mode, the fourth indoor unit operates in the heating mode, and the multi-split air conditioning system operates in the main refrigeration mode. When the second indoor unit (the indoor unit having a large refrigeration capacity) receives an instruction for switching from the refrigeration mode to the heating mode, the indoor unit sends the mode switching instruction to the shunt device, the shunt device determines that the multi-split air conditioning system is switched from the main refrigeration mode to the main heating mode, in this case, the switching flag bit of the four-way valve is equal to 1.

[0045] The shunt device, after delay of the first preset time, controls the refrigeration control valve corresponding to the second indoor unit to close, and controls the second throttling component and the first control valve to be in the open state (or controls the second throttling component and the bypass valve to be in the open state) to release pressure, to reduce the differential pressure across the heating control valve corresponding to the second indoor unit. Then, after delay of the second time, the shunt device controls the second throttling component and the first control valve to be in the closed state

(or controls the second throttling component and the bypass valve to be in the closed state) and controls the heating control valve corresponding to the indoor unit to be in the open state, and simultaneously controls the four-way valve to switch, thereby effectively reducing the number of impacts of the refrigerant on the pipeline. In addition, when large mode switching is performed, the differential pressure across the heating control valve is minimum, and the impact is minimum during switching, and by controlling the second throttling component, the first control valve and the bypass valve, the differential pressure across the heating control valve can be reduced, such that the differential pressure across the heating control valve is smaller, thereby significantly improving the impact of refrigerant caused by mode switching of the indoor unit, reducing the impact noise caused by the impact of the refrigerant, and effectively improving the reliability and noise quality of the system.

[0046] In order to enable those skilled in the art to understand the present disclosure more clearly, Fig. 3 is a flow chart of a method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to an embodiment of the present disclosure.

[0047] As shown in Fig. 3, the method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system may include the following operations:

At block S101, the indoor unit operates in a heating (refrigeration) mode.

At block S102, the indoor unit receives a mode switching instruction for switching from the heating (refrigeration) mode to a refrigeration (heating) mode.

At block S103, the corresponding heating (refrigeration) control valve is closed after delay of a T1 time.

At block S104, the second throttling component, the first control valve and the bypass valve are controlled to release pressure, and are controlled to close after delay of a T2 time.

At block S105, it is determined whether the switching flag bit of the four-way valve is 1. If yes, block S107 is performing, and otherwise, block S106 is performed.

At block S106, the corresponding refrigeration (heating) control valve is controlled to open.

At block S107, the four-way valve is controlled to switch, and simultaneously the corresponding refrigeration (heating) control valve is controlled to open.

At block S108, mode switching is complete.

[0048] In summary, with the method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system according to embodiments of the present disclosure, when any indoor unit in the plurality of indoor units receives the mode switching instruction, the indoor unit sends the mode switching instruction to the shunt device, the shunt device performs switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releases the pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce the differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtains the switching flag bit of the four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve, such that hidden dangers of pipe cracking caused by impact of refrigerant can be eliminated, the corresponding impact noise can be reduced, and the reliability and noise quality of the system can be effectively improved.

[0049] The multi-split air conditioning system according to embodiments of the present disclosure will be described in detail below.

[0050] As shown in Fig. 1, the multi-split air conditioning system may include an outdoor unit 10, a plurality of indoor units and a shunt device 30.

[0051] The outdoor unit includes a compressor and a four-way valve (not shown in the figure). The shunt device 30 includes a first heat exchange component 31, a second heat exchange component 32, a first throttling component 33 arranged between an outlet of a first heat exchange flow path of the first heat exchange component 31 and an inlet of a first heat exchange flow path of the second heat exchange component 32, a second throttling component 34 arranged between an outlet of a first heat exchange flow path of the second heat exchange component 32 and an inlet of a second heat exchange flow path of the second heat exchange component 32, a bypass valve SVME arranged between the outlet of the first heat exchange flow path of the second heat exchange component 32 and a low pressure pipeline of the shunt device 30, a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units and a control module (not shown in the figure). The first throttling component 33 includes a first control valve SVMC, and a second throttle component 35 includes a first throttling element EXV2 and a second control valve SVP.

[0052] The plurality of indoor units may include a first indoor unit 21, a second indoor unit 22, a third indoor unit 23 and a fourth indoor unit 24. The first indoor unit 21 corresponds to a heating control valve SV1B and a refrigeration control valve SV1, the second indoor unit 22 corresponds to a heating control valve SV2B and a refrigeration control valve SV2, the third indoor unit 23 corresponds to a heating control valve SV3B and a refrigeration control valve SV3, the fourth indoor unit 24 corresponds to a heating control valve SV4B and a refrigeration control valve SV4.

[0053] When any indoor unit in the plurality of indoor units receives a mode switching instruction, the indoor

unit sends the mode switching instruction to the shunt device 30, the control module in the shunt device 30 is configured to perform switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, release a pressure by controlling the second throttling component 34, the first control valve SVMC and the bypass valve SVME to reduce the differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtain a switching flag bit of the four-way valve, and control the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

[0054] According to an embodiment of the present disclosure, the switching flag bit of the four-way valve includes 0 and 1. When the switching flag bit of the four-way valve is 0, the operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode. When the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to a pure refrigeration mode.

[0055] According to an embodiment of the present disclosure, when the control module determines that the indoor unit is switched from the heating mode to the refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control module is configured to, after delay of a first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the first control valve SVMC to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the first control valve SVMC to be in the closed state, and control the refrigeration control valve corresponding to the indoor unit to be in the open state. Alternatively, the control module is configured to, after delay of the first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the bypass valve SVME to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the bypass valve SVME to be in the closed state, and control the refrigeration control valve corresponding to the indoor unit to be in the open state.

[0056] According to another embodiment of the present disclosure, when the control module determines that the indoor unit is switched from the refrigeration mode to the heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control module is configured to, after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the first control valve SVMC to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the first control valve SVMC to be in the closed state, and control the heating control valve corresponding to the indoor unit to be in the open state. Alternatively, the control module is configured to, after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the bypass valve SVME to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the bypass valve SVME to be in the closed state, and control the heating control valve corresponding to the indoor unit to be in the open state.

[0057] According to an embodiment of the present disclosure, when the control module determines that the indoor unit is switched from the heating mode to the refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to, after delay of the first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the first control valve SVMC to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the first control valve SVMC to be in the closed state, and control the refrigeration control valve corresponding to the indoor unit to be in the open state and controls the four-way valve to switching. Alternatively, the control module is configured to, after delay of the first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the bypass valve SVME to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the bypass valve SVME to be in the closed state, and control the refrigeration control valve corresponding to the indoor unit to be in the open state and control the four-way valve to switch.

[0058] According to another embodiment of the present disclosure, when the control module determines that the indoor unit is switched from the refrigeration mode to the heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to, after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the first control valve SVMC to be in the open state,

after delay of the second time, the control module is configured to control the second throttling component 34 and the first control valve SVMC to be in the closed state, and control the heating control valve corresponding to the indoor unit to be in the open state and control the four-way valve to switch. Alternatively, the control module is configured to, after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component 34 and the bypass valve SVME to be in the open state, after delay of the second time, the control module is configured to control the second throttling component 34 and the bypass valve SVME to be in the closed state, and control the heating control valve corresponding to the indoor unit to be in the open state and control the four-way valve to switch.

[0059] With the multi-split air conditioning system according to embodiments of the present disclosure, when any indoor unit in a plurality of indoor units receives the mode switching instruction, the indoor unit sends the mode switching instruction to the shunt device, the shunt device performs switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releases the pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce the differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtains a switching flag bit of the four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve, such that the hidden dangers of pipe cracking caused by impact of refrigerant can be eliminated, the corresponding impact noise can be reduced, and the reliability and noise quality of the system can be effectively improved.

[0060] In the description of the present disclosure, it should 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 "circumferential" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are intended to facilitate and simplify the description of the present disclosure, rather than to indicate or imply that the device or element referred to must have a specific orientation, be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation of the present disclosure.

[0061] 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 include one or more this feature. In the description of the present disclosure, "a plurality of' means at least two, for example, two or three, unless specified otherwise.

[0062] 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.

[0063] In the present disclosure, 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. 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.

[0064] Reference throughout this specification to "an embodiment," "some embodiments," "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. 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. In addition, different embodiments or examples and features of different embodiments or examples described in the specification may be combined by those skilled in the art without mutual contradiction.

[0065] Although embodiments of present disclosure have been shown and described above, it should be understood that above embodiments are just explanatory, and cannot be construed to limit the present disclosure, for those skilled in the art, changes, modifications, alternations, and variations can be made to the embodiments within the scope of the present disclosure.

Claims

1. A method for controlling switching between operating modes of an indoor unit in a multi-split air conditioning system, wherein,
the multi-split air conditioning system comprises: an outdoor unit, a shunt device and a plurality of indoor units,
the outdoor unit comprises: a compressor and a four-way valve, the shunt device comprises: a first heat exchange component, a second heat exchange component, a first throttling component arranged between an outlet of a first heat exchange flow path of the first heat exchange component and an inlet of a first heat exchange flow path of the second heat exchange component, a second throttling component arranged between an outlet of a first heat exchange flow path of the second heat exchange component and an inlet of a second heat exchange flow path of the second heat exchange component, a bypass valve arranged between the outlet of the first heat exchange flow path of the second heat exchange component and a low pressure pipeline of the shunt device, and a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units, the first throttling component comprises a first control valve,
the method comprises:

   when any indoor unit in the plurality of indoor units receives a mode switching instruction, sending, by the indoor unit, the mode switching instruction to the shunt device;
   performing, by the shunt device, switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releasing a pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtaining a switching flag bit of the four-way valve, and controlling the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

2. The method according to claim 1, wherein the switching flag bit of the four-way valve comprises 0 and 1, when the switching flag bit of the four-way valve is 0, the operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode;
when the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to the pure refrigeration mode.

3. The method according to claim 2, wherein when determining by the shunt device that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the method comprises:

   after delay of a first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, and controlling the refrigeration control valve corresponding to the indoor unit to be in an open state; or
   after delay of the first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, and controlling the refrigeration control valve corresponding to the indoor unit to be in the open state.

4. The method according to claim 2, wherein when determining by the shunt device that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the method comprises:

   after delay of a first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, controlling the refrigeration control valve corresponding to the indoor unit to be in an open state, and controlling the four-way valve to

switch; or

after delay of the first preset time, controlling, by the shunt device, the heating control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of the second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, controlling the refrigeration control valve corresponding to the indoor unit to be in the open state, and controlling the four-way valve to switch.

5. The method according to claim 2, wherein when determining by the shunt device that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the method comprises:

after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, and controlling the heating control valve corresponding to the indoor unit to be in an open state; or

after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, controlling the second throttling component and the bypass valve to be in a closed state, and controlling the heating control valve corresponding to the indoor unit to be in the open state.

6. The method according to claim 2, wherein when determining by the shunt device that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the method comprises:

after delay of a first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the first control valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the first control valve to be in a closed state, controlling the heating control valve corresponding to the indoor unit to be in an open state, and controlling the four-way valve to switch; or

after delay of the first preset time, controlling, by the shunt device, the refrigeration control valve corresponding to the indoor unit to close, and controlling the second throttling component and the bypass valve to be in an open state, and after delay of a second preset time, controlling, by the shunt device, the second throttling component and the bypass valve to be in a closed state, controlling the heating control valve corresponding to the indoor unit to be in the open state, and controlling the four-way valve to switch.

7. A multi-split air conditioning system, comprising:

an outdoor unit, comprising a compressor and a four-way valve;

a plurality of indoor units; and

a shunt device, comprising: a first heat exchange component, a second heat exchange component, a first throttling component arranged between an outlet of a first heat exchange flow path of the first heat exchange component and an inlet of a first heat exchange flow path of the second heat exchange component, a second throttling component arranged between an outlet of a first heat exchange flow path of the second heat exchange component and an inlet of a second heat exchange flow path of the second heat exchange component, a bypass valve arranged between the outlet of the first heat exchange flow path of the second heat exchange component and a low pressure pipeline of the shunt device, and a heating control valve and a refrigeration control valve corresponding to each indoor unit in the plurality of indoor units, the first throttling component comprises a first control valve,

when any indoor unit in plurality of indoor units receives a mode switching instruction, the indoor unit is configured to send the mode switching instruction to the shunt device;

the shunt device further comprises:

a control module, configured to perform switching control on the heating control valve or the refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, release a pressure by controlling the second throttling component, the first control valve and the bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtain a switching flag bit of the four-way valve, and control the

refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve.

8. The multi-split air conditioning system according to claim 7, wherein the switching flag bit of the four-way valve comprises 0 and 1,
when the switching flag bit of the four-way valve is 0, an operating mode of the multi-split air conditioning system is switched from a main refrigeration mode to a pure refrigeration mode, or switched from the main refrigeration mode to the main refrigeration mode, or switched from a main heating mode to a pure heating mode, or switched from the main heating mode to the main heating mode;
when the switching flag bit of the four-way valve is 1, the operating mode of the multi-split air conditioning system is switched from the main heating mode to the main refrigeration mode, or switched from the main refrigeration mode to the main heating mode, or switched from the main refrigeration mode to the pure heating mode, or switched from the main heating mode to a pure refrigeration mode.

9. The multi-split air conditioning system according to claim 8, wherein when the shunt device is configured to determine that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control module is configured to:

after delay of a first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state; or
after delay of the first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state.

10. The multi-split air conditioning system according to claim 8, wherein when the shunt device is configured to determine that the indoor unit is switched from a heating mode to a refrigeration mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to:

after delay of a first preset time, control the heating control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the refrigeration control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch; or
after delay of the first preset time, control the heating control valve of corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and controls the refrigeration control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch.

11. The multi-split air conditioning system according to claim 8, wherein when the shunt device is configured to determine that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 0, the control is configured to:

after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, and control the heating control valve corresponding to the indoor unit to be in an open state; or
after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, and control the heating control valve corresponding to the indoor unit to be in the open state.

12. The multi-split air conditioning system according to claim 8, wherein when the shunt device is configured to determine that the indoor unit is switched from a refrigeration mode to a heating mode according to the received mode switching instruction, and the switching flag bit of the four-way valve is 1, the control module is configured to:

after delay of a first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the first control valve to be in an open state, after delay of a second preset time, control the second throttling component and the first control valve to be in a closed state, control the heating control valve corresponding to the indoor unit to be in an open state, and control the four-way valve to switch; or

after delay of the first preset time, control the refrigeration control valve corresponding to the indoor unit to close, and control the second throttling component and the bypass valve to be in an open state, after delay of the second preset time, control the second throttling component and the bypass valve to be in a closed state, control the heating control valve corresponding to the indoor unit to be in the open state, and control the four-way valve to switch.

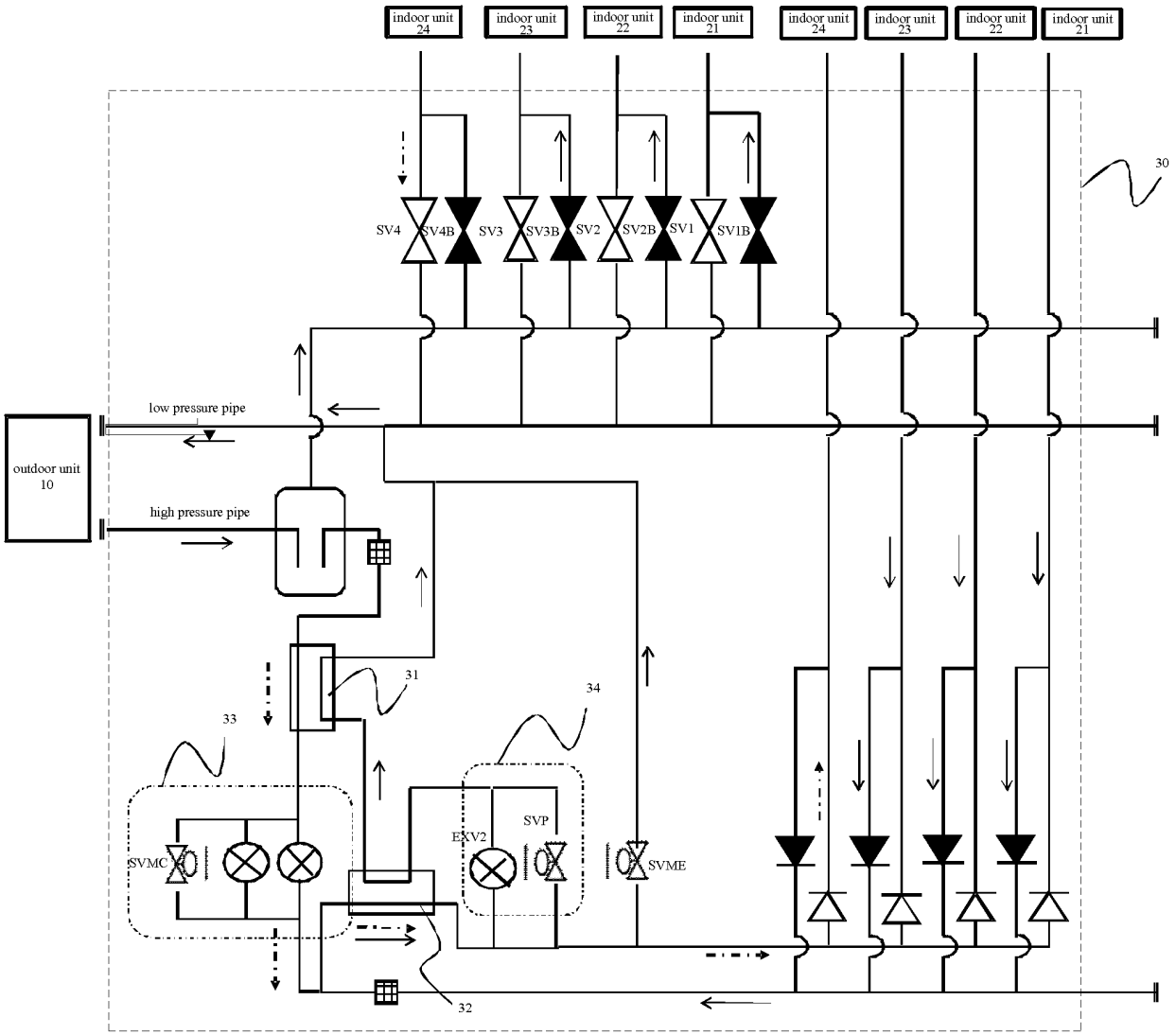
indoor unit 24
indoor unit 23
indoor unit 22
indoor unit 21
indoor unit 24
indoor unit 23
indoor unit 22
indoor unit 21
30
SV4
SV4B
SV3
SV3B
SV2
SV2B
SV1
SV1B
low pressure pipe
outdoor unit 10
high pressure pipe
31
34
33
SVP
EXV2
SVMC
SVME
32

Fig. 1

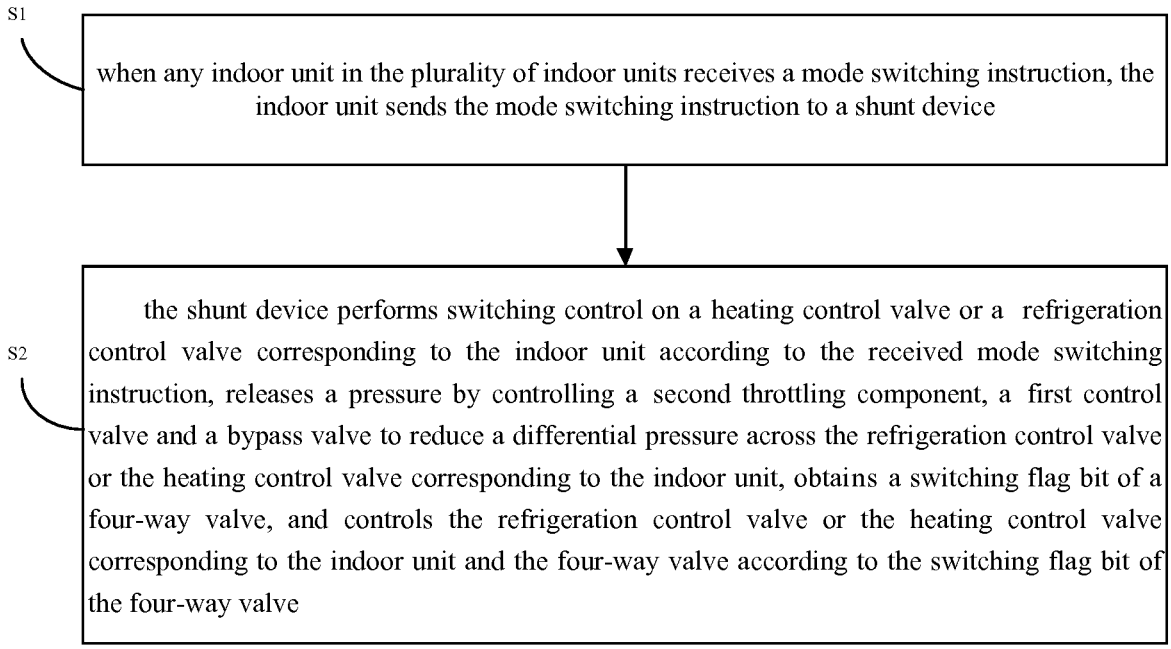
S1
when any indoor unit in the plurality of indoor units receives a mode switching instruction, the indoor unit sends the mode switching instruction to a shunt device
S2
the shunt device performs switching control on a heating control valve or a refrigeration control valve corresponding to the indoor unit according to the received mode switching instruction, releases a pressure by controlling a second throttling component, a first control valve and a bypass valve to reduce a differential pressure across the refrigeration control valve or the heating control valve corresponding to the indoor unit, obtains a switching flag bit of a four-way valve, and controls the refrigeration control valve or the heating control valve corresponding to the indoor unit and the four-way valve according to the switching flag bit of the four-way valve

Fig. 2

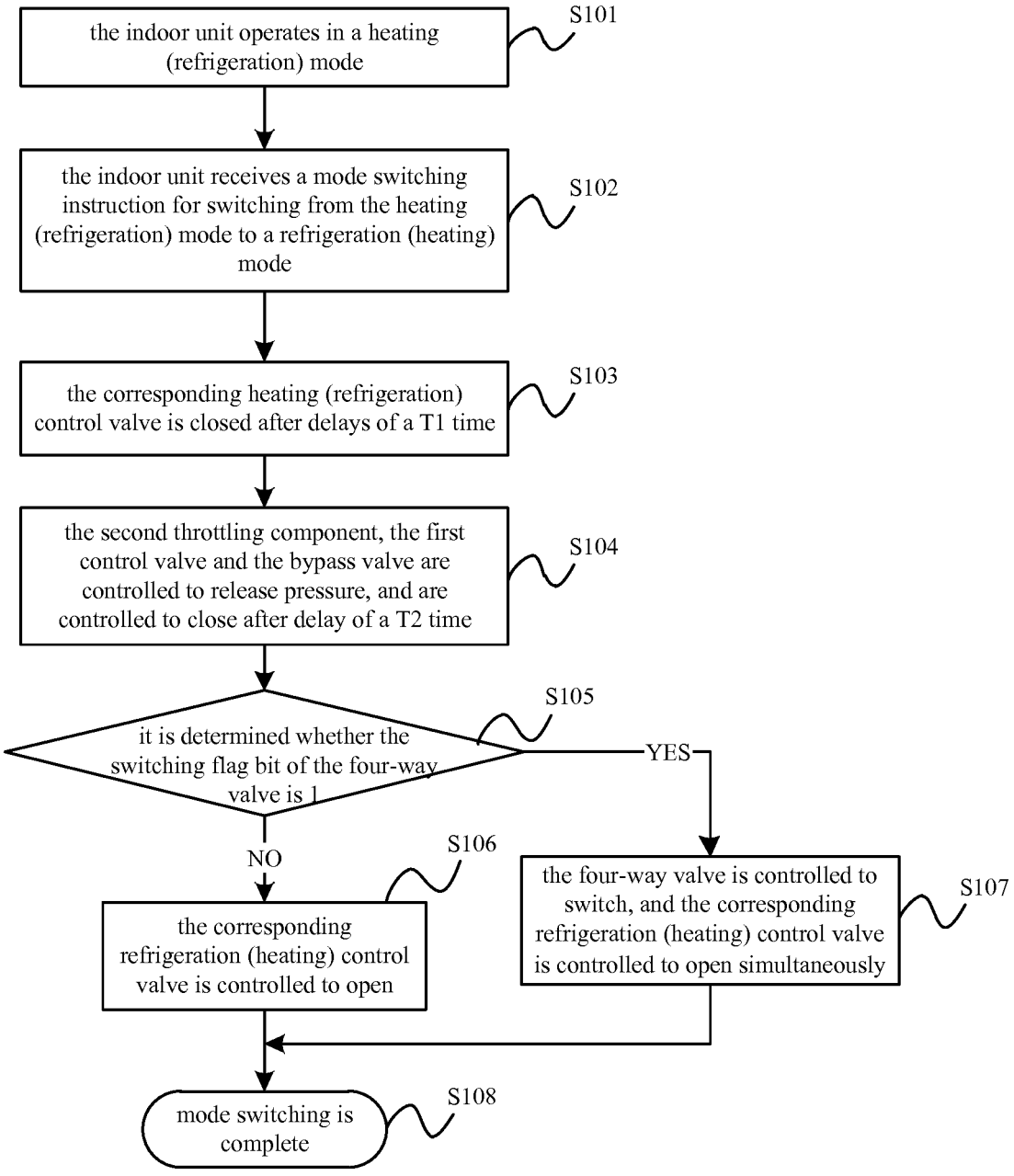
the indoor unit operates in a heating (refrigeration) mode
S101
the indoor unit receives a mode switching instruction for switching from the heating (refrigeration) mode to a refrigeration (heating) mode
S102
the corresponding heating (refrigeration) control valve is closed after delays of a T1 time
S103
the second throttling component, the first control valve and the bypass valve are controlled to release pressure, and are controlled to close after delay of a T2 time
S104
it is determined whether the switching flag bit of the four-way valve is 1
S105
YES
NO
the corresponding refrigeration (heating) control valve is controlled to open
S106
the four-way valve is controlled to switch, and the corresponding refrigeration (heating) control valve is controlled to open simultaneously
S107
mode switching is complete
S108

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/104675

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/00 (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)

F24F 11

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, CNKI, CNTXT, VEN: 多联机, 一拖多, 室内机, 室内装置, 室内单元, 运行模式, 切换, 控制, 分流, 压缩机, 四通阀, 旁通, 制冷, 制热, 控制阀, 压差, 标志位, multi-split, multi-connect+, indoor unit+, indoor machine+, indoor device+, operat+ mode+, switch+, control+, distribut+, compressor, four way valve, bypass, cool+, heat+, control+ valve+, pressure difference, sign position

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105627507 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 01 June 2016 (01.06.2016), description, paragraphs [0005], [0034] and [0041], and figures 1-4	1-12
A	CN 1495390 A (LG ELECTRONICS INC.), 12 May 2004 (12.05.2004), entire document	1-12
A	CN 201007582 Y (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 16 January 2008 (16.01.2008), entire document	1-12
A	CN 105115063 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 02 December 2015 (02.12.2015), entire document	1-12
A	JP 2001174090 A (FUJITSU GENERAL LTD.), 29 June 2001 (29.06.2001), entire document	1-12
A	KR 20060091526 A (LG ELECTRONICS INC.), 21 August 2006 (21.08.2006), entire document	1-12

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

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2017	05 June 2017
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer YANG, Xiuhua Telephone No. (86-10) 62084899

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/104675

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		JP 4383801 B2	16 December 2009
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		US 2004035132 A1	26 February 2004
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		KR 20040017603 A	27 February 2004
		EP 1420216 A3	17 August 2005
CN 201007582 Y	16 January 2008	None	
CN 105115063 A	02 December 2015	None	
JP 2001174090 A	29 June 2001	None	
KR 20060091526 A	21 August 2006	KR 100619775 B1	11 September 2006

Form PCT/ISA/210 (patent family annex) (July 2009)