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(54) **AIR CONDITIONER**
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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of air conditioning, and in particular to an air conditioner.

BACKGROUND

[0002] With the increasing improvement of people's living standards and the demand for energy saving, the enhanced vapor injection refrigerant system is more and more widely used, especially applications to the coal-to-electricity conversion and multi-split air conditioners in northern China. In addition, as for multi-split air conditioner systems or other refrigerant systems, due to the application of long connection pipes and the existence of throttle devices on the indoor machine side, many systems are provided with secondary subcoolers to reduce pipeline pressure loss and indoor machine throttling noise. When both enhanced vapor injection and secondary subcooling are required on a refrigerant system application, an economizer may be shared. However, due to the opposite flow directions of cooling and heating refrigerants, the economizer is bound to perform downstream heat exchange in one of the directions, which results in a small temperature difference for heat exchange and a low heat exchange efficiency. EP 2 357 427 A1 discloses an air conditioner according to the preamble of claim 1.

SUMMARY

[0003] Aspects of the invention are set out in the claims. A main objective of the present invention is to provide an air conditioner which aims to enable the air conditioner to have a high heating capacity in low-temperature environments while having a thermostatic dehumidification function.

[0004] In order to achieve the above purpose, the air conditioner provided in the present invention is defined in claim 1. It includes an outdoor unit and an indoor unit, where the outdoor unit includes an enhanced vapor compression mechanism and an outdoor heat exchanger, and the indoor unit includes a first heat exchanger and a first throttle regulator; the air conditioner further includes: a discharge pipe connected to a discharge side of the compression mechanism, a low-pressure suction pipe connected to a low-pressure suction side of the compression mechanism, a first piping connecting the discharge pipe, the outdoor heat exchanger, the first throttle regulator, and the first heat exchanger in sequence, and a second piping connecting the first heat exchanger and the low-pressure suction pipe, thus forming a refrigerant circuit; the outdoor unit further includes a first switching device, the first switching device being capable of switching between a first switching state of the first switching device and a second switching state of the first switching device, where in the first switching state the first switching device causes the first piping to communicate with the suction pipe and the second piping to communicate with the discharge pipe, and in the second switching state the first switching device causes the first piping to communicate with the discharge pipe and the second piping to communicate with the suction pipe; and the air conditioner further includes an economizer, where the economizer is provided on the first piping between the outdoor heat exchanger and the first throttle device; a first refrigerant flow path and a second refrigerant flow path are provided in the economizer, the first refrigerant flow path being connected to the first piping through a refrigerant bridge; and one end of the second refrigerant flow path communicates with the first piping through a liquid pickup pipe and the other end communicates with both a medium-pressure suction port of the compressor and the suction pipe through a return pipe, so that refrigerant flow directions in the first refrigerant flow path and the second refrigerant flow path are opposite.

[0005] In some embodiments, the refrigerant bridge has a first port, a second port, and a refrigerant passage that causes the first port to communicate with the second port, and the refrigerant bridge is connected to the first piping through the first port and the second port.

[0006] In some embodiments, the refrigerant bridge has a third port and a fourth port, and the two ends of the first refrigerant flow path are connected to the third port and the fourth port, respectively; the first port communicates with the third port through a first bridge section, the first bridge section allowing unidirectional fluid flow from the first port to the third port; the third port communicates with the second port through a second bridge section, the second bridge section allowing unidirectional fluid flow from the second port to the third port; the second port communicates with the fourth port through a third bridge section, the third bridge section allowing unidirectional fluid flow from the fourth port to the second port; and the fourth port communicates with the first port through a fourth bridge section, the fourth bridge section allowing unidirectional fluid flow from the fourth port to the first port.

[0007] In some embodiments, the refrigerant bridge has a third port and a fourth port, and the two ends of the first refrigerant flow path are connected to the third port and the fourth port, respectively; the first port communicates with the third port through a first bridge section, the first bridge section allowing unidirectional fluid flow from the third port to the first port; the third port communicates with the second port through a second bridge section, the second bridge section allowing unidirectional fluid flow from the third port to the second port; the second port communicates with the fourth port through a third bridge section, the third bridge section allowing unidirectional fluid flow from the second port to the fourth port; and the fourth port communicates with the first port through a fourth bridge section, the fourth bridge section allowing unidirectional fluid flow from the first port to the fourth port.

[0008] In some embodiments, the first bridge section, the second bridge section, the third bridge section, and the fourth bridge section are each provided with a one-way valve.

[0009] In some embodiments, the liquid pickup pipe is provided with a liquid pickup throttle valve.

[0010] According to the invention, the return pipe includes a return pipe body, a first communication pipe, and a second communication pipe; one end of the first communication pipe communicates with the return pipe body and the other end communicates with the medium-pressure suction port of the compressor; the return pipe body or the first communication pipe is provided with a first control valve; and one end of the second communication pipe communicates with the return pipe body and the other end communicates with the suction pipe, and the second communication pipe is provided with a second control valve.

[0011] In some embodiments, an inflow end of the liquid pickup pipe communicates with the first piping between the economizer and the outdoor side heat exchanger, or an inflow end of the liquid pickup pipe communicates with the first piping between the economizer and the first indoor throttle regulator.

[0012] In some embodiments, an inflow end of the liquid pickup pipe has a liquid pickup port at a junction with the first piping, the liquid pickup port being located below the first piping around the liquid pickup port.

[0013] In some embodiments, the air conditioner further includes a liquid pickup structure having a liquid pickup chamber and a first refrigerant port, a second refrigerant port, and a liquid pickup port that communicate with the liquid pickup chamber, the liquid pickup port being located below the first refrigerant port and the second refrigerant port.

[0014] In some embodiments, the air conditioner further includes a second heat exchanger, a second throttle regulator, a third piping, and a branch pipe branching off from the discharge pipe, the third piping connecting a first intersection point of the first piping, the second throttle regulator, the second heat exchanger, and the branch pipe in sequence, where the first intersection point is located between the first throttle regulator and the outdoor heat exchanger, and the economizer is located on the first piping between the first intersection point and the outdoor heat exchanger.

[0015] In some embodiments, the third piping communicates with the branch pipe, and a third control valve is provided on the branch pipe to control the opening and closing of the branch pipe; and the third piping communicates with the low-pressure suction pipe or with the second piping through a coupling pipe, and a fourth control valve is provided on the coupling pipe to control the opening and closing of the coupling pipe.

[0016] In some embodiments, the air conditioner further includes a second switching device, the second switching device being capable of switching between a third switching state and a fourth switching state of the second switching device, where

in the third switching state, the second switching device causes the third piping to communicate with the branch pipe, and in the fourth switching state, the second switching device causes the third piping to communicate with the suction pipe.

[0017] In some embodiments, the air conditioner further includes an outdoor side throttle regulator, the outdoor side throttle regulator being located on the first piping between the economizer and the outdoor side heat exchanger.

[0018] In some embodiments, the air conditioner further includes: a first connection pipe branching off from a second intersection point of the first piping and a second connection pipe branching off from the second piping, the second intersection point being located between the first throttle regulator and the outdoor heat exchanger, and the air conditioner further includes multiple indoor units, the multiple indoor units being connected in parallel to the first connection pipe and the second connection pipe.

[0019] In some embodiments, the economizer includes a plate heat exchanger or a double-pipe heat exchanger having a first end and a second end provided opposite each other, where the first refrigerant flow path enters through the first end and exits through the second end and the second refrigerant flow path enters through the second end and exits through the first end; or the first refrigerant flow path enters through the second end and exits through the first end and the second refrigerant flow path enters through the first end and exits through the second end.

[0020] In the technical scheme of the present invention, by connecting the refrigerant inflow end of the first refrigerant flow path of the economizer to the refrigerant bridge and setting the flow direction of the second refrigerant flow path, the refrigerant flow directions in the first refrigerant flow path and the second refrigerant flow path are always opposite (whether in the heating mode where the refrigerant flows from the indoor heat exchanger to the outdoor heat exchanger, or in the cooling mode where the refrigerant flows from the outdoor heat exchanger to the indoor heat exchanger). In this way, the temperature difference between refrigerants in the first refrigerant flow path and the second refrigerant flow path is adequately maintained, so that the heat exchange effect between the first refrigerant flow path and the second refrigerant flow path can be ensured, which is conducive to ensuring the air replenishment effect of the economizer on the compressor in the heating mode, thus ensuring the heating capacity of the air conditioner in low-temperature environments; and which, at the same time, is conducive to ensuring the liquefaction effect (exhaust effect) of the economizer on the refrigerant in the cooling mode, ensuring that the refrigerant entering the indoor throttle device is in the liquid state, thus eliminating the abnormal sound generated in the indoor throttling process.

BRIEF DESCRIPTION OF DRAWINGS

[0021]

Fig. 1 is a schematic diagram of the structure of an embodiment of an air conditioner according to the present invention;

Fig. 2 is a schematic diagram of the structure of another embodiment of an air conditioner according to the present invention;

Fig. 3 is a schematic diagram of the internal structure of an embodiment in the heating mode at A in Fig. 2;

Fig. 4 is a schematic diagram of the internal structure of an embodiment in the cooling mode at A in Fig. 2;

Fig. 5 is a schematic diagram of the structure of another embodiment in the heating mode at A in Fig. 2;

Fig. 6 is a schematic diagram of the structure of another embodiment in the cooling mode at A in Fig. 2;

Fig. 7 is a partial enlarged view of an embodiment of a junction of a liquid pickup pipe with a first piping in an air conditioner according to the present invention;

Fig. 8 is a partial enlarged view of another embodiment of a junction of a liquid pickup pipe with a first piping in an air conditioner according to the present invention;

Fig. 9 is a partial enlarged view of yet another embodiment of a junction of a liquid pickup pipe with a first piping in an air conditioner according to the present invention; and

Fig. 10 is a partial enlarged view of yet another embodiment of a junction of a liquid pickup pipe with a first piping in an air conditioner according to the present invention.

Description of reference numerals:

[0022]

Reference numeral	Name	Reference numeral	Name
100	Outdoor unit	110	Compressor
111	Discharge pipe	112	Branch pipe
113	Low-pressure suction pipe	114	Coupling pipe
120	Gas-liquid separator	131	First switching device
132	Second switching device	133	First control valve
134	First liquid pickup point	140	First piping
141	Outdoor side heat exchanger	142	Outdoor side throttle regulator
143	Economizer	144	Liquid pickup throttle valve
143a	First refrigerant flow path	143b	Second refrigerant flow path
145	Liquid pickup pipe	146	return pipe
147	Second communication pipe	148	First communication pipe
149	Second control valve	150	Second piping
160	Third piping	135	Second liquid pickup point
200	Indoor unit	210	Second heat exchanger
220	First heat exchanger	230	Second throttle regulator
240	First throttle regulator	250	Second connection pipe

(continued)

Reference numeral	Name	Reference numeral	Name
260	First connection pipe	211	First intersection point
212	Second intersection point	P	Exhaust port
M	Medium-pressure suction port	S	Low-pressure suction port
310	Third control valve	320	Fourth control valve
510	First end	520	Second end
600	Refrigerant bridge	610	First port
620	Second port	630	Third port
640	Fourth port	650	First bridge section
660	Second bridge section	670	Third bridge section
680	Fourth bridge section	Q	First junction
800	Liquid pickup structure	810	Liquid pickup chamber
820	Second refrigerant port	830	First refrigerant port
840	Liquid pickup port	690	One-way valve

[0023] The achievement of the purpose, functional features and advantages of the present invention will be further illustrated in conjunction with the embodiments and with reference to the accompanying drawings.

DETAILED DESCRIPTION

[0024] The technical schemes in the embodiments of the present invention are described in the following with reference to the accompanying drawings in the embodiments of the present invention. All other embodiments obtained by those of ordinary skill in the art based on the embodiments of the present invention without inventive effort are within the scope of the present invention.

[0025] It should be noted that all directional indications (such as up, down, left, right, front, back, ...) in the embodiments of the present invention are used only to explain the relative position relationship, movement situation, etc., among the components in a particular attitude (as shown in the attached figures), and if that particular attitude is changed, the directional indications change accordingly.

[0026] The following illustration will focus on the specific structure of the air conditioner.

[0027] Referring to Figs. 1 to 4, the entire pipeline structure and component configuration of the air conditioner will first be introduced. In an embodiment of the present invention, the air conditioner includes an outdoor unit 100 and an indoor unit 200, where the outdoor unit 100 includes a compression mechanism and an outdoor side heat exchanger 141, and the indoor unit 200 includes a first heat exchanger 220 and a first throttle regulator 240; the air conditioner further includes: a discharge pipe 111 connected to a discharge side of the compression mechanism, a low-pressure suction pipe 113 connected to a low-pressure suction side of the compression mechanism, a first piping 140 connecting the discharge pipe 111, the outdoor side heat exchanger 141, the first throttle regulator 240, and the first heat exchanger 220 in sequence, and a second piping 150 connecting the first heat exchanger 220 and the low-pressure suction pipe 113, thus forming a refrigerant circuit; the outdoor unit 100 further includes a first switching device 131, the first switching device 131 being capable of switching between a first switching state of the first switching device 131 and a second switching state of the first switching device 131, where in the first switching state the first switching device 131 causes the first piping 140 to communicate with the suction pipe and the second piping 150 to communicate with the discharge pipe 111, and in the second switching state the first switching device 131 causes the first piping 140 to communicate with the discharge pipe 111 and the second piping 150 to communicate with the suction pipe.

[0028] By the setting of the first switching device 131, in the first switching state the air conditioner is in the heating state, i.e., the first heat exchanger 220 is in the heating operation. In the second switching state, the air conditioner is in the cooling state. The first switching device 131 may be a four-way valve.

[0029] The air conditioner further includes an economizer 143, where the economizer 143 is provided on the first piping 140 between the outdoor side heat exchanger 141 and the first throttle device; a first refrigerant flow path 143a and a second refrigerant flow path 143b are provided in the economizer 143, the first refrigerant flow path 143a being connected to the first piping 140 through a refrigerant bridge 600; and one end of the second refrigerant flow path 143b communicates with the first piping 140 through a liquid pickup pipe 145 and the other end communicates with both a medium-pressure suction port of the compressor 110 and the suction pipe through a return pipe 146, so that refrigerant flow directions in the first refrigerant flow path 143a and the second refrigerant flow path 143b are opposite.

[0030] Regarding the operation of the economizer 143, in the heating mode, the first switching device 131 is in the first state, in which case the discharge pipe 111 communicates with the second piping 150, so that the high-temperature and high-pressure refrigerant passes through the discharge pipe 111 and the second piping 150 and then enters the first heat exchanger 220 for heating, and then flows into the refrigerant bridge 600 through the first piping 140, and after being subject to the action of the refrigerant bridge 600, flows into the first refrigerant flow path 143a of the economizer 143, and flows back to the first piping 140 after passing through the first refrigerant flow path 143a, and passes through the outdoor throttle valve and the outdoor side heat exchanger 141, and then flows back to the compressor 110 through the suction pipe from the low-pressure suction port. The second refrigerant flow path 143b of the economizer 143, after liquid pickup and passing through the plate heat exchanger to exchange heat with the first refrigerant flow path 143a, flows through the return pipe 146 back to the medium-pressure suction pipe of the compressor 110. At the same time, the communication between the return pipe 146 and the suction pipe is cut off, so as to replenish air to the compressor 110, thus improving the heating capacity of the compressor 110 in low-temperature environments.

[0031] In the cooling mode, the first switching device 131 is in the second state, in which case the discharge pipe 111 communicates with the first piping 140, and the high-temperature and high-pressure refrigerant passes through the discharge pipe 111 and the first piping 140, enters the outdoor side heat exchanger 141, then passes through the outdoor side heat exchanger 141 and then the outdoor throttle valve, and then enters the first refrigerant flow path 143a of the economizer 143 through the refrigerant bridge 600, and the first refrigerant flow path 143a passes through the plate heat exchanger and then flows back to the first piping 140, and then along the first piping 140 and through the first indoor throttle device, enters the first heat exchanger 220 for cooling; the inflow end of the second refrigerant flow path communicates with the first piping 140, and the refrigerant passes through the plate heat exchanger to exchange heat with the refrigerant in the first refrigerant flow path 143a (to perform heat exchange through the plate heat exchanger), and then flows through the return pipe 146 and the suction pipe back to the low-pressure suction port of the compressor 110, so that the refrigerant entering the room through the economizer 143 and the first piping 140 is in the liquid state, thus avoiding the harsh and abnormal sound generated by the indoor throttle devices during the throttling process.

[0032] The economizer 143 includes a plate heat exchanger or a double-pipe heat exchanger having a first end 510 and a second end 520 provided opposite each other, where the first refrigerant flow path 143a enters through the first end 510 and exits through the second end 520 and the second refrigerant flow path 143b enters through the second end 520 and exits through the first end 510; or the first refrigerant flow path 143a enters through the second end 520 and exits through the first end 510 and the second refrigerant flow path 143b enters through the first end 510 and exits through the second end 520. The refrigerant in the first refrigerant flow path 143a and the refrigerant in the second refrigerant flow path 143b exchange heat through the plate heat exchanger or the double-pipe heat exchanger. Since the first refrigerant flow path 143a and the second refrigerant flow path 143b flow in opposite directions, the temperature difference between refrigerants in the first refrigerant flow path 143a and the second refrigerant flow path 143b is kept maximum, thus ensuring the heat exchange effect.

[0033] Regarding the refrigerant bridge 600, the refrigerant bridge 600 may be in various forms, as long as it enables, as the refrigerant passes through the first piping 140 (whether the refrigerant flows from the indoor heat exchanger to the outdoor side heat exchanger 141, or from the outdoor side heat exchanger 141 to the indoor heat exchanger), the refrigerant flow direction in the first refrigerant flow path 143a to be always opposite to the refrigerant flow direction in the second refrigerant flow path 143b so as to increase the temperature difference and thus ensure the heat exchange effect.

[0034] In this embodiment, by connecting the refrigerant inflow end of the first refrigerant flow path 143a of the economizer 143 to the refrigerant bridge 600 and setting the flow direction of the second refrigerant flow path 143b, the refrigerant flow directions in the first refrigerant flow path 143a and the second refrigerant flow path 143b are always opposite (whether in the heating mode where the refrigerant flows from the indoor heat exchanger to the outdoor side heat exchanger 141, or in the cooling mode where the refrigerant flows from the outdoor side heat exchanger 141 to the indoor heat exchanger). In this way, the temperature difference between refrigerants in the first refrigerant flow path 143a and the second refrigerant flow path 143b is adequately maintained, so that the heat exchange effect between the first refrigerant flow path 143a and the second refrigerant flow path 143b can be ensured, which is conducive to ensuring the air replenishment effect of the economizer 143 on the compressor 110 in the heating mode, thus ensuring the heating capacity of the air conditioner in low-temperature environments; and which, at the same time, is conducive to ensuring the liquefaction effect (exhaust effect) of the economizer 143 on the refrigerant in the cooling mode, ensuring that the refrigerant entering the indoor throttle device is in the liquid state, thus eliminating the abnormal sound generated in the indoor throttling process.

[0035] It is worth noting that the conception of the present invention can be used not only for conventional air conditioners, but also for situations where multiple indoor heat exchangers are provided in the same one indoor unit 200, and also for situations where the refrigerant system has multiple indoor units 200. The increase in the complexity of the structure of a single indoor unit 200 itself, or the increase in the number of indoor units 200, will increase the length of the refrigerant pipeline. The effect of the present invention is to eliminate abnormal sound.

[0036] The situation where multiple indoor heat exchangers are provided in a single indoor unit 200 will be described below:

The indoor unit 200 further includes a second heat exchanger 210, a second throttle regulator 230, and a thermal circulation device for delivering heat or cold from the indoor unit 200 into the room.

[0037] The air conditioner further includes a third piping 160 and a branch pipe 112 branching off from the discharge pipe 111, the third piping 160 connecting a first intersection point 211 of the first piping 140, the second throttle regulator 230, the second heat exchanger 210, and the branch pipe 112 in sequence so as to form a refrigerant circuit, where the first intersection point 211 is located between the first throttle regulator 240 and the outdoor side heat exchanger 141; and the economizer 143 is located on the first piping 140 between the first intersection point 211 and the outdoor side heat exchanger 141.

[0038] Here, in some embodiments, the thermal circulation device may be a wind wheel, and the rotation of the wind wheel delivers to the room the air for which heat has been exchanged with an initial heat exchanger and the second heat exchanger 210. Of course, in other embodiments, the thermal circulation device may also be a water circulation device, where the first heat exchanger 220 and the second heat exchanger 210 deliver heat or cold to the room through the circulating water flowing in the water circulation device.

[0039] On the basis of the above pipeline, the air conditioner can realize cooling by the first heat exchanger 220 and heating by the second heat exchanger 210, so that thermostatic dehumidification can be realized. Here, the first throttle regulator 240 includes a solenoid throttle valve, such as a solenoid expansion valve, and the second throttle regulator 230 includes a solenoid throttle valve, such as a solenoid expansion valve. The first switching device 131 is in the second state, where the first heat exchanger 220 performs cooling at which point the refrigerant is discharged from the discharge pipe 111 and enters the second heat exchanger 210 through the branch pipe 112 and the third piping 160; and the second heat exchanger 210 performs heating at which point the refrigerant flows out of the second heat exchanger 210 and then flows into the second piping 150 and, along the second piping 150, passes through the refrigerant bridge 600, the economizer 143, the outdoor side heat exchanger 141 and the suction pipe and flows back to the low-pressure suction port of the compressor 110.

[0040] In some other embodiments, the air conditioner further includes a second switching device 132, the second switching device 132 being capable of switching between a third switching state and a fourth switching state of the second switching device 132, where in the third switching state, the second switching device 132 causes the third piping 160 to communicate with the branch pipe 112, and in the fourth switching state, the second switching device 132 causes the third piping 160 to communicate with the suction pipe.

[0041] By the setting of the second switching device 132, in the third switching state, the air conditioner is in a thermostatic dehumidification state. In the fourth switching state, the air conditioner is in the cooling state, i.e., the first heat exchanger 220 and the second heat exchanger 210 perform cooling at the same time. The second switching device 132 may be a four-way valve. Also connected to the second switching device 132 is an auxiliary branch pipe, which communicates with the suction pipe when the third piping 160 communicates with the branch pipe 112. When the third piping 160 communicates with the low-pressure suction pipe 113, the auxiliary branch pipe communicates with the low-pressure suction pipe 113 and the branch pipe 112. A filter and a capillary are provided on the auxiliary branch pipe.

[0042] Of course, in some embodiments, the first switching device 131 and the second switching device 132 may exist at the same time, so that the air conditioner can be switched among three states of thermostatic dehumidification, heating only and cooling only.

[0043] In order to better regulate the subcooling degree of the outdoor side heat exchanger 141, the air conditioner further includes an outdoor side throttle regulator 142, the outdoor side throttle regulator 142 being located on the first piping 140 between the economizer 143 and the outdoor side heat exchanger 141. The outdoor side throttle regulator 142 includes an outdoor throttle valve, such as an electronic expansion valve.

[0044] The specific operation of the economizer 143 will be described below based on the situation where there exist a first indoor heat exchanger and a second indoor heat exchanger in the room.

[0045] In order to improve the heating capacity of the air conditioner at low temperatures, the air conditioner further includes the economizer 143; the economizer 143 is provided on the first piping 140 between the outdoor side heat exchanger 141 and the first intersection point 211, and the return pipe 146 of the economizer 143 communicates with the medium-pressure suction port of the compressor 110. The return pipe 146 may be in various forms, and the return pipe 146 may include only the return pipe 146 body, or may include the return pipe 146 body and the first communication pipe 148, one end of the first communication pipe 148 communicating with the return pipe 146 body and the other end communicating with the medium-pressure suction port of the compressor 110.

[0046] A first control valve 133 is provided on the return pipe 146 or on the first communication pipe 148 between the return pipe 146 and the medium-pressure suction port of the compressor 110. The compressor 110 at this point is an enhanced vapor injection compressor 110 having a low-pressure suction port and a medium-pressure suction port. The liquid pickup pipe 145 is provided with a liquid pickup throttle valve 144. In this way, the discharge from the compressor 110, after being switched by the first switching device 131 and the second switching device 132, enters the second heat exchanger 210 (the refrigerant enters through the third piping 160) and the first heat exchanger 220 (the refrigerant enters through the first piping 140), respectively, for heating, and the liquid refrigerant coming from the second heat exchanger 210 and the first heat exchanger 220 is divided into two parts when it passes through the economizer 143: the first part (through the refrigerant bridge 600 and the first refrigerant flow path 143a) is directly subjected to throttling and pressure reduction by the outdoor side throttle regulator 142 (electronic expansion valve) and then enters the outdoor side heat exchanger 141 for evaporation and heat absorption; and the second part (through the second refrigerant flow path 143b) is subjected to throttling and pressure reduction by the liquid pickup throttle valve 144 (electronic expansion valve), and then enters the economizer 143 through the liquid pickup pipe 145 for heat absorption and evaporation, and the evaporated medium-pressure saturated vapor passes through the return pipe 146, the first control valve 133, and the connection pipe and enters the medium-pressure suction port of the compressor 110, and is compressed after being mixed with the refrigerant from the low-pressure suction port of the compressor 110, thus solving the problems of low refrigerant flow, low back pressure, and high compression ratio in low-temperature environments, and improving the low-temperature heat production and the reliability of the system. With the technology of the present invention, when the outdoor environment temperature is low, the system design of the enhanced vapor injection compressor 110 and the economizer 143 increases the refrigerant suction amount of the compressor 110 in low-temperature environments, which in turn increases the heat production at a low temperature, while reducing the compression ratio in low-temperature environments, so the reliability of the system can be improved.

[0047] In order to improve the liquid pickup effect, the inflow end of the liquid pickup pipe 145 communicates with the first piping 140 between the economizer 143 and the outdoor side heat exchanger 141, while in some other embodiments, the inflow end of the liquid pickup pipe 145 may also communicate with the first piping 140 between the economizer 143 and the first intersection point 211 (in the absence of the first intersection point 211, the inflow end of the liquid pickup pipe 145 communicates with the first piping 140 between the economizer 143 and the first indoor throttle regulator). That is, the refrigerant flows in through the refrigerant outflow end of the economizer 143, which is conducive to improving the reliability of liquid pickup.

[0048] The junction between the inflow end of the liquid pickup pipe 145 and the first piping 140 is referred to as the liquid pickup point. As for the selection of the liquid pickup point, it will be beneficial for different working conditions to select corresponding liquid pickup points under different working conditions. When the inflow end of the liquid pickup pipe 145 communicates with the first piping 140 between the economizer 143 and the outdoor side heat exchanger 141, the connection position is referred to as a first liquid pickup point 134, or referred to as an upstream liquid pickup point; and when the inflow end of the liquid pickup pipe 145 communicates with the first piping 140 between the economizer 143 and the first intersection point 211 (or the first indoor throttle regulator), the connection position is referred to as a second liquid pickup point 135, or referred to as a downstream liquid pickup point. In the situation of heating by the indoor heat exchanger where the enhanced vapor injection needs to be turned on, the first liquid pickup point 134 or the upstream liquid pickup point is selected in order to replenish air to the compressor 110, thus increasing its heating capacity in low-temperature environments; and in the situation of cooling or thermostatic dehumidification (or dehumidification and reheating) by the indoor heat exchanger, the second liquid pickup point 135 or the downstream liquid pickup point is selected to cause the refrigerant entering the indoor unit 200 to be liquid as much as possible, thus avoiding the generation of abnormal sound during indoor throttling.

[0049] Referring to Figs. 7-10, in some embodiments, in order to ensure the liquid pickup effect, the inflow end of the liquid pickup pipe 145 has a liquid pickup port 840 at a junction with the first piping 140, the liquid pickup port 840 being located below the first piping 140 around the liquid pickup port 840. By setting the position of the liquid pickup port 840 to be lower than that of the first piping 140, because the liquid refrigerant flows along the lower side pipe wall of the first piping 140 (the density of the refrigerant in the liquid state is greater than that in the gaseous state), so that when the refrigerant passes through the liquid pickup port 840, the liquid refrigerant enters preferentially under the action of gravity, thus ensuring that refrigerant picked up at the liquid pickup port 840 is in the liquid state.

[0050] The liquid pickup port 840 may be formed in many ways, such as, for example, providing a liquid pickup structure 800 at the junction of the liquid pickup pipe 145 with the first piping 140, where the liquid pickup structure 800 has a liquid pickup chamber 810 and three refrigerant ports that communicate with the liquid pickup chamber 810, namely, a first refrigerant port 830, a second refrigerant port 820 and a liquid pickup port 840, the liquid pickup port 840 being located below the first refrigerant port 830 and the second refrigerant port 820. Both the first refrigerant port 830 and the second refrigerant port 820 communicate with the first piping 140, and the liquid pickup port 840 communicates with the inflow end of the liquid pickup pipe 145. Specifically, the first refrigerant port 830 communicates with the first piping 140 near the outdoor heat exchanger, and the second refrigerant port 820 communicates with the first piping 140 near the first indoor throttle regulator. The liquid pickup port 840 is located at the bottom of the liquid pickup structure 800. The liquid pickup structure 800 may be in various shapes, such as rectangular, square, column, etc. The first refrigerant port 830 and the second refrigerant port 820 may be located at the two ends or at the top of the liquid pickup structure 800, but, of course, in some embodiments, the first piping 140 may also extend into the liquid pickup chamber 810 through the first refrigerant port

830 and the second refrigerant port 820.

[0051] In some other embodiments, in order to avoid unpleasant abnormal sound generated when the refrigerant in the gas-liquid two-phase state passes through the indoor throttle device, the air conditioner further includes a gas-liquid separator 120 and the economizer 143, the gas-liquid separator 120 being provided on the low-pressure suction pipe 113; and the economizer 143 is provided on the first piping 140 between the outdoor side heat exchanger 141 and the first intersection point 211, and the return pipe 146 of the economizer 143 communicates with the gas-liquid separator 120. The return pipe 146 includes the return pipe 146 body and the second communication pipe 147, one end of the second communication pipe 147 communicating with the return pipe 146 body and the other end communicating with the gas-liquid separator 120. For ease of control, in some examples, the return pipe 146 communicates with the gas-liquid separator 120 through the low-pressure suction pipe 113, and a second control valve 149 is provided on the return pipe 146 or the second connection pipe 250 between the return pipe 146 and the low-pressure suction pipe 113.

[0052] In the present invention, by adopting the system design with the economizer 143 on the basis of the three-pipe system, by controlling the liquid pickup throttle valve 144 (electronic expansion valve) in the system design circuit with the economizer 143, the refrigerant condensing temperature at the outlet of the outdoor side heat exchanger 141 is further reduced, which improves the subcooling degree and causes the refrigerant to condense completely to the liquid state, and the liquid refrigerant enters the indoor heat exchanger for heat absorption and evaporation after the throttling and pressure reduction by the indoor electronic expansion valves, so that the refrigerant passing through the indoor throttle devices is in the full liquid state, thus solving the problem of abnormal sound of refrigerant generated by the gas-liquid two-phase state refrigerant.

[0053] After the discharge of the compressor 110 is switched by the first switching device 131, the high-pressure and high-temperature gaseous refrigerant enters the outdoor side heat exchanger 141 for condensation and heat exchange, and the medium-temperature and high-pressure refrigerant in the gas-liquid two-phase state coming out of the outdoor side heat exchanger 141 enters the economizer 143 and is then divided into two parts: the first part, after the throttling and pressure reduction by the liquid pickup throttle valve 144, passes through the liquid pickup pipe 145 and then enters the economizer 143 for heat absorption and evaporation, and the evaporated gaseous refrigerant enters the gas-liquid separator 120 through the return pipe 146, the second control valve 149 (solenoid valve) and the connection pipe, and after being mixed with the gaseous refrigerant that has been subjected to heat absorption and evaporation by the indoor heat exchanger, enters the suction port of the compressor 110 together; and the second part, after further condensation and heat exchange by the economizer 143, is changed from gas-liquid two-phase refrigerant to pure liquid refrigerant, and this part of pure liquid refrigerant flows to the room, and then, after the throttling and pressure reduction by a dehumidification throttle valve and a reheating throttle valve, enters the first heat exchanger 220 and the second heat exchanger 210 for heat absorption and evaporation, respectively. Since the state of the refrigerant entering the first throttle regulator 240 and the second throttle regulator 230 (electronic expansion valve) changes from the gas-liquid two-phase state to the pure liquid state, the problem of abnormal sound of refrigerant caused by gas-liquid two-phase refrigerant when passing through throttle devices is solved.

[0054] In this embodiment, by means of the technical scheme of the present invention, the refrigerant condensing temperature at the outlet of the outdoor side heat exchanger 141 is further reduced, which improves the subcooling degree and causes the refrigerant to condense completely to the liquid state from the gas-liquid two-phase state, and the liquid refrigerant enters the indoor heat exchanger for heat absorption and evaporation after the throttling and pressure reduction by the indoor electronic expansion valves (the first throttle regulator 240 and the second throttle regulator 230), so that the refrigerant passing through the indoor throttle devices (the first throttle regulator 240 and the second throttle regulator 230) is in the full liquid state, thus solving the problem of abnormal sound of refrigerant generated by the gas-liquid two-phase refrigerant when passing through the throttle regulators, thereby improving the satisfaction of users

[0055] It is worth noting that, in some embodiments, the return pipe 146 communicates with the medium-pressure suction port of the compressor 110 and the gas-liquid separator 120, respectively, through different communication pipes, in which case the two communication pipes (the first communication pipe 148 and the second communication pipe 147) are provided with the first control valve 133 (near the compressor 110) and the second control valve 149 (near the gas-liquid separator 120), respectively. The return pipe 146 according to the invention includes the return pipe 146 body and the two communication pipes. In the heating mode, the second control valve 149 is closed and the first control valve 133 is opened, allowing the refrigerant to flow into the compressor 110 to improve heating capacity. In the cooling mode or thermostatic dehumidification mode, the first control valve 133 is closed and the second control valve 149 is opened to eliminate the abnormal sound. Of course, in some embodiments, the second control valve 149 may also be closed and the first control valve 133 opened due to special working conditions. By means of such settings, the air conditioner can adjust the first control valve 133 and the second control valve 149 according to the specific situation, thus improving the heating capacity of the air conditioner in the heating mode and reducing noise in the cooling and thermostatic dehumidification modes.

[0056] Regarding the specific connection of the compressor 110 to the economizer 143, the compressor 110 is an enhanced vapor injection compressor 110, and this compressor 110 has a medium-pressure suction port M (i.e., vapor injection port) in addition to the conventional high-pressure exhaust port P and low-pressure suction port S, where the medium-pressure refrigerant vapor enters the compressor 110 through this vapor injection port to increase the effective flow of refrigerant.

[0057] The a port of the economizer 143 is connected to a third port 630 of the refrigerant bridge 600, the b port of the economizer 143 is connected to a fourth port 640 of the refrigerant bridge 600, the c port of the economizer 143 is connected to the liquid pickup pipe 145, the d port of the economizer 143 is connected to the return pipe 146, the liquid pickup throttle valve 144 is connected in series to the liquid pickup pipe 145, the first control valve 133 is connected in series to a communication pipe, and the second control valve 149 is connected in series to another communication pipe, with one end of the communication pipe being connected to the medium-pressure suction port M of the compressor 110, and the other communication pipe being connected to the inlet end of the gas-liquid separator 120.

[0058] In some embodiments, the air conditioner further includes multiple indoor units 200, and the form of heat exchangers included in each indoor unit 200 may be different, for example, one or more of an indoor machine with thermostatic dehumidification function (having both the first heat exchanger 220 and the second heat exchanger 210), an ordinary cooling/heating indoor machine (having only one heat exchanger and a corresponding throttle device), and an indoor machine with a conversion device that can freely switch between cooling or heating states may be included, so that the air conditioner can perform mixed operations of thermostatic dehumidification, cooling and heating at the same time.

[0059] Specifically, the air conditioner further includes: a first connection pipe 260 branching off from a second intersection point 212 of the first piping 140 and a second connection pipe 250 branching off from the second piping 150, the second intersection point 212 being located between the first throttle regulator 240 and the outdoor side heat exchanger 141, and the air conditioner further includes multiple indoor units 200, the multiple indoor units 200 being connected in parallel to the first connection pipe 260 and the second connection pipe 250.

[0060] In some embodiments, in order to improve the reliability of the second switching device 132, instead of using a four-way valve, the second switching device 132 is controlled using two solenoid valves. Specifically, the third piping 160 communicates with the branch pipe 112 and communicates with the low-pressure suction pipe 113 or the second piping 150, with a third control valve 310 being provided on the branch pipe 112, and the third piping 160 communicates with the low-pressure suction pipe 113 or with the second piping 150 through the coupling pipe 114, with a fourth control valve 320 being provided on the coupling pipe 114. It is worth noting that the end of the coupling pipe 114 away from the third piping 160 may communicate with either the second piping 150 between the first switching device 131 and the indoor heat exchanger or the second piping 150 between the first switching device 131 and the gas-liquid separator 120. Since the third control valve 310 and the fourth control valve 320 are separate control valves, the structure is simpler and more stable and reliable compared to the four-way valve. In addition, the third control valve 310 and the fourth control valve 320 may be solenoid valves. The solenoid valve can still work stably and reliably when liquid refrigerant enters, while in the four-way valve, if liquid refrigerant enters, its working stability will be affected. Therefore, the use of separate third control valve 310 and fourth control valve 320 can improve the stability and reliability of the operation and state switching of the air conditioner.

[0061] It is worth noting that the states of the third control valve 310 and the fourth control valve 320 in the case of power off may be set according to the actual requirements of the working conditions. Take the third control valve 310 as an example. During the operation of the air conditioner, the third control valve 310 maintains a normally open state for a long period of time, in which case the third control valve 310 may be selected as a normally open valve, that is, most of its work can be completed in the power-off state, and it needs to be powered on only when the state of the third control valve 310 needs to be switched. Similarly, if the third control valve 310 maintains a normally closed state for a long time, it is selected to be a normally closed valve. In this way, it is conducive to reducing the electrical energy consumed by the second switching device 132 (including the third control valve 310) during the operation of the air conditioner, thus contributing to the rational use of energy.

[0062] In some embodiments, in order to simplify the pipeline structure, the third piping 160, the branch pipe 112 and the coupling pipe 114 are connected at the first junction Q. Of course, the low-pressure suction pipe 113 may communicate with the other two pipes through the coupling pipe 114. In this case, one three-way valve may be provided at the first junction Q instead of two two-way valves. The three-way valve realizes the communication of the third piping 160 to the coupling pipe 114 and the branch pipe 112, respectively, and may control the opening and closing of the coupling pipe 114 and the branch pipe 112, respectively. In this way, it is conducive to improving the convenience of the connection of the third piping 160, the coupling pipe 114 and the branch pipe 112.

Cooling mode:

[0063] The high-temperature and high-pressure refrigerant is discharged from an exhaust pipe and passes through the first switching device 131, the first piping 140, the outdoor side heat exchanger 141, and the economizer 143 in sequence, and then enters an evaporation heat exchanger and the first heat exchanger 220, respectively, for cooling. One part flows out of the first heat exchanger 220, passes through the second piping 150 and the first switching device 131 (which may be absent in some embodiments), and flows into the gas-liquid separator 120; and the other part flows out of the evaporation heat exchanger, passes through the third piping 160 and enters the coupling pipe 114, and when the coupling pipe 114 communicates with the low-pressure suction pipe 113, the refrigerant enters the gas-liquid separator 120 through the low-pressure suction pipe 113; and when the coupling pipe 114 communicates with the second piping 150, the refrigerant flows into the second piping 150 through the coupling pipe 114, and then flows into the gas-liquid separator 120 through the second piping 150. In this process, the third control valve 310 is closed and the fourth control valve 320 is opened.

Heating mode:

[0064] The high-temperature and high-pressure refrigerant is discharged from the exhaust pipe, and one part thereof passes through the first switching device 131 (which may be absent in some embodiments) and the second piping 150 in sequence, then enters the first heat exchanger 220 for heating, and then flows out of the first heat exchanger 220 and enters the first piping 140; and the other part passes through the branch pipe 112 and the third piping 160 in sequence and enters the second heat exchanger 210 for heating, and flows out of the second heat exchanger 210 and then enters the first piping 140, passes through the economizer 143, the outdoor side heat exchanger 141, and the first switching device 131, and then flows into the gas-liquid separator 120. In this process, the third control valve 310 is opened and the fourth control valve 320 is closed.

Thermostatic dehumidification mode:

[0065] The high-temperature and high-pressure refrigerant is discharged from the exhaust pipe, and one part thereof passes through the first switching device 131 (which may be absent in some embodiments), the first piping 140, the outdoor side heat exchanger 141, and the economizer 143 in sequence, and then enters the first heat exchanger 220 for cooling, and then passes through the second piping 150 and the first switching device 131 and flows into the gas-liquid separator 120. The other part passes through the branch pipe 112 and the third piping 160 in sequence and enters the second heat exchanger 210 for heating, and then flows into the first heat exchanger 220 for cooling. In this process, the third control valve 310 is opened and the fourth control valve 320 is closed.

[0066] The specifics of the refrigerant bridge 600 will be described with an example as follows:

The refrigerant bridge 600 has a first port 610, a second port 620, and a refrigerant passage that causes the first port 610 to communicate with the second port 620, and the refrigerant bridge 600 is connected to the first piping 140 through the first port 610 and the second port 620. Specifically, the first port 610 communicates with the first piping 140 near the outdoor side heat exchanger 141, and the second port 620 communicates with the first piping 140 near the indoor unit 200. The refrigerant bridge 600 further has a second port 620 and a fourth port 640, where the refrigerant bridge 600 is connected to the first refrigerant flow path of the economizer 143 through the second port 620 and the fourth port 640. The refrigerant may enter the refrigerant bridge 600 through the first port 610 or the second port 620, flow into the first refrigerant flow path 143a through the third port 630 (the fourth port 640), pass through the first refrigerant flow path 143a and then enter the refrigerant bridge 600 through the fourth port 640 (the third port 630), and then flow into the first piping 140 through the second port 620 or the first port 610.

[0067] There are many approaches of allowing unidirectional fluid flow between adjacent ports, as illustrated by two specific examples below:

In the first approach, the refrigerant bridge 600 has a third port 630 and a fourth port 640, with the two ends of the first refrigerant flow path 143a being connected to the third port 630 and the fourth port 640, respectively; the first port 610 communicates with the third port 630 through a first bridge section 650, the first bridge section 650 allowing unidirectional fluid flow from the first port 610 to the third port 630; the third port 630 communicates with the second port 620 through a second bridge section 660, the second bridge section 660 allowing unidirectional fluid flow from the second port 620 to the third port 630; the second port 620 communicates with the fourth port 640 through a third bridge section 670, the third bridge section 670 allowing unidirectional fluid flow from the fourth port 640 to the second port 620; and the fourth port 640 communicates with the first port 610 through a fourth bridge section 680, the fourth bridge section 680 allowing unidirectional fluid flow from the fourth port 640 to the first port 610.

[0068] Two examples are given below for illustration:

Referring to Fig. 3, in the heating mode of the indoor machine, liquid pickup is conducted at the first liquid pickup point 134 (the upstream liquid pickup point):

The refrigerant, after flowing out of the indoor heat exchanger, enters the first piping 140, and enters the first bridge section 650 along the first piping 140 through the first port 610, flows out through the third port 630 and then enters the first refrigerant flow path 143a of the economizer 143, enters through the first end 510 (in some embodiments, it may also enter through the second end 520 and flow out through the first end 510) into the plate heat exchanger or double-pipe heat exchanger for heat exchange and then flows out through the second end 520, and then enters the third bridge section 670 through the fourth port 640, flows out of the refrigerant bridge 600 through the second port 620 and enters the first piping

140, and then passes through the outdoor side throttle regulator 142 and the outdoor side heat exchanger 141 in sequence.

[0069] The refrigerant, after being subjected to liquid pickup at the first liquid pickup point 134 by the liquid pickup pipe 145, passes through the liquid pickup throttle valve 144 and enters through the second end 520 into the plate heat exchanger or double-pipe heat exchanger for heat exchange, and then flows out through the first end 510 (in some embodiments it may also enter through the first end 510 and flow out through the second end 520, as long as it is opposite to the first refrigerant flow path 143a), and then enters the return pipe 146 and, along the return pipe 146, flows back to the medium-pressure suction port of the compressor 110.

[0070] Referring to Fig. 4, in the cooling or dehumidification and reheating mode of the indoor machine, liquid pickup is conducted at the second liquid pickup point 135 (the downstream liquid pickup point):

The refrigerant, after flowing out of the outdoor side heat exchanger 141, enters the first piping 140, and enters the second bridge section 660 along the first piping 140 through the second port 620, flows out through the third port 630 and then enters the first refrigerant flow path 143a of the economizer 143, enters through the first end 510 (in some embodiments, it may also enter through the second end 520 and flow out through the first end 510) into the plate heat exchanger or double-pipe heat exchanger for heat exchange and then flows out through the second end 520, and then enters the fourth bridge section 680 through the fourth port 640, flows out of the refrigerant bridge 600 through the first port 610 and enters the first piping 140, and then enters the indoor heat exchanger.

[0071] The refrigerant, after being subjected to liquid pickup at the second liquid pickup point 135 by the liquid pickup pipe 145, passes through the liquid pickup throttle valve 144 and enters through the second end 520 into the plate heat exchanger or double-pipe heat exchanger for heat exchange, and then flows out through the first end 510 (in some embodiments it may also enter through the first end 510 and flow out through the second end 520, as long as it is opposite to the first refrigerant flow path 143a), and then enters the return pipe 146, and along the return pipe 146 it flows back to the medium-pressure suction port of the compressor 110.

[0072] In the second approach, the refrigerant bridge 600 has a third port 630 and a fourth port 640, with the two ends of the first refrigerant flow path 143a being connected to the third port 630 and the fourth port 640, respectively; the first port 610 communicates with the third port 630 through a first bridge section 650, the first bridge section 650 allowing unidirectional fluid flow from the third port 630 to the first port 610; the third port 630 communicates with the second port 620 through a second bridge section 660, the second bridge section 660 allowing unidirectional fluid flow from the third port 630 to the second port 620; the second port 620 communicates with the fourth port 640 through a third bridge section 670, the third bridge section 670 allowing unidirectional fluid flow from the second port 620 to the fourth port 640; and the fourth port 640 communicates with the first port 610 through a fourth bridge section 680, the fourth bridge section 680 allowing unidirectional fluid flow from the first port 610 to the fourth port 640.

[0073] Two examples are given below for illustration:

Referring to Fig. 5, in the heating mode of the indoor machine, liquid pickup is conducted at the first liquid pickup point 134 (the upstream liquid pickup point):

The refrigerant, after flowing out of the indoor heat exchanger, enters the first piping 140, and enters the fourth bridge section 680 along the first piping 140 through the first port 610, flows out through the fourth port 640 and then enters the first refrigerant flow path 143a of the economizer 143, enters through the second end 520 (in some embodiments, it may also enter through the first end 510 and flow out through the second end 520) into the plate heat exchanger or double-pipe heat exchanger for heat exchange and then flows out through the first end 510, and then enters the second bridge section 660 through the third port 630, flows out of the refrigerant bridge 600 through the second port 620 and enters the first piping 140, and then passes through the outdoor side throttle regulator 142 and the outdoor side heat exchanger 141 in sequence.

[0074] The refrigerant, after being subjected to liquid pickup at the first liquid pickup point 134 by the liquid pickup pipe 145, passes through the liquid pickup throttle valve 144 and enters through the first end 510 into the plate heat exchanger or double-pipe heat exchanger for heat exchange, and then flows out through the second end 520 (in some embodiments it may also enter through the second end 520 and flow out through the first end 510, as long as it is opposite to the refrigerant flow direction in the first refrigerant flow path 143a), and then enters the return pipe 146 and, along the return pipe 146, flows back to the medium-pressure suction port of the compressor 110.

[0075] Referring to Fig. 6, in the cooling or dehumidification and reheating mode of the indoor machine, liquid pickup is conducted at the second liquid pickup point 135 (the downstream liquid pickup point).

[0076] The refrigerant, after flowing out of the outdoor side heat exchanger 141, enters the first piping 140, and enters the third bridge section 670 along the first piping 140 through the second port 620, flows out through the fourth port 640 and then enters the first refrigerant flow path 143a of the economizer 143, enters through the second end 520 (in some embodiments, it may also enter through the first end 510 and flow out through the second end 520) into the plate heat exchanger or double-pipe heat exchanger for heat exchange and then flows out through the first end 510, and then enters the first bridge section 650 through the third port 630, flows out of the refrigerant bridge 600 through the first port 610 and enters the first piping 140, and then enters the indoor heat exchanger.

[0077] The refrigerant, after being subjected to liquid pickup at the second liquid pickup point 135 by the liquid pickup pipe 145, passes through the liquid pickup throttle valve 144 and enters through the first end 510 into the plate heat exchanger or double-pipe heat exchanger for heat exchange, and then flows out through the second end 520 (in some embodiments it may also enter through the second end 520 and flow out through the first end 510, as long as it is opposite to the first refrigerant flow direction), and then enters the return pipe 146 and, along the return pipe 146, flows back to the medium-pressure suction port of the compressor 110.

[0078] Here, there are various approaches of allowing unidirectional fluid flow, taking the setting of one-way valve 690 as an example, the first bridge section 650, the second bridge section 660, the third bridge section 670, and the fourth bridge section 680 are each provided with a one-way valve 690 to achieve unidirectional fluid flow with each bridge section.

Claims

1. An air conditioner, comprising: an outdoor unit (100) comprising an enhanced vapor compression mechanism and an outdoor heat exchanger; an indoor unit (200) comprising a first heat exchanger (220) and a first throttle regulator (240); a discharge pipe (111) connected to a discharge side of the compression mechanism, a low-pressure suction pipe (113) connected to a low-pressure suction side of the compression mechanism, a first piping (140) connecting the discharge pipe (111), the outdoor heat exchanger, the first throttle regulator (240), and the first heat exchanger (220) in sequence, and a second piping (150) connecting the first heat exchanger (220) and the low-pressure suction pipe (113), thus forming a refrigerant circuit; a first switching device (131) capable of switching between: a first switching state of the first switching device (131), in which the first switching device (131) causes the first piping (140) to communicate with the suction pipe and causes the second piping (150) to communicate with the discharge pipe (111); and a second switching state of the first switching device (131), in which the first switching device (131) causes the first piping (140) to communicate with the discharge pipe (111) and causes the second piping (150) to communicate with the suction pipe; and an economizer (143) arranged on the first piping (140) between the outdoor heat exchanger and the first throttle device; a first refrigerant flow path (143a) arranged in the economizer (143) and connected to the first piping (140) through a refrigerant bridge (600); and a second refrigerant flow path (143b) arranged in the economizer (143), one end of the second refrigerant flow path (143b) communicating with the first piping (140) through a liquid pickup pipe (145) and the other end of the second refrigerant flow path (143b) communicating with both a medium-pressure suction port of the compressor (110) and the suction pipe through a return pipe (146), wherein refrigerant flow directions in the first refrigerant flow path (143a) and the second refrigerant flow path (143b) are opposite;
characterised in that the return pipe (146) comprises a return pipe body, a first communication pipe (148), and a second communication pipe (147); one end of the first communication pipe (148) communicates with the return pipe body and the other end of the first communication pipe (148) communicates with the medium-pressure suction port of the compressor (110); the return pipe body or the first communication pipe (148) is provided with a first control valve (133); and one end of the second communication pipe (147) communicates with the return pipe body and the other end of the second communication pipe (147) communicates with the suction pipe, and the second communication pipe (147) is provided with a second control valve (149).

2. The air conditioner of claim 1, wherein: the refrigerant bridge (600) has a first port (610), a second port (620), and a refrigerant passage that causes the first port (610) to communicate with the second port (620); and the refrigerant bridge (600) is connected to the first piping (140) through the first port (610) and the second port (620).

3. The air conditioner of claim 2, wherein: the refrigerant bridge (600) has a third port (630) and a fourth port (640); the two ends of the first refrigerant flow path (143a) are connected to the third port (630) and the fourth port (640), respectively; the first port (610) communicates with the third port (630) through a first bridge section (650) which allows unidirectional fluid flow from the first port (610) to the third port (630); the third port (630) communicates with the second port (620) through a second bridge section (660) which allows unidirectional fluid flow from the second port (620) to the third port (630); the second port (620) communicates with the fourth port (640) through a third bridge section (670) which allows unidirectional fluid flow from the fourth port (640) to the second port (620); and the fourth port (640) communicates with the first port (610) through a fourth bridge section (680) which allows unidirectional fluid flow from the fourth port (640) to the first port (610).

4. The air conditioner of claim 2, wherein: the refrigerant bridge (600) has a third port (630) and a fourth port (640); the two ends of the first refrigerant flow path (143a) are connected to the third port (630) and the fourth port (640), respectively; the first port (610) communicates with the third port (630) through a first bridge section (650) which allows unidirectional fluid flow from the third port (630) to the first port (610); the third port (630) communicates with the second port (620) through a second bridge section (660) which allows unidirectional fluid flow from the third port (630) to the second port (620); the second port (620) communicates with the fourth port (640) through a third bridge section

(670) which allows unidirectional fluid flow from the second port (620) to the fourth port (640); and the fourth port (640) communicates with the first port (610) through a fourth bridge section (680) which allows unidirectional fluid flow from the first port (610) to the fourth port (640).

5. The air conditioner of claim 4, wherein the first bridge section (650), the second bridge section (660), the third bridge section (670), and the fourth bridge section (680) are each provided with a one-way valve (690).

6. The air conditioner of claim 1, wherein the liquid pickup pipe (145) is provided with a liquid pickup throttle valve (144).

7. The air conditioner of claim 1, wherein: an inflow end of the liquid pickup pipe (145) communicates with the first piping (140) between the economizer (143) and the outdoor side heat exchanger; or an inflow end of the liquid pickup pipe (145) communicates with the first piping (140) between the economizer (143) and the first indoor throttle regulator.

8. The air conditioner of claim 1, wherein an inflow end of the liquid pickup pipe (145) has a liquid pickup port (840) at a junction with the first piping (140), the liquid pickup port (840) is located below the first piping (140).

9. The air conditioner of claim 8, further comprising: a liquid pickup structure (800) comprising: a liquid pickup chamber (810); a first refrigerant port (830) communicating with the liquid pickup chamber (810); a second refrigerant port (820) communicating with the liquid pickup chamber (810); and a liquid pickup port (840) communicating with the liquid pickup chamber (810), the liquid pickup port (840) being located below the first refrigerant port (830) and the second refrigerant port (820).

10. The air conditioner of claim 1, further comprising: a second heat exchanger (210); a second throttle regulator (230); a branch pipe (112) branching off from the discharge pipe (111); and a third piping (160) connecting a first intersection point (211) of the first piping, the second throttle regulator (230), the second heat exchanger (210), and the branch pipe (112) in sequence; wherein the first intersection point (211) is located between the first throttle regulator (240) and the outdoor heat exchanger, the economizer (143) is located on the first piping (140) between the first intersection point (211) and the outdoor heat exchanger.

11. The air conditioner of claim 10, further comprising: a coupling pipe (114); a third control valve (310) arranged on the branch pipe (112)to control the opening and closing of the branch pipe (112); and a fourth control valve (320) arranged on the coupling pipe (114) to control the opening and closing of the coupling pipe (114); wherein the third piping (160) communicates with the branch pipe (112), the third piping (160) communicates with the low-pressure suction pipe (113) or with the second piping (150) through the coupling pipe (114), optionally, further comprising: a second switching device (132) capable of switching between a third switching state of the second switching device (132), in which the second switching device (132) causes the third piping (160) to communicate with the branch pipe (112), and a fourth switching state of the second switching device (132), in which the second switching device (132) causes the third piping (160) to communicate with the suction pipe.

12. The air conditioner of claim 1, further comprising an outdoor side throttle regulator (142), the outdoor side throttle regulator (142) being located on the first piping (140) between the economizer (143) and the outdoor side heat exchanger.

13. The air conditioner of claim 1, further comprising: a first connection pipe (260) branching off from a second intersection point (212) of the first piping (140), the second intersection point (212) being located between the first throttle regulator (240) and the outdoor heat exchanger; a second connection pipe (250) branching off from the second piping (150); and a plurality of indoor units (200) connected in parallel to the first connection pipe (260) and the second connection pipe (250).

14. The air conditioner of any one of claims 1 to 13, wherein the economizer (143) comprises: a plate heat exchanger or a double-pipe heat exchanger, which has a first end (510) and a second end (520) provided opposite each other, wherein: the first refrigerant flow path (143a) enters through the first end (510) and exits through the second end (520) and the second refrigerant flow path (143b) enters through the second end (520) and exits through the first end (510); or the first refrigerant flow path (143a) enters through the second end (520) and exits through the first end (510) and the second refrigerant flow path (143b) enters through the first end (510) and exits through the second end (520).

Patentansprüche

1. Klimaanlage, Folgendes umfassend: eine Außeneinheit (100), die einen Mechanismus zur verstärkten Dampfkompression und einen Außenwärmetauscher umfasst, eine Inneneinheit (200), die einen ersten Wärmetauscher (220) und einen ersten Drosselregler (240) umfasst, eine Ablassleitung (111), die mit einer Ablassseite des Kompressionsmechanismus verbunden ist, eine Niederdruck-Ansaugleitung (113), die mit einer Niederdruck-Ansaugseite des Kompressionsmechanismus verbunden ist, eine erste Rohrleitung (140), welche die Ablassleitung (111), den Außenwärmetauscher, den ersten Drosselregler (240) und den ersten Wärmetauscher (220) in Reihe verbindet, und eine zweite Rohrleitung (150), die den ersten Wärmetauscher (220) und die Niederdruck-Ansaugleitung (113) verbindet, wodurch ein Kühlkreis gebildet wird, eine erste Schaltvorrichtung (131), die in der Lage ist, zwischen Folgendem umzuschalten: einem ersten Schaltzustand der ersten Schaltvorrichtung (131), in dem die erste Schaltvorrichtung (131) bewirkt, dass die erste Rohrleitung (140) mit der Ansaugleitung in Verbindung steht, und bewirkt, dass die zweite Rohrleitung (150) in Verbindung mit der Ablassleitung (111) steht, und einem zweiten Schaltzustand der ersten Schaltvorrichtung (131), in dem die erste Schaltvorrichtung (131) bewirkt, dass die erste Rohrleitung (140) mit der Ablassleitung (111) in Verbindung steht, und bewirkt, dass die zweite Rohrleitung (150) mit der Ansaugleitung in Verbindung steht, und einen Vorwärmer (143), der an der ersten Rohrleitung (140) zwischen dem Außenwärmetauscher und der ersten Drosselvorrichtung angeordnet ist, einen ersten Kühlmittel-Strömungsweg (143a), der in dem Vorwärmer (143) angeordnet und durch eine Kühlmittelbrücke (600) mit der ersten Rohrleitung (140) verbunden ist, und einen zweiten Kühlmittel-Strömungsweg (143b), der in dem Vorwärmer (143) angeordnet ist, wobei ein Ende des zweiten Kühlmittel-Strömungsweges (143b) durch eine Flüssigkeitsaufnahmeleitung (145) mit der ersten Rohrleitung (140) in Verbindung steht und das andere Ende des zweiten Kühlmittel-Strömungsweges (143b) durch eine Rückführungsleitung (146) mit sowohl einem Mitteldruck-Ansauganschluss des Kompressors (110) als auch der Ansaugleitung in Verbindung steht, wobei die Strömungsrichtungen des Kühlmittels in dem ersten Kühlmittel-Strömungsweg (143a) und dem zweiten Kühlmittel-Strömungsweg (143b) entgegengesetzt sind, **dadurch gekennzeichnet, dass** die Rückführungsleitung (146) einen Rückführungsleitungskörper, eine erste Verbindungsleitung (148) und eine zweite Verbindungsleitung (147) umfasst, ein Ende der ersten Verbindungsleitung (148) mit dem Rückführungsleitungskörper in Verbindung steht und das andere Ende der ersten Verbindungsleitung (148) mit einem Mitteldruck-Ansauganschluss des Kompressors (110) in Verbindung steht, der Rückführungsleitungskörper oder die erste Verbindungsleitung (148) mit einem ersten Steuerventil (133) versehen ist und ein Ende der zweiten Verbindungsleitung (147) mit dem Rückführungsleitungskörper in Verbindung steht und das andere Ende der zweiten Verbindungsleitung (147) mit der Ansaugleitung in Verbindung steht und die zweite Verbindungsleitung (147) mit einem zweiten Steuerventil (149) versehen ist.

2. Klimaanlage nach Anspruch 1, wobei: die Kühlmittelbrücke (600) einen ersten Anschluss (610), einen zweiten Anschluss (620) und einen Kühlmitteldurchlass aufweist, der bewirkt, dass der erste Anschluss (610) mit dem zweiten Anschluss (620) in Verbindung steht, und die Kühlmittelbrücke (600) durch den ersten Anschluss (610) und den zweiten Anschluss (620) mit der ersten Rohrleitung (140) verbunden ist.

3. Klimaanlage nach Anspruch 2, wobei: die Kühlmittelbrücke (600) einen dritten Anschluss (630) und einen vierten Anschluss (640) aufweist, die zwei Enden des ersten Kühlmittel-Strömungsweges (143a) mit dem dritten Anschluss (630) beziehungsweise dem vierten Anschluss (640) verbunden sind, der erste Anschluss (610) durch einen ersten Brückenabschnitt (650), der ein unidirektionales Strömen von Fluid von dem ersten Anschluss (610) zu dem dritten Anschluss (630) ermöglicht, mit dem dritten Anschluss (630) in Verbindung steht, der dritte Anschluss (630) durch einen zweiten Brückenabschnitt (660), der ein unidirektionales Strömen von Fluid von dem zweiten Anschluss (620) zu dem dritten Anschluss (630) ermöglicht, mit dem zweiten Anschluss (620) in Verbindung steht, der zweite Anschluss (620) durch einen dritten Brückenabschnitt (670), der ein unidirektionales Strömen von Fluid von dem vierten Anschluss (640) zu dem zweiten Anschluss (620) ermöglicht, mit dem vierten Anschluss (640) in Verbindung steht und der vierte Anschluss (640) durch einen vierten Brückenabschnitt (680), der ein unidirektionales Strömen von Fluid von dem vierten Anschluss (640) zu dem ersten Anschluss (610) ermöglicht, mit dem ersten Anschluss (610) in Verbindung steht.

4. Klimaanlage nach Anspruch 2, wobei: die Kühlmittelbrücke (600) einen dritten Anschluss (630) und einen vierten Anschluss (640) aufweist, die zwei Enden des ersten Kühlmittel-Strömungsweges (143a) mit dem dritten Anschluss (630) beziehungsweise dem vierten Anschluss (640) verbunden sind, der erste Anschluss (610) durch einen ersten Brückenabschnitt (650), der ein unidirektionales Strömen von Fluid von dem dritten Anschluss (630) zu dem ersten Anschluss (610) ermöglicht, mit dem dritten Anschluss (630) in Verbindung steht, der dritte Anschluss (630) durch einen zweiten Brückenabschnitt (660), der ein unidirektionales Strömen von Fluid von dem dritten Anschluss (630) zu dem zweiten Anschluss (620) ermöglicht, mit dem zweiten Anschluss (620) in Verbindung steht, der zweite Anschluss

(620) durch einen dritten Brückenabschnitt (670), der ein unidirektionales Strömen von Fluid von dem zweiten Anschluss (620) zu dem vierten Anschluss (640) ermöglicht, mit dem vierten Anschluss (640) in Verbindung steht und der vierte Anschluss (640) durch einen vierten Brückenabschnitt (680), der ein unidirektionales Strömen von Fluid von dem ersten Anschluss (610) zu dem vierten Anschluss (640) ermöglicht, mit dem ersten Anschluss (610) in Verbindung steht.

5. Klimaanlage nach Anspruch 4, wobei der erste Brückenabschnitt (650), der zweite Brückenabschnitt (660), der dritte Brückenabschnitt (670) und der vierte Brückenabschnitt (680) jeweils mit einem Rückschlagventil (690) versehen sind.

6. Klimaanlage nach Anspruch 1, wobei die Flüssigkeitsaufnahmeleitung (145) mit einem Flüssigkeitsaufnahme-Drosselventil (144) versehen ist.

7. Klimaanlage nach Anspruch 1, wobei: ein Einlassende der Flüssigkeitsaufnahmeleitung (145) zwischen dem Vorwärmer (143) und dem außenseitigen Wärmetauscher mit der ersten Rohrleitung (140) in Verbindung steht oder ein Einlassende der Flüssigkeitsaufnahmeleitung (145) zwischen dem Vorwärmer (143) und dem ersten Innendrosselregler mit der ersten Rohrleitung (140) in Verbindung steht.

8. Klimaanlage nach Anspruch 1, wobei ein Einlassende der Flüssigkeitsaufnahmeleitung (145) an einer Kreuzung mit der ersten Rohrleitung (140) einen Flüssigkeitsaufnahmeanschluss (840) aufweist, wobei sich der Flüssigkeitsaufnahmeanschluss (840) unter der ersten Rohrleitung (140) befindet.

9. Klimaanlage nach Anspruch 8, ferner Folgendes umfassend: eine Flüssigkeitsaufnahmestruktur (800), die Folgendes umfasst: eine Flüssigkeitsaufnahmekammer (810), einen ersten Kühlmittelanschluss (830), der mit der Flüssigkeitsaufnahmekammer (810) in Verbindung steht, einen zweiten Kühlmittelanschluss (820), der mit der Flüssigkeitsaufnahmekammer (810) in Verbindung steht, und einen Flüssigkeitsaufnahmeanschluss (840), der mit der Flüssigkeitsaufnahmekammer (810) in Verbindung steht, wobei sich der Flüssigkeitsaufnahmeanschluss (840) unter dem ersten Kühlmittelanschluss (830) und dem zweiten Kühlmittelanschluss (820) befindet.

10. Klimaanlage nach Anspruch 1, ferner Folgendes umfassend: einen zweiten Wärmetauscher (210), einen zweiten Drosselregler (230), eine Zweigleitung (112), die von der Ablassleitung (111) abzweigt, und eine dritte Rohrleitung (160), die einen ersten Schnittpunkt (211) der ersten Rohrleitung, den zweiten Drosselregler (230), den zweiten Wärmetauscher (210) und die Zweigleitung (112) in Reihe verbindet, wobei sich der erste Schnittpunkt (211) zwischen dem ersten Drosselregler (240) und dem Außenwärmetauscher befindet, sich der Vorwärmer (143) zwischen dem ersten Schnittpunkt (211) und dem Außenwärmetauscher an der ersten Rohrleitung (140) befindet.

11. Klimaanlage nach Anspruch 10, ferner Folgendes umfassend: eine Kopplungsleitung (114), ein drittes Steuerventil (310), das an der Zweigleitung (112) angeordnet ist, um das Öffnen und Schließen der Zweigleitung (112) zu steuern, und ein viertes Steuerventil (320), das an der Kopplungsleitung (114) angeordnet ist, um das Öffnen und Schließen der Kopplungsleitung (114) zu steuern, wobei die dritte Rohrleitung (160) mit der Zweigleitung (112) in Verbindung steht, die dritte Rohrleitung (160) durch die Kopplungsleitung (114) mit der Niederdruck-Ansaugleitung (113) oder mit der zweiten Rohrleitung (150) in Verbindung steht, ferner optional Folgendes umfassend: eine zweite Schaltvorrichtung (132), die in der Lage ist, zwischen einem dritten Schaltzustand der zweiten Schaltvorrichtung (132), in dem die zweite Schaltvorrichtung (132) bewirkt, dass die dritte Rohrleitung (160) mit der Zweigleitung (112) in Verbindung steht, und einem vierten Schaltzustand der zweiten Schaltvorrichtung (132), in dem die zweite Schaltvorrichtung (132) bewirkt, dass die dritte Rohrleitung (160) mit der Ansaugleitung in Verbindung steht, umzuschalten.

12. Klimaanlage nach Anspruch 1, ferner einen außenseitigen Drosselregler (142) umfassend, wobei sich der außenseitige Drosselregler (142) zwischen dem Vorwärmer (143) und dem außenseitigen Wärmetauscher an der ersten Rohrleitung (140) befindet.

13. Klimaanlage nach Anspruch 1, ferner Folgendes umfassend: eine erste Verbindungsleitung (260), die von einem zweiten Schnittpunkt (212) der ersten Rohrleitung (140) abzweigt, wobei sich der zweite Schnittpunkt (212) zwischen dem ersten Drosselregler (240) und dem Außenwärmetauscher befindet, eine zweite Verbindungsleitung (250), die von der zweiten Rohrleitung (150) abzweigt, und mehrere Inneneinheiten (200), die mit der ersten Verbindungsleitung (260) und der zweiten Verbindungsleitung (250) parallel verbunden sind.

14. Klimaanlage nach einem der Ansprüche 1 bis 13, wobei der Vorwärmer (143) Folgendes umfasst: einen Plattenwärmetauscher oder einen Doppelrohrwärmetauscher, der ein erstes Ende (510) und ein zweites Ende (520) aufweist, die einander gegenüber bereitgestellt sind, wobei: der erste Kühlmittel-Strömungsweg (143a) durch das erste Ende (510) ein- und durch das zweite Ende (520) austritt und der zweite Kühlmittel-Strömungsweg (143b) durch das zweite Ende (520) ein- und durch das erste Ende (510) austritt oder der erste Kühlmittel-Strömungsweg (143a) durch das zweite Ende (520) ein- und durch das erste Ende (510) austritt und der zweite Kühlmittel-Strömungsweg (143b) durch das erste Ende (510) ein- und durch das zweite Ende (520) austritt.

Revendications

1. Climatiseur comprenant : une unité extérieure (100) comprenant un mécanisme amélioré de compression de vapeur et un échangeur de chaleur extérieur ; une unité intérieure (200) comprenant un premier échangeur de chaleur (220) et un premier régulateur d'étranglement (240) ; un tuyau d'évacuation (111) raccordé à un côté évacuation du mécanisme de compression, un tuyau d'aspiration à basse pression (113) raccordé à un côté aspiration à basse pression du mécanisme de compression, une première tuyauterie (140) raccordant successivement le tuyau d'évacuation (111), l'échangeur de chaleur extérieur, le premier régulateur d'étranglement (240) et le premier échangeur de chaleur (220), et une deuxième tuyauterie (150) raccordant le premier échangeur de chaleur (220) et le tuyau d'aspiration à basse pression (113), formant ainsi un circuit de fluide frigorigène ; un premier dispositif de commutation (131) capable de commuter entre : un premier état de commutation du premier dispositif de commutation (131), dans lequel le premier dispositif de commutation (131) fait communiquer la première tuyauterie (140) avec le tuyau d'aspiration et fait communiquer la deuxième tuyauterie (150) avec le tuyau d'évacuation (111) ; et un deuxième état de commutation du premier dispositif de commutation (131), dans lequel le premier dispositif de commutation (131) fait communiquer la première tuyauterie (140) avec le tuyau d'évacuation (111) et fait communiquer la deuxième tuyauterie (150) avec le tuyau d'aspiration ; et un économiseur (143) agencé sur la première tuyauterie (140) entre l'échangeur de chaleur extérieur et le premier dispositif d'étranglement ; une première voie d'écoulement de fluide frigorigène (143a) agencée dans l'économiseur (143) et raccordée à la première tuyauterie (140) par l'intermédiaire d'un pont de fluide frigorigène (600) ; et une seconde voie d'écoulement de fluide frigorigène (143b) agencée dans l'économiseur (143), une extrémité de la seconde voie d'écoulement de fluide frigorigène (143b) communiquant avec la première tuyauterie (140) par l'intermédiaire d'un tuyau de prélèvement de liquide (145) et l'autre extrémité de la seconde voie d'écoulement de fluide frigorigène (143b) communiquant à la fois avec un orifice d'aspiration à moyenne pression du compresseur (110) et le tuyau d'aspiration par l'intermédiaire d'un tuyau de retour (146), les directions d'écoulement de fluide frigorigène dans la première voie d'écoulement de fluide frigorigène (143a) et la seconde voie d'écoulement de fluide frigorigène (143b) étant opposées ;
le climatiseur étant **caractérisé en ce que** le tuyau de retour (146) comprend un corps de tuyau de retour, un premier tuyau de communication (148) et un second tuyau de communication (147) ; une extrémité du premier tuyau de communication (148) communique avec le corps de tuyau de retour et l'autre extrémité du premier tuyau de communication (148) communique avec l'orifice d'aspiration à moyenne pression du compresseur (110) ; le corps de tuyau de retour ou le premier tuyau de communication (148) est muni d'une première vanne de commande (133) ; et une extrémité du second tuyau de communication (147) communique avec le corps de tuyau de retour et l'autre extrémité du second tuyau de communication (147) communique avec le tuyau d'aspiration, et le second tuyau de communication (147) est muni d'une deuxième vanne de commande (149).

2. Climatiseur selon la revendication 1, dans lequel : le pont de fluide frigorigène (600) comporte un premier orifice (610), un deuxième orifice (620) et un passage de fluide frigorigène qui fait communiquer le premier orifice (610) avec le deuxième orifice (620) ; et le pont de fluide frigorigène (600) est raccordé à la première tuyauterie (140) par l'intermédiaire du premier orifice (610) et du deuxième orifice (620).

3. Climatiseur selon la revendication 2, dans lequel : le pont de fluide frigorigène (600) comporte un troisième orifice (630) et un quatrième orifice (640) ; les deux extrémités de la première voie d'écoulement de fluide frigorigène (143a) sont raccordées respectivement au troisième orifice (630) et au quatrième orifice (640) ; le premier orifice (610) communique avec le troisième orifice (630) par l'intermédiaire d'une première section de pont (650) qui permet un écoulement de fluide unidirectionnel du premier orifice (610) vers le troisième orifice (630) ; le troisième orifice (630) communique avec le deuxième orifice (620) par l'intermédiaire d'une deuxième section de pont (660) qui permet un écoulement de fluide unidirectionnel du deuxième orifice (620) vers le troisième orifice (630) ; le deuxième orifice (620) communique avec le quatrième orifice (640) par l'intermédiaire d'une troisième section de pont (670) qui permet un écoulement de fluide unidirectionnel du quatrième orifice (640) vers le deuxième orifice (620) ; et le quatrième orifice (640) communique avec le premier orifice (610) par l'intermédiaire d'une quatrième section de pont (680) qui permet un écoulement de fluide unidirectionnel du quatrième orifice (640) vers le premier orifice (610).

4. Climatiseur selon la revendication 2, dans lequel : le pont de fluide frigorigène (600) comporte un troisième orifice (630) et un quatrième orifice (640) ; les deux extrémités de la première voie d'écoulement de fluide frigorigène (143a) sont raccordées respectivement au troisième orifice (630) et au quatrième orifice (640) ; le premier orifice (610) communique avec le troisième orifice (630) par l'intermédiaire d'une première section de pont (650) qui permet un écoulement de fluide unidirectionnel du troisième orifice (630) vers le premier orifice (610) ; le troisième orifice (630) communique avec le deuxième orifice (620) par l'intermédiaire d'une deuxième section de pont (660) qui permet un écoulement de fluide unidirectionnel du troisième orifice (630) vers le deuxième orifice (620) ; le deuxième orifice (620) communique avec le quatrième orifice (640) par l'intermédiaire d'une troisième section de pont (670) qui permet un écoulement de fluide unidirectionnel du deuxième orifice (620) vers le quatrième orifice (640) ; et le quatrième orifice (640) communique avec le premier orifice (610) par l'intermédiaire d'une quatrième section de pont (680) qui permet un écoulement de fluide unidirectionnel du premier orifice (610) vers le quatrième orifice (640).

5. Climatiseur selon la revendication 4, dans lequel la première section de pont (650), la deuxième section de pont (660), la troisième section de pont (670) et la quatrième section de pont (680) sont chacune munies d'une vanne unidirectionnelle (690).

6. Climatiseur selon la revendication 1, dans lequel le tuyau de prélèvement de liquide (145) est muni d'une vanne d'étranglement de prélèvement de liquide (144).

7. Climatiseur selon la revendication 1, dans lequel : une extrémité d'entrée du tuyau de prélèvement de liquide (145) communique avec la première tuyauterie (140) entre l'économiseur (143) et l'échangeur de chaleur côté extérieur ; ou une extrémité d'entrée du tuyau de prélèvement de liquide (145) communique avec la première tuyauterie (140) entre l'économiseur (143) et le premier régulateur d'étranglement intérieur.

8. Climatiseur selon la revendication 1, dans lequel une extrémité d'entrée du tuyau de prélèvement de liquide (145) comporte un orifice de prélèvement de liquide (840) au niveau d'une jonction avec la première tuyauterie (140), l'orifice de prélèvement de liquide (840) étant situé en dessous de la première tuyauterie (140).

9. Climatiseur selon la revendication 8, comprenant en outre : une structure de prélèvement de liquide (800) comprenant : une chambre de prélèvement de liquide (810) ; un premier orifice de fluide frigorigène (830) communiquant avec la chambre de prélèvement de liquide (810) ; un second orifice de fluide frigorigène (820) communiquant avec la chambre de prélèvement de liquide (810) ; et un orifice de prélèvement de liquide (840) communiquant avec la chambre de prélèvement de liquide (810), l'orifice de prélèvement de liquide (840) étant situé sous le premier orifice de fluide frigorigène (830) et le second orifice de fluide frigorigène (820).

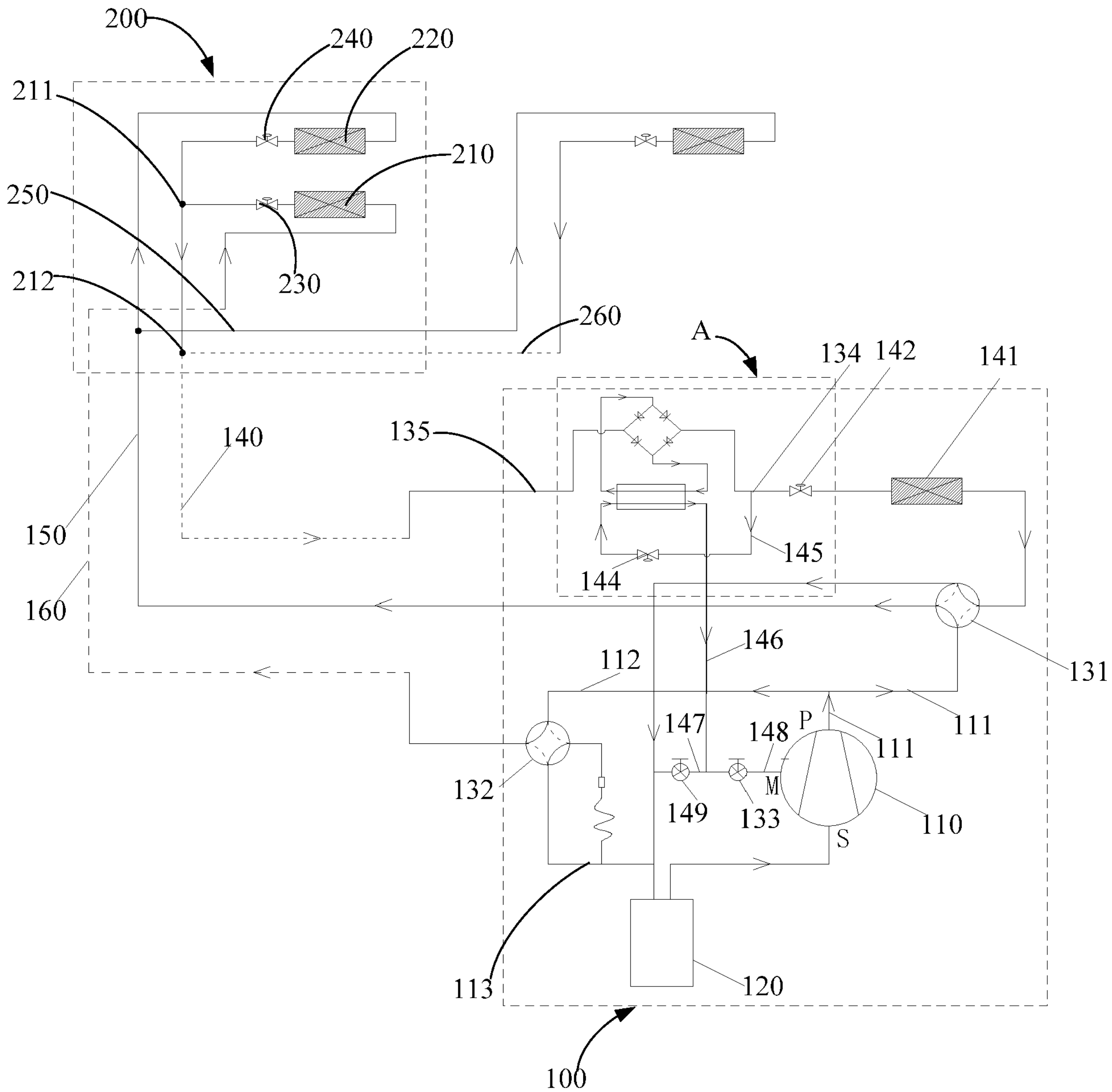
10. Climatiseur selon la revendication 1, comprenant en outre : un second échangeur de chaleur (210) ; un second régulateur d'étranglement (230) ; un tuyau de branchement (112) se branchant sur le tuyau d'évacuation (111) ; et une troisième tuyauterie (160) raccordant successivement un premier point d'intersection (211) de la première tuyauterie, le second régulateur d'étranglement (230), le second échangeur de chaleur (210) et le tuyau de branchement (112) ; le premier point d'intersection (211) étant situé entre le premier régulateur d'étranglement (240) et l'échangeur de chaleur extérieur, l'économiseur (143) étant situé sur la première tuyauterie (140) entre le premier point d'intersection (211) et l'échangeur de chaleur extérieur.

11. Climatiseur selon la revendication 10, comprenant en outre : un tuyau d'accouplement (114) ; une troisième vanne de commande (310) agencée sur le tuyau de branchement (112) pour commander l'ouverture et la fermeture du tuyau de branchement (112) ; et une quatrième vanne de commande (320) agencée sur le tuyau d'accouplement (114) pour commander l'ouverture et la fermeture du tuyau d'accouplement (114) ; la troisième tuyauterie (160) communiquant avec le tuyau de branchement (112), la troisième tuyauterie (160) communiquant avec le tuyau d'aspiration à basse pression (113) ou avec la deuxième tuyauterie (150) par l'intermédiaire du tuyau d'accouplement (114), le climatiseur comprenant éventuellement en outre : un second dispositif de commutation (132) capable de commuter entre un troisième état de commutation du second dispositif de commutation (132), dans lequel le second dispositif de commutation (132) fait communiquer la troisième tuyauterie (160) avec le tuyau de branchement (112), et un quatrième état de commutation du second dispositif de commutation (132), dans lequel le second dispositif de commutation (132) fait communiquer la troisième tuyauterie (160) avec la tuyauterie d'aspiration.

12. Climatiseur selon la revendication 1, comprenant en outre un régulateur d'étranglement côté extérieur (142), le régulateur d'étranglement côté extérieur (142) étant situé sur la première tuyauterie (140) entre l'économiseur (143) et l'échangeur de chaleur côté extérieur.

13. Climatiseur selon la revendication 1, comprenant en outre : un premier tuyau de raccordement (260) se branchant sur un second point d'intersection (212) de la première tuyauterie (140), le second point d'intersection (212) étant situé entre le premier régulateur d'étranglement (240) et l'échangeur de chaleur extérieur ; un second tuyau de raccordement (250) se branchant sur la deuxième tuyauterie (150) ; et une pluralité d'unités intérieures (200) raccordées en parallèle au premier tuyau de raccordement (260) et au second tuyau de raccordement (250).

14. Climatiseur selon l'une quelconque des revendications 1 à 13, dans lequel l'économiseur (143) comprend : un échangeur de chaleur à plaques ou un échangeur de chaleur à double tuyau, qui comporte une première extrémité (510) et une seconde extrémité (520) opposées l'une à l'autre, la première voie d'écoulement de fluide frigorigène (143a) entrant par la première extrémité (510) et sortant par la seconde extrémité (520) et la seconde voie d'écoulement de fluide frigorigène (143b) entrant par la seconde extrémité (520) et sortant par la première extrémité (510) ; ou la première voie d'écoulement de fluide frigorigène (143a) entrant par la seconde extrémité (520) et sortant par la première extrémité (510) et la seconde voie d'écoulement de fluide frigorigène (143b) entrant par la première extrémité (510) et sortant par la seconde extrémité (520).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260
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145
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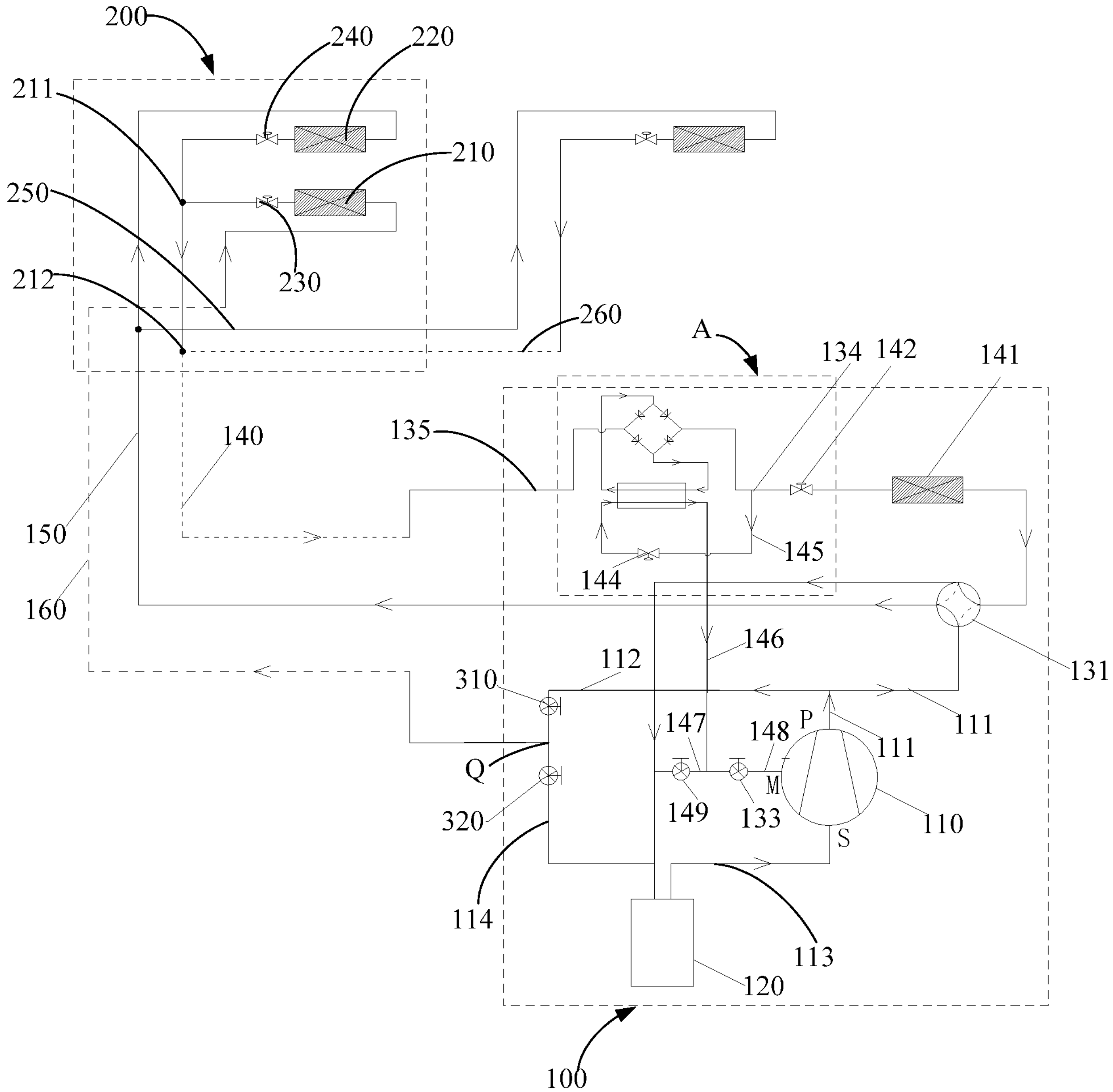
131
112
111
147
148
P
111
132
M
149
133
110
S
113
120
100

Fig. 1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Q
M
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S
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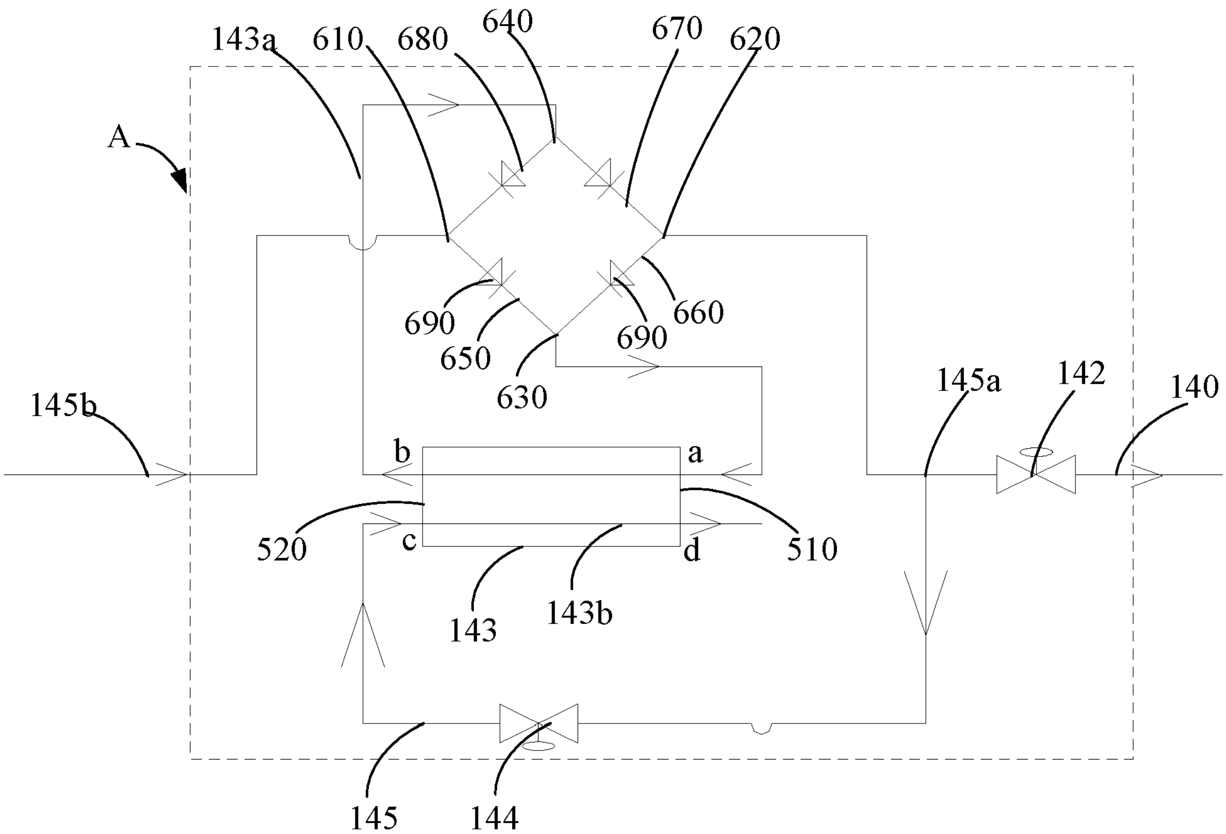
Fig. 2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670
620
A
690
650
630
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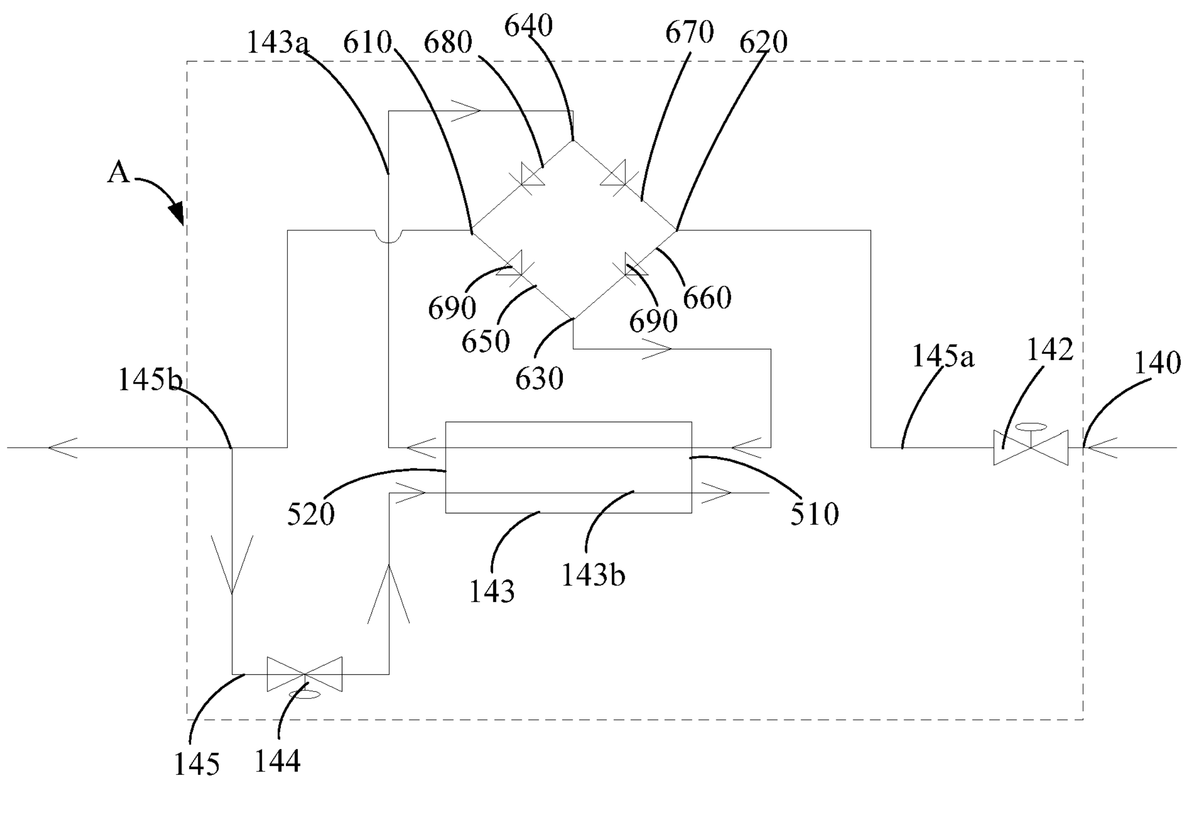
660
145b
145a
142
140
b
a
520
c
d
510
143
143b
145
144

Fig. 3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145b
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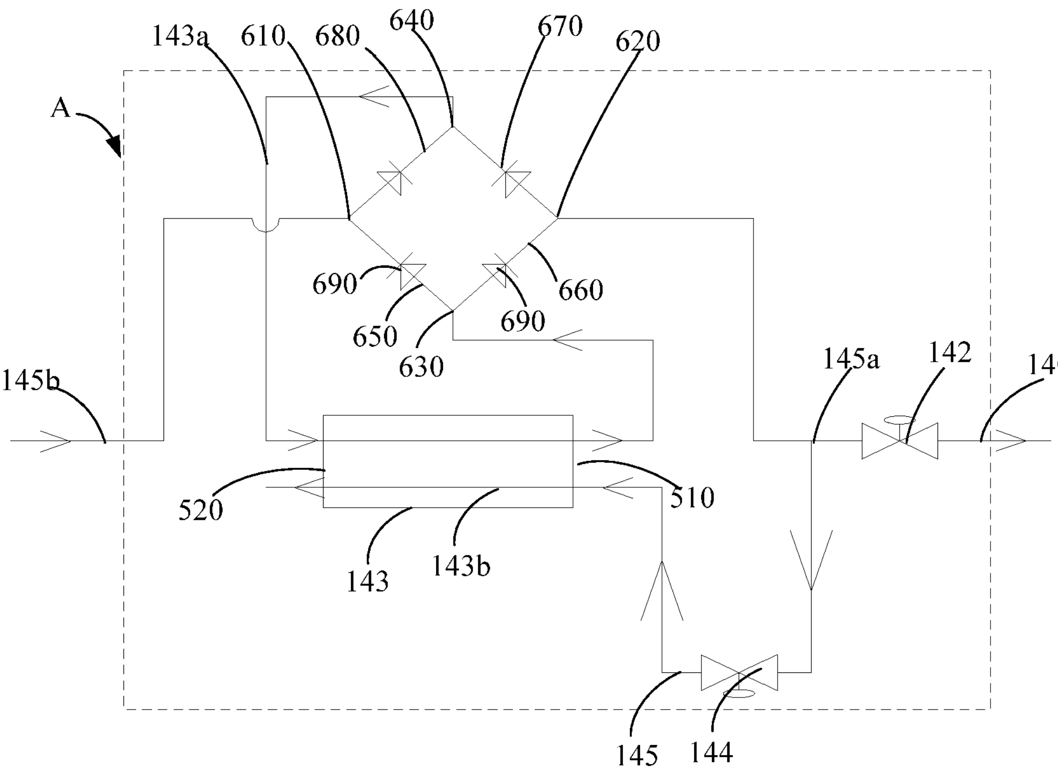
142
140
520
510
143
143b
145
144

Fig. 4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680
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A
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660
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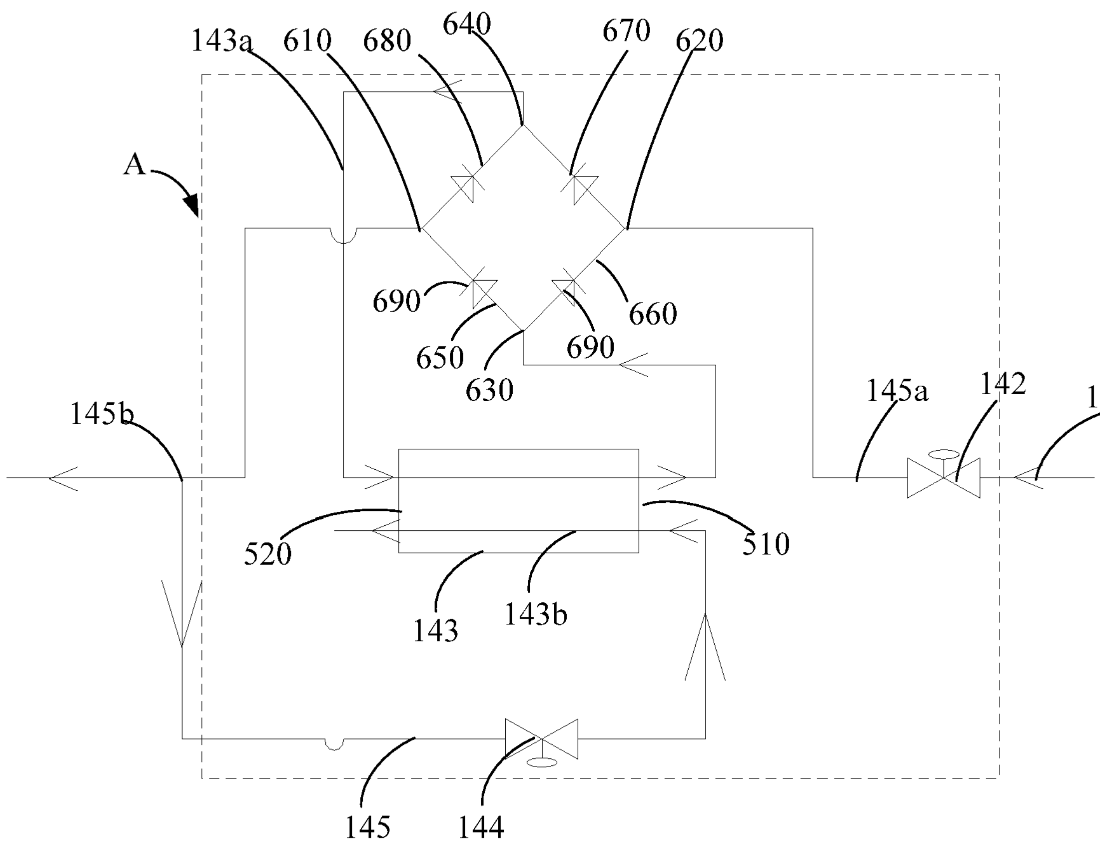
690
630
145b
145a
142
140
520
510
143
143b
145
144

Fig. 5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680
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145b
145a
142
140
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510
143
143b
145
144

Fig. 6

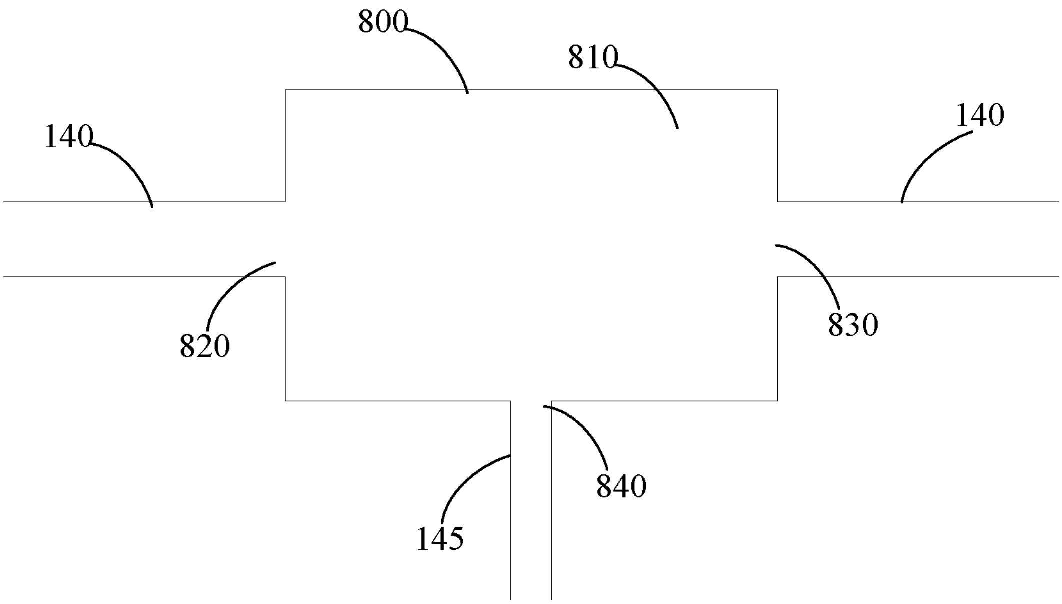

Fig. 7

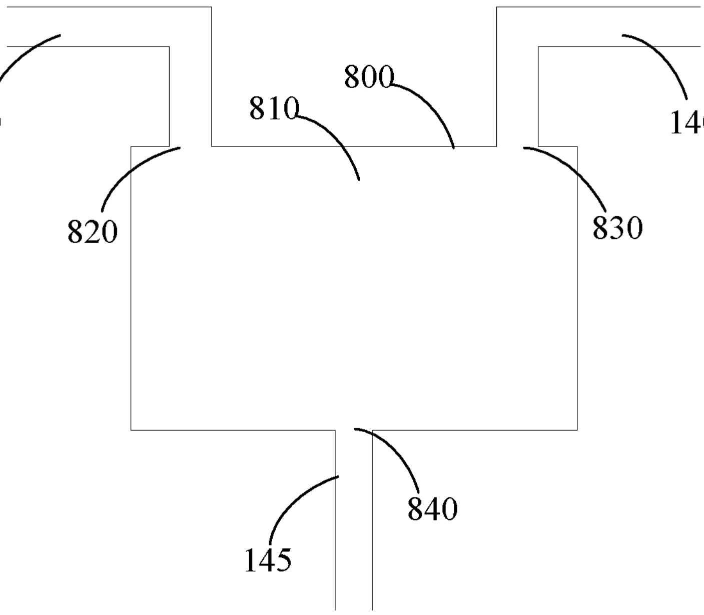

Fig. 8

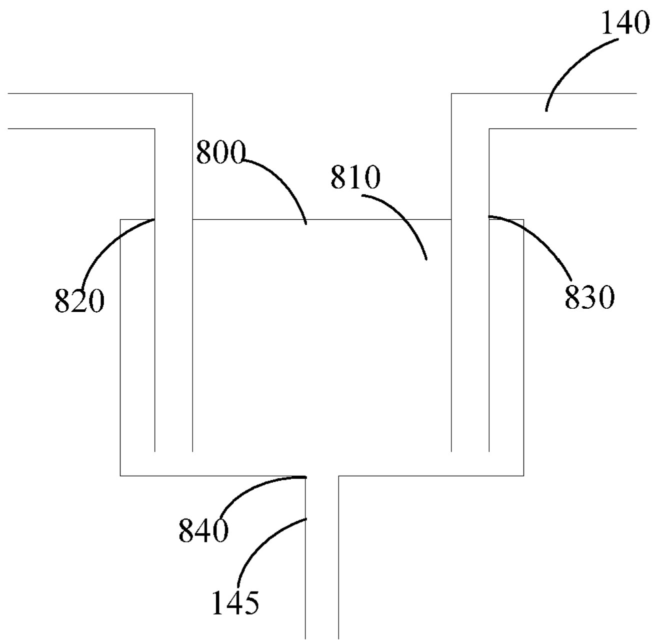

Fig. 9

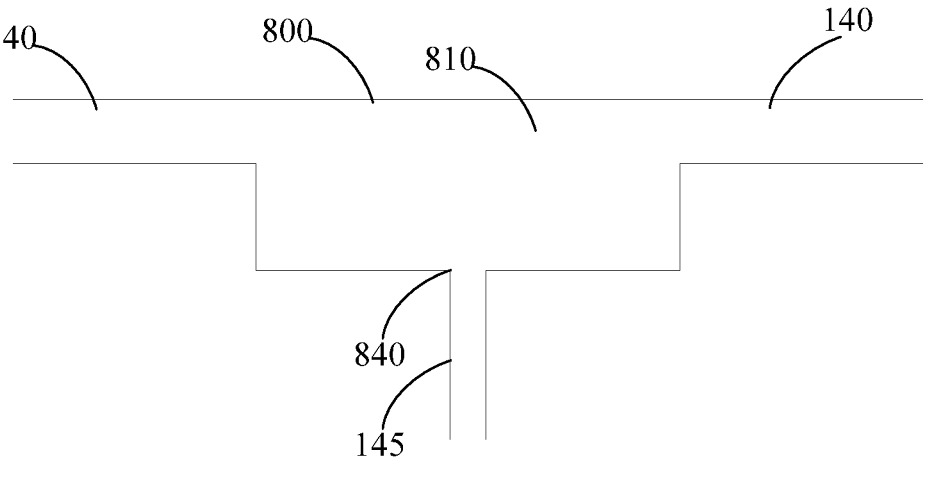

Fig. 10

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- EP 2357427 A1 **[0002]**