a part of the first introduction pipe, the part being on a side of the second end, connecting a side of the second end of the first introduction pipe to between an end of the second introduction pipe on the upstream side and a branch pipe of the branch pipes, the branch pipe being connected to a most upstream side of the second introduction pipe among the branch pipes, wherein the adjusting pipe has a U-shape in top view.

Further, a refrigerant distributor includes: a first introduction pipe configured to be open at a first end and closed at a second end and to cause refrigerant to flow from the first end toward the second end; a second introduction pipe configured to be closed in ends on both upstream and downstream sides and to cause the refrigerant to flow in a direction opposite to a refrigerant flow direction in the first introduction pipe; a plurality of branch pipes connected to the second introduction pipe along the direction of the refrigerant through the second introduction pipe; and an adjusting pipe configured to connect the first introduction pipe and the second introduction pipe, the adjusting pipe connecting a part of the first introduction pipe, the part being on a side of the second end, connecting a side of the second end of the first introduction pipe to between an end of the second introduction pipe on the upstream side and a branch pipe of the branch pipes, the branch pipe being connected to a most upstream side of the second introduction pipe among the branch pipes, wherein the adjusting pipe has a rectilinear shape in top view, and a connecting member on a side of the first introduction pipe is connected at a higher position than a connecting member on a side of the second introduction pipe.

Advantageous Effects of Invention

[0011]

According to the embodiment of the present invention, the refrigerant distributor includes the adjusting pipe, which is configured to connect a part of the first introduction pipe that is on a side of the second end to between an end of the second introduction pipe on the upstream side and a most upstream side of the second introduction pipe. This makes it possible to cancel out centrifugal force generated when refrigerant flows from the first introduction pipe to the second introduction pipe as well as to stir the refrigerant, and thereby provide a refrigerant distributor capable of distributing refrigerant equally among plural indoor units as well as to provide an air-conditioning apparatus that uses the refrigerant distributor.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a circuit diagram of an air-conditioning apparatus equipped with a refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a schematic front view of a conventional refrigerant branching unit.

[Fig. 3] Fig. 3 is a schematic perspective view of the conventional refrigerant branching unit.

[Fig. 4] Fig. 4 is a schematic side view of a refrigerant distributor provided on the conventional refrigerant

branching unit.

[Fig. 5] Fig. 5 is a schematic perspective view of the refrigerant distributor provided on the conventional refrigerant branching unit.

[Fig. 6] Fig. 6 is a schematic top view of the conventional refrigerant distributor.

[Fig. 7] Fig. 7 is a diagram showing amounts of liquid refrigerant distributed to respective branch pipes in the conventional refrigerant distributor.

[Fig. 8] Fig. 8 is a schematic perspective view of a refrigerant branching unit equipped with the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 9] Fig. 9 is a schematic side view of the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 10] Fig. 10 is a schematic perspective view of the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 11] Fig. 11 is a schematic top view of the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 12] Fig. 12 is an enlarged schematic perspective view of a lower end of the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 13] Fig. 13 is a diagram showing amounts of liquid refrigerant distributed to respective branch pipes in the refrigerant distributor according to Embodiment 1 of the present invention.

[Fig. 14] Fig. 14 is an enlarged schematic perspective view of a lower end of a refrigerant distributor according to Embodiment 2 of the present invention.

[Fig. 15] Fig. 15 is an enlarged schematic perspective view of a lower end of a refrigerant distributor according to Embodiment 3 of the present invention.

Description of Embodiments

[0013]

Embodiments of an outdoor unit of an air-conditioning apparatus according to the present invention will be described below with reference to the accompanying drawings. Note that the embodiments shown in the drawings are examples and are not intended to limit the present invention. Also, in the drawings, components denoted by the same reference numerals are identical or equivalent components. This applies throughout the entire specification. Furthermore, in the following drawings, components may not be shown in their true size relations.

[0014]

Embodiment 1.

wall surface of the second introduction pipe 11 and an inner wall surface of the lower end 11b, thereby cancelling out the centrifugal force, reducing the flow velocity, and further facilitating stirring of the two-phase gas-liquid refrigerant by impact of the hit. With the centrifugal force cancelled out, the two-phase gas-liquid refrigerant stirred sufficiently flows upward in the second introduction pipe 11, and is distributed to the individual branch pipes 10. In this way, by cancelling out the centrifugal force acting on the two-phase gas-liquid refrigerant, reducing the flow velocity of the refrigerant, stirring the refrigerant sufficiently, and then distributing the two-phase gas-liquid refrigerant to the individual branch pipes 10, it becomes possible to distribute homogeneous refrigerant to each distributor.

[0032]

Fig. 13 is a diagram showing amounts of liquid refrigerant distributed to respective branch pipes in the refrigerant distributor according to Embodiment 1 of the present invention. As shown in Fig. 13, the amounts of liquid-phase refrigerant distributed to the respective branch pipes 10a to 10f are improved compared to distribution characteristics shown in Fig. 7, and the liquid-phase refrigerant is distributed equally among the branch pipes 10a to 10f. In this way, since the second introduction pipe 11 equipped with the branch pipes 10a to 10f is connected with the first introduction pipe 12 via the adjusting pipe 13, the deflection of refrigerant caused by the centrifugal force generated due to shape of the conventional refrigerant distributor 71 and resulting increases in the flow velocity of the refrigerant can be cancelled out by the first introduction pipe 12, second introduction pipe 11, and adjusting pipe 13.

[0033]

[Advantageous effects of Embodiment 1]

Thus, according to Embodiment 1, a refrigerant distributor 20 includes: a first introduction pipe 12 configured to be open at a first end and closed at a second end and to cause refrigerant to flow from the first end toward the second end; a second introduction pipe 11 configured to be closed in ends on both upstream and downstream sides and to cause the refrigerant to flow in a direction opposite to a

[0041]

[Behavior of refrigerant in refrigerant distributor]

Next, behavior of refrigerant in the refrigerant distributor 20a will be described.

As shown in Fig. 14, two-phase gas-liquid refrigerant flowing into the first introduction pipe 12 from top to bottom hits an inner wall surface of the lower end 12b of the first introduction pipe 12, cancelling out downward momentum and stirring gas-phase refrigerant and liquid-phase refrigerant. Then, the two-phase gas-liquid refrigerant flows into the adjusting pipe 17 through the connecting member 13a. Since the adjusting pipe 17 has a U-shape, centrifugal force acts on the two-phase gas-liquid refrigerant. The two-phase gas-liquid refrigerant flowing out of the adjusting pipe 13 through the connecting member 13b flows into the second introduction pipe 11. In so doing, the two-phase gas-liquid refrigerant hits an inner wall surface of the second introduction pipe 11 and an inner wall surface of the lower end 11b, thereby cancelling out the centrifugal force, reducing the flow velocity, and further facilitating stirring of the two-phase gas-liquid refrigerant by impact of the hit. With the centrifugal force cancelled out, the two-phase gas-liquid refrigerant stirred sufficiently flows upward in the second introduction pipe 11, and is distributed to the individual branch pipes 10. In this way, by cancelling out the centrifugal force acting on the two-phase gas-liquid refrigerant, reducing the flow velocity of the refrigerant, stirring the refrigerant sufficiently as well, and then distributing the two-phase gas-liquid refrigerant to the individual branch pipes 10, it becomes possible to distribute homogeneous refrigerant to each distributor.

[0042]

[Advantageous effects of Embodiment 2]

Thus, according to Embodiment 2, the adjusting pipe 17 is installed by being inclined toward the branch pipes 10. Consequently, in addition to the effects of Embodiment 1, by cancelling out the centrifugal force acting on the two-phase gas-liquid refrigerant, reducing the flow velocity of the refrigerant, stirring the refrigerant sufficiently as well, and then distributing the two-phase gas-liquid refrigerant to the individual branch pipes 10, it becomes possible to distribute homogeneous refrigerant

to each distributor.

[0043]

Embodiment 3.

A basic configuration of a refrigerant distributor according to Embodiment 3 is similar to that of the refrigerant distributor according to Embodiment 1, and thus Embodiment 3 will be described below by focusing on differences from Embodiment 1. A difference of Embodiment 3 from Embodiment 1 lies in that the adjusting pipe has a rectilinear shape.

[0044]

Fig. 15 is an enlarged schematic perspective view of a lower end of the refrigerant distributor according to Embodiment 3 of the present invention. As shown in Fig. 15, a refrigerant distributor 20b includes an adjusting pipe 16, a first introduction pipe 12, and a second introduction pipe 11. The adjusting pipe 16 has a rectilinear shape in top view. The adjusting pipe 16 is connected to the first introduction pipe 12 via a connecting member 13a, and to the second introduction pipe 11 via a connecting member 13b. When the first introduction pipe 12 and second introduction pipe 11 are placed vertically in a level flat site, the adjusting pipe 16 is connected to the first introduction pipe 12 and second introduction pipe 11 in a horizontal direction. Note that although in the example shown in Embodiment 3, the adjusting pipe 16 is connected in a horizontal direction, the present invention is not limited to this. For example, by installing the connecting member 13a of the first introduction pipe 12 at a higher level than the connecting member 13b of the second introduction pipe 11, the adjusting pipe 16 may be installed by being inclined. In that case, the refrigerant flowing out of the adjusting pipe 16 hits the lower end 11b of the second introduction pipe 11 more intensely, thereby stirring the two-phase gas-liquid refrigerant more vigorously and offering the effect of reducing the flow velocity of the refrigerant.

[0045]

[Behavior of refrigerant in refrigerant distributor]

Next, behavior of refrigerant in the refrigerant distributor 20b will be described.

As shown in Fig. 15, the two-phase gas-liquid refrigerant flowing into the first introduction pipe 12 from top to bottom hits an inner wall surface of the lower end 12b of the first introduction pipe 12, cancelling out downward momentum and stirring gas-phase refrigerant and liquid-phase refrigerant. Then, the two-phase gas-liquid refrigerant flows into the adjusting pipe 16 through the connecting member 13a. The two-phase gas-liquid refrigerant flowing out of the adjusting pipe 16 through the connecting member 13b flows into the second introduction pipe 11. In so doing, the two-phase gas-liquid refrigerant hits the inner wall surface and lower end 11b of the second introduction pipe 11, thereby reducing the flow velocity, and further facilitating stirring of the two-phase gas-liquid refrigerant by impact of the hit. The two-phase gas-liquid refrigerant stirred sufficiently flows upward in the second introduction pipe 11, and is distributed to the individual branch pipes 10. In this way, by reducing the flow velocity of the two-phase gas-liquid refrigerant, stirring the refrigerant sufficiently, and then distributing the two-phase gas-liquid refrigerant to the individual branch pipes 10, it becomes possible to distribute homogeneous refrigerant to each distributor.

[0046]

[Advantageous effects of Embodiment 3]

Thus, according to Embodiment 3, the adjusting pipe 16 has a rectilinear shape in top view. Consequently, in addition to the effects of Embodiment 1, Embodiment 3 provides the refrigerant distributor 20b capable of reducing the flow velocity of the refrigerant and facilitating stirring of the two-phase gas-liquid refrigerant.

[0047]

Also, on the adjusting pipe 16, the connecting member 13a on the side of the first introduction pipe 12 is connected at a higher level than the connecting member 13b on the side of the second introduction pipe 11. Consequently, the refrigerant flowing out of the adjusting pipe 16 hits the lower end 11b of the second introduction pipe 11 more intensely, thereby stirring the two-phase gas-liquid refrigerant more vigorously and offering the effect of reducing the flow velocity of the refrigerant.

[0048]