DUAL AIR CONDITIONER FOR VEHICLE

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ABSTRACT
The present invention relates to a dual air conditioner for a vehicle, which includes a rear high-temperature pipe that is connected to a rear expansion valve of a rear air conditioner and installed in such a way as to be directly branched from a dual pipe type internal heat exchanger of a front air conditioner, thereby reducing the number of required components and simplifying the manufacturing process with no need to use a connector for branching the rear high-temperature pipe from the front air conditioner, and enhancing a refrigerant movement and reducing material expenses and working process by simplifying piping work and a piping route.
Fig. 8
DUAL AIR CONDITIONER FOR VEHICLE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a dual air conditioner for a vehicle, and more particularly, to a dual air conditioner for a vehicle, which includes a rear high-temperature pipe that is connected to a rear expansion valve of a rear air conditioner and installed in such a way as to be directly branched from expanded pipe parts of a dual pipe type internal heat exchanger of a front air conditioner.

[0003] 2. Background Art

[0004] In general, an air conditioner for a vehicle is a car part, which is installed in a vehicle for the purpose of cooling or heating the interior of the vehicle in the summer season or the winter season or removing frost from a windshield in the rainy season or the winter season to thereby secure a driver's front and rear visual fields. Such an air conditioner typically includes a heating device and a cooling device together, so that it can heat, cool or ventilate the interior of the vehicle through the steps of selectively introducing the inside air or the outside air into the air conditioner, heating or cooling the introduced air, and blowing the heated or cooled air into the vehicle.

[0005] In case of small cars having a narrow interior space, a single air conditioner that has one evaporator mounted in an engine room of the front side of the car is generally applied to the small car. However, in case of some of luxury cars or RVs (Recreational Vehicles), in order to sufficiently supply an air-conditioning environment to the rear inside room of the car, as shown in FIG. 1, a dual air conditioner that includes a front air conditioner 10 mounted in the engine room and having a front evaporator 14 and a rear air conditioner 20 mounted in the rear side of the car and having a rear evaporator 22 is applied to the car.

[0006] The dual air conditioner including the front air conditioner 10 and the rear air conditioner 20 can simultaneously or separately operate the front evaporator 14 and the rear evaporator 22, and the front evaporator 14 and the rear evaporator form a refrigeration cycle where refrigerant circulates through one compressor 11 and one condenser 12.

[0007] FIG. 1 is a view illustrating a state where a dual air conditioner for a vehicle according to a prior art is installed in a car, FIG. 2 is a configurative view of the dual air conditioner for the vehicle according to the prior art, and FIG. 3 is a perspective view showing a part where refrigerant is branched from the front air conditioner to the rear air conditioner in the dual air conditioner according to the prior art.

[0008] As shown in the drawings, the front air conditioner 10 includes: a compressor 11 for sucking and compressing refrigerant; a condenser 12 for condensing refrigerant of high temperature and high pressure sent from the compressor 11; a front expansion valve 13 for throttling the refrigerant condensed and liquefied in the condenser 12; a front evaporator 14 for evaporating the liquefied refrigerant of low temperature and low pressure throttled by the front expansion valve 13 by heat-exchanging with air sent to the interior of the vehicle to thereby cool the air sent to the interior of the vehicle through the endothermic action by latent heat of vaporization of the refrigerant; and a pipe 16 for connecting the above-mentioned components with one another, so that the front air conditioner 10 can cool the front seat of the vehicle.

[0009] Moreover, the front air conditioner 10 further includes a dual pipe type internal heat exchanger 15, which has a dual pipe structure that is formed at a section of a front low-temperature pipe 16a for connecting the front evaporator 14 and the compressor 11 with each other and front high-temperature pipes 16b and 16c for connecting the condenser 12 and the front expansion valve 13 with each other, so as to heat-exchange refrigerants flowing in the pipes with each other.

[0010] Hereinafter, the dual pipe type internal heat exchanger 15 heat-exchanges the liquid refrigerant of high-temperature and high-pressure, which is in the state before it is throttled by the front expansion valve 13, with the refrigerant gas of low-temperature and low-pressure discharged from the front evaporator 14, so that the refrigerant introduced into the front evaporator 14 can move smoothly, a pressure drop of the refrigerant in the front evaporator 14 can be decreased, and an overheat region (not shown) of the front evaporator 14, which has a relatively higher temperature, can be reduced because the dual pipe type internal heat exchanger 15 is set to completely evaporate the refrigerant in order to prevent liquid refrigerant from being introduced into the compressor.

[0011] Accordingly, the front air conditioner can stabilize the flow of refrigerant inside cooling tubes of the front evaporator 14 because specific volume of the refrigerant introduced into the front evaporator 14 is reduced and the pressure drop of the refrigerant in the front evaporator 14 is also reduced, and reduce the overheat region of the front evaporator 14, which may cause a degradation of cooling performance of the air conditioner due to the relatively higher temperature since the refrigerant introduced into the compressor 11 may be overheated after being discharged from the front evaporator 14, whereby the cooling efficiency of the air conditioner can be improved greatly. Finally, the dual air conditioner can promote efficiencies of the compressor 11, the condenser 12, and the front evaporator 14 to thereby cause high efficiency and miniaturization of the air conditioner.

[0012] Moreover, the rear air conditioner 20 includes: a rear high-temperature pipe 23 for branching refrigerant flowing from the condenser 12 of the front air conditioner 10 toward the front expansion valve 13 to and a rear expansion valve 21 for throttling the branched refrigerant; and a rear evaporator 22 for evaporating refrigerant introduced from the rear expansion valve 21 and joining the refrigerant with refrigerant flowing from the front evaporator 14 to the compressor 11, and cools the rear seat of the vehicle.

[0013] As described above, the front air conditioner 10 having the front expansion valve 13 and the front evaporator 14 and the rear air conditioner 20 having the rear expansion valve and the rear evaporator 22 forms a refrigeration cycle commonly using one compressor 11 and one condenser 12.

[0014] Hereinafter, a refrigerant circulation process of the dual air conditioner will be described.

[0015] First, when a cooling switch (not shown) is turned on, the compressor 11 is driven by a driving force of an engine to suck and compress refrigerant of low-temperature and low-pressure and to send refrigerant gas of high-temperature and high-pressure to the condenser 12, and then, the condenser 12 heat-exchanges the refrigerant gas with the outside air and condenses the refrigerant gas into a liquid of high-temperature and high-pressure. Next, the liquid refrigerant of high-temperature and high-pressure sent from the condenser 12 passes through an outer pipe 15b of the dual pipe type internal heat exchanger 15.

[0016] Continuously, some of the refrigerant passing through the outer pipe 15b of the dual pipe type internal heat
exchanger 15 is introduced and expanded into the front expansion valve 13 through the front high-temperature pipe 16c, and is introduced into the front evaporator 14, and then, is evaporated by heat-exchange with air blown to the front seat of the interior of the vehicle. The remainder of the refrigerant is introduced and expanded into the rear expansion valve 21 through the rear high-temperature pipe 23 branched from the front high-temperature pipe 16c, and is introduced into the rear evaporator 22, and then, is evaporated by heat-exchange with air blown to the rear seat of the interior of the vehicle.

[0017] Through the above process, the front seat and the rear seat inside the vehicle are cooled. That is, the air blown by a blower (not shown) is cooled by latent heat of the refrigerant circulating in the evaporators 14 and 22 while passing through the evaporators 14 and 22, and then, is discharged to the interior of the vehicle in a cooled state.

[0018] Next, the refrigerant gas of low-temperature and low-pressure evaporated and discharged from the front evaporator 14 and the refrigerant gas of low-temperature and low-pressure evaporated and discharged from the rear evaporator 22 are joined together, and then, passes through the inner pipe 15a of the dual pipe type internal heat exchanger 15.

[0019] In this instance, the refrigerant gas of low-temperature and low-pressure passing through the inner pipe 15a of the dual pipe type internal heat exchanger 15 heat-exchanges with liquid refrigerant of high-temperature and high-pressure passing through the outer pipe 15b of the dual pipe type internal heat exchanger 15, and then, is sucked into the compressor 11 and recirculated in the above refrigeration cycle.

[0020] Moreover, as shown in FIGS. 2 and 3, the rear air conditioner 20 branches the refrigerant circulating in the front air conditioner 10 and circulates the refrigerant to the rear expansion valve 21 and the rear evaporator 22. That is, because the rear high-temperature pipe 23 is branched from the front high-temperature pipe 16c, which connects the outer pipe 15b of the dual pipe type internal heat exchanger 15 and the front expansion valve 13 with each other, the refrigerant can be circulated to the rear expansion valve 21 and the rear evaporator 22.

[0021] In this instance, in order to connect the front high-temperature pipe 16c and the rear high-temperature pipe 23 with each other, as shown in FIGS. 4 and 5, a connector 30 is used, and the connector 30 is manufactured by the following process.

[0022] FIG. 4 illustrates a state where the front high-temperature pipe 16c is divided and the divide front high-temperature pipes 16c are welded to both ends of the connector 30, and the rear high-temperature pipe 23 is welded to the connector 30 in a perpendicular direction.

[0023] FIG. 5 illustrates a state where the front high-temperature pipe 16c perforates the connector 30 and the rear high-temperature pipe 23 is welded to the connector 30 in the perpendicular direction. In this instance, the front high-temperature pipe 16c, which perforates the connector 30, has a hole.

[0024] However, the dual air conditioner for the vehicle according to the prior art has a problem in that the number of components and the number of manufacturing processes are increased because the rear high-temperature pipe 23 is connected to the front high-temperature pipe 16c via the connector 30 in order to branch the refrigerant, which circulates inside the front air conditioner 10, and circulate the branched refrigerant to the rear air conditioner 20.

[0025] Furthermore, in the case that a distance between the dual pipe type internal heat exchanger 15 and the front expansion valve 13 is short, piping work and piping route of the front high-temperature pipe 16c and the rear high-temperature pipe 23 become complicated, and hence, a flow of the refrigerant is unstable.

[0026] Additionally, because the rear high-temperature pipe 23 is branched from the connector 30 in the perpendicular direction, the flow of the refrigerant is unstable.

SUMMARY OF THE INVENTION

[0027] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior arts, and it is an object of the present invention to provide a dual air conditioner for a vehicle, which includes a rear high-temperature pipe that is connected to a rear expansion valve of a rear air conditioner and installed in such a way as to be directly branched from a dual pipe type internal heat exchanger of a front air conditioner, thereby reducing the number of required components and simplifying the manufacturing process with no need to use a connector for branching the rear high-temperature pipe from the front air conditioner, and enhancing a refrigerant movement and reducing material expenses and working process by simplifying piping work and a piping route.

[0028] To accomplish the above object, according to the present invention, there is provided a dual air conditioner for a vehicle comprising: a front air conditioner including compressor for sucking and compressing refrigerant; a condenser for condensing refrigerant compressed in the compressor, a front expansion valve for throttling the refrigerant condensed in the condenser, a front evaporator for evaporating the refrigerant introduced from the front expansion valve, and a dual pipe type internal heat exchanger having a dual pipe structure formed at a section of a front low-temperature pipe for connecting the front evaporator and the compressor with each other and front high-temperature pipes for connecting the condenser and the front expansion valve with each other, the dual pipe type internal heat exchanger heat-exchanging the refrigerants that flow in the pipes with each other, the front air conditioner cooling the front seat side of the vehicle; and a rear air conditioner including a rear high-temperature pipe for branching refrigerant flowing from the condenser toward the front expansion valve and a rear expansion valve for throttling the branched refrigerant, and a rear evaporator for evaporating refrigerant introduced from the rear expansion valve and joining the refrigerant with refrigerant flowing from the front evaporator to the compressor, the rear high-temperature pipe being connected to a side of the dual pipe type internal heat exchanger in such a way as to be directly branched from the internal heat exchanger and being connected with the rear expansion valve, the rear air conditioner cooling the rear seat side of the vehicle.

[0029] According to the present invention, the dual air conditioner for the vehicle, which includes a rear high-temperature pipe that is connected to a rear expansion valve of a rear air conditioner and installed in such a way as to be directly branched from a dual pipe type internal heat exchanger of a front air conditioner, does not require the connector branching the rear high-temperature pipe from the front air conditioner, can reduce the number of required components and simplify the manufacturing process, and allow simple piping work regardless with a distance between the dual pipe type internal heat exchanger and the front expansion valve.
Moreover, the dual air conditioner according to the present invention can enhance a refrigerant movement and reduce material expenses and working process by simplifying the piping route of the rear high-temperature pipe.

Furthermore, the dual air conditioner according to the present invention can minimize a pressure loss of the refrigerant and provide a smooth flow of the refrigerant when the refrigerant passing through the outer pipe is distributed to the rear high-temperature pipe because the rear high-temperature pipe is directly branched from the expanded pipe part of the outer pipe of the dual pipe type internal heat exchanger.

Additionally, the dual air conditioner according to the present invention can allow a smooth flow of the refrigerant to the pipe of high-temperature and high-pressure because the pipe is mounted to the expanded pipe part, which has a diameter larger than the dual pipe type internal heat exchanger and is less hindered in fluid movement by the inner pipe.

In addition, the dual air conditioner according to the present invention can easily control, a flow rate of the refrigerant distributed to the pipes by controlling inclination angles and diameters of the front high-temperature pipe and the rear high-temperature pipe, which are respectively connected to the expanded pipe part of the outer pipe in a circumferential direction or in a longitudinal direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be apparent from the following detailed description of the preferred embodiments of the invention in conjunction with the accompanying drawings, in which:

FIG. 1 is a view illustrating a state where a dual air conditioner for a vehicle according to a prior art is installed in a car;

FIG. 2 is a configurative view of the dual air conditioner for the vehicle according to the prior art;

FIG. 3 is a perspective view showing a part where refrigerant is branched from a front air conditioner to a rear air conditioner in the dual air conditioner according to the prior art;

FIGS. 4 and 5 are perspective view illustrating a state where a front high-temperature pipe and a rear high-temperature pipe are joined by a connector in the dual air conditioner according to the prior art;

FIG. 6 is a configurative view of a dual air conditioner for a vehicle according to the present invention;

FIG. 7 is a perspective view showing a part where refrigerant is branched from a front air conditioner to a rear air conditioner in the dual air conditioner according to preferred embodiment of the present invention;

FIG. 8 is a sectional view taken along the line of A-A of FIG. 7;

FIG. 9 is a sectional view illustrating a dual pipe type internal heat exchanger of FIG. 6;

FIG. 10 is a partially sectional view showing a flow direction of refrigerant in the dual pipe type internal heat exchanger of FIG. 9;

FIG. 11 is a perspective view showing a part where refrigerant is branched from the front air conditioner to the rear air conditioner in the dual air conditioner according to another preferred embodiment of the present invention;

FIG. 12 is a sectional view illustrating a dual pipe type internal heat exchanger of FIG. 11;

FIG. 13 is an enlarged sectional view showing an expanded pipe part of FIG. 12;

FIG. 14 is an enlarged sectional view showing the expanded pipe part of FIG. 13 according to another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will be now made in detail to the preferred embodiment of the present invention with reference to the attached drawings.

A dual air conditioner 100 for a vehicle according to the present invention includes a front air conditioner 200 mounted in an engine room of the vehicle and a rear air conditioner 300 mounted in the rear side of the vehicle and branching refrigerant circulating in the front air conditioner 200.

First, the front air conditioner 200 has a refrigeration cycle including a compressor 210, a condenser 220, a dual pipe type internal heat exchanger 250, a front expansion valve 230, and a front evaporator 240, which are connected with one another in order via a pipe P.

The compressor 210 is operated by receiving driving power from a power supply (an engine, a motor, or others) to thereby intake and compress refrigerant of low-temperature and low-pressure in a gas phase discharged from the front evaporator 240 and discharge the refrigerant in the gas phase of high-temperature and high-pressure to the condenser 220.

The condenser 220 heat-exchanges the gas refrigerant of high-temperature and high-pressure discharged from the compressor 210 with the outside air, condenses it into a liquid phase of high-temperature and high-pressure, and then, discharges the condensed refrigerant to the front expansion valve 230.

The front expansion valve 230 rapidly expands the liquid refrigerant of high-temperature and high-pressure discharged from the condenser 220 through the throttling action in such a way that the refrigerant of high-temperature and high-pressure is turned into a saturated vapor phase of low-temperature and low-pressure, and then, sends the refrigerant to the front evaporator 240.

The front evaporator 240 heat-exchanges the liquid refrigerant of low-pressure throttled in the front expansion valve 230 with air sent to the interior of the vehicle, so that the refrigerant is evaporated, thereby cooling the air discharged to the interior of the vehicle due to the heat absorption effect by latent heat of the refrigerant.

Continuously, the refrigerant gas of low-temperature and low-pressure evaporated from the front evaporator 240 is sucked into the compressor 210 and is recirculated in the above cycle.

Furthermore, in the above refrigerant circulation process, cooling of the interior of the vehicle is achieved in such a way that the air blown by a blower (not shown) of the air conditioner for the vehicle is cooled by the evaporated latent heat of the liquid refrigerant circulating in the evaporator 240 while passing through the front evaporator 240 and discharged to the interior of the vehicle in a cooled state.

The dual pipe type internal heat exchanger 250 includes a dual pipe structure that is formed at a section of a front low-temperature pipe P3 for connecting the front evaporator 240 and the compressor 210 with each other and a high-temperature pipe P1 and a front high-temperature pipe P2 for connecting the condenser 220 and the front expansion...
The dual pipe type internal heat exchanger 250 includes: an inner pipe 251 disposed at the section of the front low-temperature pipe P3 for connecting the front evaporator 240 and the compressor 210 with each other; and an outer pipe 252 joined to the outer circumferential surface of the inner pipe 251 in a dual pipe structure.

In other words, as shown in FIGS. 9 and 10, the dual pipe type internal heat exchanger 250 includes: a spiral projection portion 251a and a spiral groove portion 251b formed on one of the inner pipe 251 and the outer pipe 252; a first refrigerant channel R1 formed inside the inner pipe 251; and a second refrigerant channel R2 formed between the inner pipe 251 and the outer pipe 252.

Here, the first refrigerant channel R1 is a channel that refrigerant (of a gas phase) discharged from the front evaporator 240 and the rear evaporator 320 is joined and flows, and the second refrigerant channel R2 is a channel that refrigerant (of a liquid phase) discharged from the condenser 220 flows.

Referring to FIGS. 9 and 10, the spiral projection portion 251a and the spiral groove portion 251b are formed on the outer circumferential surface of the inner pipe 251, and the outer pipe 252 that is a round pipe is joined to the inner pipe 251 in the dual pipe structure.

In this instance, the spiral projection portion 251a of the inner pipe 251 is in close contact with the inner circumferential surface of the outer pipe 252, such that the second refrigerant channel R2 formed between the inner pipe 251 and the outer pipe 252 is formed in a spiral shape.

Moreover, both end portions of the spiral projection portion 251a and the spiral groove portion 251b formed on the outer circumferential surface of the inner pipe 251 are ended inside an expanded pipe part 253 formed at both end portions of the outer pipe 252.

In the meantime, both ends of the outer pipe 252 are sealed by being welded with the outer circumferential surface of the front low-temperature pipe P3.

Furthermore, the outer pipe 252 has expanded pipe parts 253 formed at both end portions thereof, wherein one of the expanded pipe part 253 is welded and joined with the high-temperature pipe P1 that is connected with the condenser 220, and the other expanded pipe part 253 is welded and joined with the front high-temperature pipe P2 that is connected with the front expansion valve 230.

As described above, because the outer pipe 252 has the expanded pipe parts 253 formed at both end portions thereof to enlarge the refrigerant channel (flow channel sectional area), it can minimize a pressure loss of the refrigerant when the refrigerant is introduced into the outer pipe 252 or when the refrigerant is discharged from the outer pipe 252.

Additionally, the rear air conditioner 300 includes: a rear high-temperature pipe P4 for branching refrigerant of high-temperature and high-pressure heading forward the front expansion valve 230 and a rear expansion valve 310 for throttling the branched refrigerant; and a rear evaporator 320 for evaporating refrigerant of low-pressure and low-temperature introduced from the rear expansion valve 310 and joining the refrigerant to refrigerant flowing from the front evaporator 240 to the compressor 210 and cools the rear seat of the vehicle.

In other words, the rear air conditioner 300 branches the refrigerant through the rear high-temperature pipe P4 before the refrigerant is introduced into the front expansion valve 230 of the front air conditioner 200, and then, circulates the branched refrigerant to the rear expansion valve 310 and the rear evaporator 320.

Moreover, the rear low-temperature pipe P5 connected to an outlet of the rear evaporator 320 is connected with the front low-temperature pipe P3 before it passes the dual pipe type internal heat exchanger 250 from the front evaporator 240, so that the refrigerant, which is evaporated in the rear evaporator 320, is evaporated in the front evaporator 240, and then, joined with the refrigerant flowing in the front low-temperature pipe P3.

Furthermore, the rear high-temperature pipe P4 is connected to a side of the dual pipe type internal heat exchanger 250 in such a way as to be directly branched, and then, is connected with the rear expansion valve 310.

Accordingly, while the refrigerant discharged from the condenser 220 of the front air conditioner 200 flows to the front expansion valve 230 through the outer pipe 252 of the dual pipe type internal heat exchanger 250, some of the refrigerant flowing in the outer pipe 252 is directly branched to the rear high-temperature pipe P4, and hence, flows to the rear expansion valve 310.

Additionally, the rear high-temperature pipe P4 is welded and connected to the expanded pipe part 253 of the outer pipe 252 connected with the front high-temperature pipe P2, which is connected with the front expansion valve 230. That is, because the rear high-temperature pipe P4 is connected to the expanded pipe part 253 of the outer pipe 252, it can minimize a pressure loss of the refrigerant and provide a smooth flow of the refrigerant when the refrigerant passing through the second refrigerant channel R2 of the outer pipe 252 is distributed to the rear high-temperature pipe P4.

In addition, a flow rate of the refrigerant distributed through the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252, can be controlled in various ways through the following embodiments.

In a preferred embodiment, as shown in FIG. 8, the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252, are connected in a circumferential direction of the expanded pipe part 253 in a state where they are spaced apart from each other at a predetermined interval.

In this instance, the front high-temperature pipe P2 is connected to one side (left side) relative to a vertical centerline C of the expanded pipe part 253 in such a way as to be inclined at a predetermined angle (01) in a downward direction (gravitational direction) and the rear high-temperature pipe P4 is connected to the other side (right side) relative to the vertical centerline C in such a way as to be inclined at a predetermined angle (02) in the downward direction (gravitational direction).

Here, it is preferable that the inclination angle (01) of the front high-temperature pipe P2 relative to the vertical centerline C of the expanded pipe part 253 is smaller than the inclination angle (02) of the rear high-temperature pipe P4.

That is, because the front high-temperature pipe P2 connected to the expanded pipe part 253 is inclined at the angle, which is closer to verticality than the rear high-temperature pipe P4, it is more affected by the gravity force, and hence, relatively more refrigerant introduced into the expanded pipe part 253 after passing through the second
refrigerant channel P2 of the outer pipe 252 is distributed to the front high-temperature pipe P2 by the gravity force. [0078] As described above, the inclination angles of the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252, are controlled so that the flow rate of the refrigerant distributed to the pipes P2 and P4 can be controlled. [0079] In a second preferred embodiment of the present invention, as shown in FIGS. 11 to 13, the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252, are spaced apart from each other at a predetermined interval in a longitudinal direction of the expanded pipe part 253. [0080] In this instance, the front high-temperature pipe P2 and the rear high-temperature pipe P4 are connected at right angles to the downward direction (gravitational direction) of the expanded pipe part 253. [0081] Moreover, in the second embodiment illustrated in FIGS. 11 to 13, because the front high-temperature pipe P2 and the rear high-temperature pipe P4 are all connected at right angles to the downward direction of the expanded pipe part 253, diameters D1 and D2 of the front high-temperature pipe P2 and the rear high-temperature pipe P4 are controlled so that the flow rate of the refrigerant distributed to the pipes P2 and P4 can be controlled. [0082] Here, it is preferable that the diameter D1 of the front high-temperature pipe P2 is larger than the diameter D2 of the rear high-temperature pipe P4 so that more refrigerant can be supplied to the front evaporator 240, which is relatively larger than the rear evaporator. [0083] Furthermore, because the front high-temperature pipe P2 and the rear high-temperature pipe P4 are spaced apart from each other at a predetermined interval in the longitudinal direction of the expanded pipe part 253, it is preferable that a length L2 of the expanded pipe part 253, to which the front high-temperature pipe P2 and the rear high-temperature pipe P4 are connected, is greater than a length L1 of the expanded pipe part 253, to which the high-temperature pipe P1 is connected. [0084] In a third preferred embodiment of the present invention, as shown in FIG. 14, the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252, are connected in a refrigerant flow direction of the expanded pipe part 253 in such a way as to be spaced apart from each other at a predetermined interval. [0085] In this instance, the front high-temperature pipe P2 and the rear high-temperature pipe P4 are respectively connected at right angles to the downward direction (gravitational direction) of the expanded pipe part 253 and have the same diameter. [0086] Additionally, in the third preferred embodiment illustrated in FIG. 14, because the front high-temperature pipe P2 and the rear high-temperature pipe P4 are all connected at right angles to the expanded pipe part 253 and have the same diameter, an arrangement order of the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected in the refrigerant flow direction of the expanded pipe part 253, is changed so that the flow rate of the refrigerant distributed to the pipes P2 and P4 can be controlled. [0087] Here, it is preferable that the front high-temperature pipe P2 is connected closer to the upstream side of the refrigerant flow direction of the expanded pipe part 253 than the rear high-temperature pipe P4 so that more refrigerant can be supplied to the front evaporator 240, which is relatively larger than the rear evaporator. [0088] That is, relatively more the refrigerant introduced into the expanded pipe part 253 after passing through the second refrigerant channel R2 of the outer pipe 252 is distributed to the front high-temperature pipe P2, which is arranged to the upstream side of the refrigerant flow direction. [0089] As described above, even though the diameters of the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the expanded pipe part 253 of the outer pipe 252 at right angles, are the same, the flow rate of the refrigerant distributed to the pipes P2 and P4 can be controlled according to the arrangement order of the pipes P2 and P4. [0090] In the meantime, because the front high-temperature pipe P2 and the rear high-temperature pipe P4 are connected in the refrigerant flow direction of the expanded pipe part 253 in such a way as to be spaced apart from each other at the predetermined interval, it is preferable that the length L2 of the expanded pipe part 253, to which the front high-temperature pipe P2 and the rear high-temperature pipe P4 are connected, is greater than the length L1 of the expanded pipe part 253, to which the high-temperature pipe P1 is connected. [0091] As described above, because the rear high-temperature pipe P4 is directed connected to the expanded pipe part 253 of the outer pipe 252 of the dual pipe type internal heat exchanger 250, the present invention does not need the connector 30, which is required for branching the rear high-temperature pipe, and it causes reduction of the number of required components and simplification in the manufacturing process, and allow an easy and simple piping work regardless with a distance between the dual pipe type internal heat exchanger and the front expansion valve 230. [0092] Moreover, a route of the rear high-temperature pipe P4 is simplified, so that it can provide a smooth flow of refrigerant and cause reduction of manufacturing costs and working process. [0093] Hereinafter, actions of the dual air conditioner 100 for the vehicle according to the present invention will be described. [0094] First, the refrigerant gas of high-temperature and high-pressure, which is compressed in the compressor 210, is introduced into the condenser 220. The refrigerant gas introduced into the condenser 220 is condensed through heat-exchange with the outside air and phase-changed into liquid refrigerant of high-temperature and high-pressure, and then, introduced into one of the expanded pipe parts 253 of the outer pipe 252 of the dual pipe type internal heat exchanger 250. [0095] The refrigerant of high-temperature and high-pressure introduced into the expanded pipe part 253 of the outer pipe 252 is discharged from the front evaporator 240 and the rear evaporator 320 while flowing in the second refrigerant channel R2 of the outer pipe 252, performs heat-exchange with the refrigerant of low-temperature and low-pressure flowing in the first refrigerant channel R1 of the inner pipe 251, and then, is distributed to the front high-temperature pipe P2 and the rear high-temperature pipe P4, which are respectively connected to the other expanded pipe part 253.
[0096] Here, after the refrigerant distributed to the front high-temperature pipe P2 is introduced into the front expansion valve 230, the refrigerant becomes in an atomized state of low-temperature and low-pressure through decompression expansion, and then, is introduced into the front evaporator 240. The refrigerant introduced into the front evaporator 240 is evaporated by heat-exchange with the air blown to the front seat of the vehicle, and at the same time, cools the air blown to the front seat of the vehicle due to the heat absorption effect by latent heat of the refrigerant.

[0097] Moreover, after the refrigerant distributed to the rear high-temperature pipe P4 is introduced into the rear expansion valve 310, the refrigerant, becomes in an atomized state of low-temperature and low-pressure through decompression expansion, and then, is introduced into the rear evaporator 320. The refrigerant introduced into the rear evaporator 320 is evaporated by heat-exchange with the air blown to the rear seat of the vehicle, and at the same time, cools the air blown to the rear seat of the vehicle due to the heat absorption effect by latent heat of the refrigerant.

[0098] Continuously, the refrigerant gas of low-temperature and low-pressure discharged from the front evaporator 240 after evaporation and the refrigerant gas of low-temperature and low-pressure discharged from the rear evaporator 320 after evaporation are joined together through the front low-temperature pipe P3 and the rear low-temperature pipe P5, and then, passes the first refrigerant channel R1 of the inner pipe 251 of the dual pipe type internal heat exchanger 250.

[0099] In this instance, the refrigerant gas or low-temperature and low-pressure passing through the first refrigerant channel R1 of the inner pipe 251 of the dual pipe type internal heat exchanger 250 heat-exchanges with the refrigerant gas of high-temperature and high-pressure passing through the second refrigerant channel R2 of the outer pipe 252, and then, is recirculated in the above-mentioned refrigeration cycle.

[0100] While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

What is claimed is:

1. A dual air conditioner for a vehicle comprising: a front air conditioner including: a compressor for sucking and compressing refrigerant; a condenser for condensing refrigerant compressed in the compressor; a front expansion valve for throttling the refrigerant condensed in the condenser; a front evaporator for evaporating the refrigerant introduced from the front expansion valve; and a dual pipe type internal heat exchanger having a dual pipe structure formed at a section of a front low-temperature pipe for connecting the front evaporator and the compressor with each other and a high-temperature pipe and a front high-temperature pipe for connecting the condenser and the front expansion valve with each other; the dual pipe type internal heat exchanger heat-exchanging the refrigerants that flow in the pipes with each other, the front air conditioner cooling the front seat side of the vehicle; and

2. The dual air conditioner according to claim 1, wherein the dual pipe type internal heat exchanger comprises: an inner pipe disposed at the section of the front low-temperature pipe for connecting the front evaporator and the compressor with each other; and an outer pipe joined to the outer circumferential surface of the inner pipe in a dual pipe structure, the outer pipe having expanded pipe parts formed at both ends thereof, one of the expanded pipe parts being connected with the high-temperature pipe connected with the condenser, the other of the expanded pipe parts being connected with the front high-temperature pipe connected with the front expansion valve, and

3. The dual air conditioner according to claim 2, wherein the front high-temperature pipe and the rear high-temperature pipe, which are respectively connected to the expanded pipe part of the outer pipe, are connected in a circumferential direction of the expanded pipe part in a state where they are spaced apart from each other at a predetermined interval.

4. The dual air conditioner according to claim 3, wherein the front high-temperature pipe is connected to one side of a vertical centerline of the expanded pipe part in such a way as to be inclined at a predetermined angle and the rear high-temperature pipe is connected to the other side of the vertical centerline in such a way as to be inclined at a predetermined angle, and the inclination angles of the pipes are controlled so that a flow rate of the refrigerant distributed to the pipes can be controlled.

5. The dual air conditioner according to claim 4, wherein the inclination angle of the front high-temperature pipe is smaller than the inclination angle of the rear high-temperature pipe.

6. The dual air conditioner according to claim 2, wherein the front high-temperature pipe and the rear high-temperature pipe, which are respectively connected to the expanded pipe part of the outer pipe, are connected in a longitudinal direction of the expanded pipe part in a state where they are spaced apart from each other at a predetermined interval, and diameters of the pipes are controlled so that the flow rate of the refrigerant distributed to the pipes can be controlled.

7. The dual air conditioner according to claim 6, wherein the diameter of the front high-temperature pipe is greater than the diameter of the rear high-temperature pipe.

8. The dual air conditioner according to claim 6, wherein a length of the expanded pipe part, to which the front high-temperature pipe and the rear high-temperature pipe are connected, is greater than a length of the expanded pipe part, to which the high-temperature pipe is connected.

9. The dual air conditioner according to claim 2, wherein the front high-temperature pipe and the rear high-temperature pipe, which are respectively connected to the expanded pipe part of the outer pipe, are connected in a refrigerant flow
direction of the expanded pipe part in such a way as to be spaced apart from each other at a predetermined interval, and an arrangement order of the pipes, which are respectively connected in the refrigerant flow direction of the expanded pipe part, is changed so that the flow rate of the refrigerant distributed to the pipes can be controlled.

10. The dual air conditioner according to claim 9, wherein the front high-temperature pipe is connected closer to the upstream side of the refrigerant flow direction of the expanded pipe part than the rear high-temperature pipe.

11. The dual air conditioner according to claim 9, wherein the dual pipe type internal heat exchanger comprises a spiral projection portion and a spiral groove portion formed on one of the inner pipe and the outer pipe; a first refrigerant channel formed inside the inner pipe; and a second refrigerant channel formed between the inner pipe and the outer pipe.

12. The dual air conditioner according to claim 11, wherein the first refrigerant channel is a channel that the refrigerant discharged from the front evaporator and the rear evaporator is joined and flows, and the second refrigerant channel is a channel that the refrigerant discharged from the condenser flows.

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