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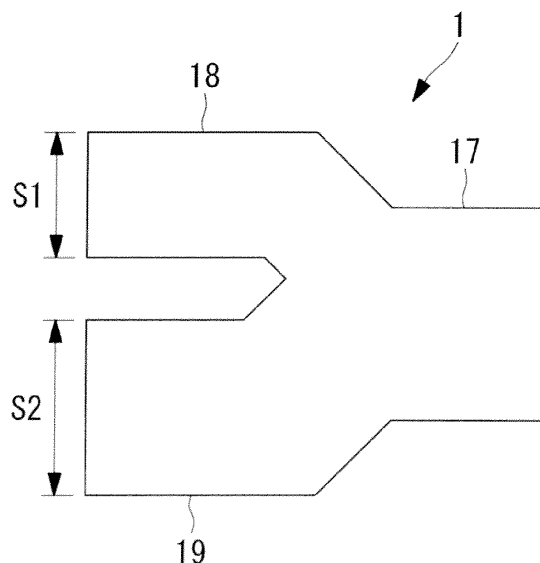
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(54) **Branch pipe and air conditioning system**

(57) A branch pipe (1) according to the present invention is provided for gas pipes for communicating at least one indoor unit and outdoor units, and used at a branch section for distributing refrigerant to the outdoor units. The branch pipe (1) includes an inflow portion (17) into which the refrigerant flows, a first outflow portion (18) for discharging the refrigerant flowing from the inflow portion (17) toward the outdoor units, and a second outflow

portion (19) for discharging the refrigerant flowing from the inflow portion (17) toward the outdoor units different from the outdoor units that are outflow destinations of the first outflow portion (18) at a target flow rate different from a target flow rate of the first outflow portion (18), and the cross section ratio  $S1:S2$  between the first outflow portion (18) and the second outflow portion (19) is determined depending on the target flow ratio between the first outflow portion (18) and the second outflow portion (19).

**FIG. 3**



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**Description**

Technical Field

5 **[0001]** The present invention relates to a branch pipe provided for gas pipes for communicating at least one indoor unit with outdoor units and an air conditioning system.

Background Art

10 **[0002]** In an air conditioning system having outdoor units and at least one indoor unit and provided with a refrigerant circuit including refrigerant pipes, plural outdoor units are arranged in parallel, in some cases. In order to distribute refrigerant to the plural outdoor units, refrigerant pipes are provided with a branch pipe. Fig. 5 and Fig. 6 illustrate a conventional branch pipe 2.

15 **[0003]** The branch pipe 2 includes an inflow portion 20 and two outflow portions 21, and the refrigerant flowing into the inflow portion 20 is divided in two directions and flows out from the two outflow portions 21. Conventionally, such two outflow portions 21 have the same cross sectional area. For example, Fig. 6 illustrates a cross section ratio of S3: S4=1:1.

20 **[0004]** Patent Literature 1 discloses a technique relating to a branch pipe joint for distributing refrigerant flowing through a main pipe into two flows, and coping with size reduction in the vicinity of a branch section eccentric flow prevention at the branch section.

Citation List

Patent Literature

25

PTL 1

**[0005]** The Publication of Japanese Patent No. 3742933

30 Summary of Invention

Technical Problem

35 **[0006]** With reference to Fig. 1, descriptions will be provided on the configuration of an air conditioning system 10. Each outdoor unit 3 of the air conditioning system 10 includes a compressor, an outdoor heat exchanger, and an expansion valve for heating, and each indoor unit 4 includes an expansion valve for cooling and an indoor heat exchanger.

40 **[0007]** In the cooling operation, the outdoor heat exchanger functions as a condenser, the indoor heat exchanger functions as an evaporator. In the cooling operation, the refrigerant circuit includes the compressor, the outdoor heat exchanger, the expansion valve for cooling and the indoor heat exchanger. In the heating operation, the indoor heat exchanger functions as a condenser, and the outdoor heat exchanger functions as an evaporator. In the heating operation, the refrigerant circuit includes the compressor, the indoor heat exchanger, the expansion valve for heating, and the outdoor heat exchanger.

**[0008]** illustrated in Fig. 1, if the air conditioning system 10 includes three outdoor units 3 and three indoor units 4, the refrigerant flows through fluid pipes 6, 7, 8, 9, 11 that are refrigerant pipes and through gas pipes 12, 13, 14, 15, 16.

45 **[0009]** In the compressors of the outdoor units 3 of the air conditioning system 10, lubricant oil is used for the sake of lubrication for a sliding part in each compressor. The lubricant oil flows along with part of the refrigerant discharged from the compressor through the refrigerant circuit including the outdoor heat exchanger, indoor heat exchanger and other components, and then is collected to the compressor again. When flowing through the refrigerant circuit, if the lubricant oil adheres to inner walls of the heat exchangers and the refrigerant pipes, this hinders heat transfer and reduces the lubricant oil amount to be returned to the compressor, which causes shortage of lubrication for the compressor. To counter this problem, a so-called "oil return operation" to periodically collect the lubricant oil to the compressors is carried out so as to collect the lubricant oil adhering to the inner walls of the heat exchangers and the refrigerant pipes and remaining stagnant there.

50 **[0010]** in the oil return operation, the compressor of every outdoor unit sucks and discharges the refrigerant at the same flow rate so that the same amount of the lubricant oil is collected to every outdoor unit.

55 **[0011]** As illustrated in Fig. 1, even in the case in which more than two outdoor units 3 are arranged in parallel, the branch pipe 2 illustrated in Fig. 5 and Fig. 6 is used at each of a branch section 28 and a branch section 29. In the oil return operation, at the branch section 29 having two outdoor units 3 that are respective refrigerant outflow destinations

on both sides of the branch section 29, the refrigerant and the lubricant oil are equally distributed to both the outdoor units 3 by the branch pipe 2 in which the outflow portion 21 has a cross section ratio of  $S3:S4 = 1:1$ . Consequently, the lubricant oil is equally collected to the two outdoor units 3.

5 [0012] On the other hand, the branch section 28 has one outdoor unit 3 as the refrigerant outflow destination on one side and two outdoor units 3 as the refrigerant outflow destination on the other side. Therefore, in the oil return operation, the flow rate of the refrigerant and the lubricant oil is different between the outflow portion 21 on the one side and the outflow portion 21 on the other side of the branch pipe 2. At this time, if the distribution ratio of the lubricant oil between one outdoor unit 3 on the one side and two outdoor units 3 on the other side becomes 1:2, the lubricant oil can be equally collected in all the three outdoor units 3. However, if the conventional branch pipe 2 having the outflow portions 21 using the cross section ratio of  $S3:S4 = 1:1$  is used at both the branch sections 28 and 29, it is difficult to equally distribute the lubricant oil to all the outdoor units 3.

10 [0013] The present invention has been made in the light of the above facts, and has an object to provide a branch pipe and an air conditioning system capable of distributing refrigerant from indoor units toward each of outdoor units at an appropriate ratio at a branch section of gas pipes through which the refrigerant flows.

#### 15 Solution to Problem

[0014] In order to solve the above problems, the branch pipe and the air conditioning system according to the present invention employs the following solutions.

20 The branch pipe according to a first aspect of the present invention is provided for gas pipes for communicating at least one indoor unit with outdoor units, and used at a branch section for distributing refrigerant to the outdoor units, and the branch pipe includes an inflow portion into which the refrigerant flows; a first outflow portion for discharging the refrigerant flowing from the inflow portion toward the outdoor units; and a second outflow portion for discharging the refrigerant flowing from the inflow portion toward the outdoor units different from the outdoor units that are outflow destinations of the first outflow portion at a target flow rate different from a target flow rate of the first outflow portion. In this branch pipe, a cross section ratio between the first outflow portion and the second outflow portion is determined depending on a target flow ratio between the first outflow portion and the second outflow portion.

25 [0015] According to the first aspect, the refrigerant flowing into the inflow portion is discharged from the first outflow portion and the second outflow portion. The cross section ratio between the cross sectional area of the first outflow portion and the cross sectional area of the second outflow portion is determined depending on the target flow rate between the target flow rate of the refrigerant in the first outflow portion and the target flow rate of the refrigerant in the second outflow portion, so that the flow speed of the refrigerant becomes equal between the first outflow portion and the second outflow portion. Contrary to the case in which the cross section ratio between the first outflow portion and the second outflow portion is 1:1, and the cross section ratio is adjusted at the gas pipes located on the downstream side and connected respectively to the first outflow portion and the second outflow portion; in the present aspect, the cross section ratio is adjusted at a closer position to the point where the refrigerant flowing from the inflow portion is branched. Accordingly, the flow rates of the refrigerant flowing respectively from the first outflow portion and the second outflow portion into the outdoor units become closer to the target flow rate. As a result, if the lubricant oil is included in the refrigerant flowing from the indoor units to the outdoor units, the lubricant oil can be distributed to each outdoor unit at a more appropriate ratio.

30 [0016] The branch pipe according to a second aspect of the present invention is provided for gas pipes for communicating at least one indoor unit with outdoor units, used at a branch section of the pipes for distributing refrigerant to the outdoor units. The branch pipe includes an inflow portion into which the refrigerant flows; a first outflow portion for discharging the refrigerant flowing from the inflow portion toward at least one outdoor unit; and a second outflow portion for discharging the refrigerant flowing from the inflow portion toward outdoor units other than and different in the number of units from the outdoor units that is an outflow destination of the first outflow portion. In this branch pipe, if a flow rate of the refrigerant is controlled to be equal for all the outdoor units, a cross section ratio between the first outflow portion and the second outflow portion is determined depending on a ratio of the number of units between the outdoor units that are the outflow destinations of the first outflow portion and the outdoor units that are the outflow destinations of the second outflow portion.

35 [0017] According to the second aspect, the refrigerant flowing into the inflow portion is discharged from the first outflow portion and the second outflow portion. If the flow rate of the refrigerant is controlled to be equal for all the outdoor units, the cross section ratio between the cross sectional area of the first outflow portion and the cross sectional area of the second outflow portion is determined depending on the ratio of the number of units between the outdoor units as the outflow destinations of the first outflow portion the outdoor units as the outflow destinations of the second outflow portion, so that the flow speed of the refrigerant becomes equal between the first outflow portion and the second outflow portion. Contrary to the case in which the cross section ratio between the first outflow portion and the second outflow portion is 1:1, and the cross section ratio is adjusted at the gas pipes located on the downstream side and connected respectively

to the first outflow portion and the second outflow portion; in the present aspect, the cross section ratio is adjusted at a closer position to the point where the refrigerant is branched. Accordingly, the refrigerant flowing respectively from the first outflow portion and the second outflow portion into the outdoor units is distributed depending on the number of the outdoor units. As a result, if the lubricant oil is included in the refrigerant flowing from the indoor units toward the outdoor units, the lubricant oil can be equally distributed to each outdoor unit.

**[0018]** The air conditioning system according to a third aspect of the present invention includes at least one indoor unit, outdoor units, and gas pipes for communicating the at least one indoor unit with the outdoor units, and the gas pipes are provided with the above described branch pipe.

**[0019]** According to the present aspect, in the oil return operation or other operations, if the lubricant oil is included in the refrigerant flowing from the indoor units to the outdoor units, the lubricant oil can be distributed to each outdoor unit at a more appropriate ratio.

Advantageous Effects of Invention

**[0020]** According to the present invention, it is possible to distribute the refrigerant from the indoor units to each of the outdoor units at an appropriate ratio at the branch section of the gas pipes through which the refrigerant flows.

Brief Description of Drawings

**[0021]**

Fig. 1 Fig. 1 is a block diagram of illustrating an air conditioning system, according to one embodiment of the present invention.

Fig. 2 Fig. 2 is an end view of illustrating a branch pipe according to the present embodiment.

Fig. 3 Fig. 3 is a longitudinal sectional view of illustrating the branch pipe according to the present embodiment.

Fig. 4 Fig. 4 is a front view of illustrating an example of piping to which the branch pipe according to the present embodiment is applied.

Fig. 5 Fig. 5 is an end view of illustrating a conventional branch pipe.

Fig. 6 Fig. 6 is a longitudinal sectional view of illustrating the conventional branch pipe.

Description of Embodiment

**[0022]** Hereinafter, descriptions will be provided on the embodiment of the present invention with reference to the drawings.

The configuration of the air conditioning system according to one embodiment of the present invention will be described with reference to Fig. 1.

As illustrated in Fig. 1, the air conditioning system 10 according to the present embodiment includes plural outdoor units 3 and plural indoor units 4. Each outdoor unit 3 includes a compressor, an outdoor heat exchanger and an expansion valve for heating, which are not illustrated, and each indoor unit 4 includes an expansion valve for cooling and an indoor heat exchanger, which are not illustrated.

**[0023]** In the cooling operation, the outdoor heat exchanger functions as a condenser and the indoor heat exchanger functions as an evaporator. A refrigerant circuit includes the compressor, the outdoor heat exchanger, the expansion valve for cooling the indoor heat exchanger. As illustrated in Fig. 1, if the air conditioning system 10 includes three outdoor units 3 and three indoor units 4, refrigerant flows through fluid pipes 6, 7, 8, 9, 11 that refrigerant pipes, and gas pipes 12, 13, 14, 15, 16.

**[0024]** In the cooling operation, high temperature and high pressure gas refrigerant discharged from the compressor of the outdoor unit 3 is transferred to the outdoor heat exchanger, where the gas refrigerant is heat-exchanged with the outdoor air to be condensed into a liquid state. This liquid refrigerant flows into the fluid pipe 6 through the fluid pipes 7, 8, 9, 11 and then into the indoor unit 4. The liquid refrigerant becomes adiabatic-expanded during passing through the expansion valve for cooling, and thereafter, is transferred to the indoor heat exchanger, where the liquid refrigerant is evaporated into a gas state by cooling the indoor air. The refrigerant that has absorbed the heat and becomes gasified in the indoor heat exchanger flows into the gas pipe 12, through the gas pipes 13, 14, 15 into the outdoor unit 3 and then is transferred to the compressor.

**[0025]** In the heating operation, the indoor heat exchanger functions as a condenser and the outdoor heat exchanger functions as an evaporator. The refrigerant circuit includes the compressor, the indoor heat exchanger, the expansion valve for heating the outdoor heat exchanger.

**[0026]** In the heating operation, a not-illustrated four-way valve provided for the indoor unit 3 is switched to a different way from that in the cooling operation. The refrigerant discharged from the compressor of each outdoor unit 3 flows into

the gas pipe 15 through the gas pipes 14, 13, 12 into the indoor heat exchanger of each indoor unit 4, where the refrigerant radiates heat toward the indoor air to be condensed into a liquid state. This liquid refrigerant flows into the fluid pipe 9 from each indoor unit 4 through the fluid pipes 8, 7, 6, and then into each outdoor unit 3. The liquid refrigerant becomes adiabatic-expanded during passing through the expansion valve for heating of each outdoor unit 3, and then, is transferred to the outdoor heat exchanger, where the liquid refrigerant is evaporated into a gas state by absorbing heat from the outdoor air. Thereafter, this gas refrigerant is transferred to the compressor of each outdoor unit 3.

[0027] A branch pipe (not-illustrated) is provided at an outdoor branch section 22, and one end of this branch pipe is connected to two fluid pipes 6 each of which is connected to one outdoor unit 3, and the other end thereof is connected to one fluid pipe 7. A branch pipe (not-illustrated) is provided at an outdoor branch section 23, and one end of this branch pipe is connected to fluid pipe 6 which is connected to one outdoor unit 3 and to one fluid pipe 7, and the other end thereof is connected to one fluid pipe 8.

[0028] A branch pipe (not-illustrated) is provided at an indoor branch section 24, and one end of this branch pipe is connected to one fluid pipe 8, and the other end thereof is connected to one fluid pipe 9 connected to one indoor unit 4 and to one fluid pipe 11. A branch pipe (not-illustrated) is provided at an indoor branch section 25, and one end of this branch pipe is connected to one fluid pipe 11, and the other end thereof is connected to two fluid pipes 9 each of which is connected to one indoor unit 4.

[0029] A branch pipe (not-illustrated) is provided at an indoor branch section 26, and one end of this branch pipe is connected to two gas pipes 12 each of which is connected to one indoor unit 4, and the other end is connected to one gas pipe 13. A branch pipe (not-illustrated) is provided at an indoor branch section 27, and one end of this branch pipe is connected to one gas pipe 12 connected to one indoor unit 4 and to one gas pipe 13, and the other end is connected to one gas pipe 14.

[0030] A branch pipe 1 as illustrated in Fig. 2 and Fig. 3 is provided at the outdoor branch section 28, and one end of the branch pipe 1 is connected to one fluid pipe 14 and the other end thereof is connected to one gas pipe 15 connected to one outdoor unit 3 and to one gas pipe 16. A branch pipe 2 as illustrated in Fig. 4 and Fig. 5 is provided at the outdoor branch section 29, and one end of the branch pipe 2 is connected to one gas pipe 16 and the other end thereof is connected to two gas pipes 15 each of which is connected to one outdoor unit 3.

[0031] In the compressor of the outdoor unit 3 included in the air conditioning system 10 of the present embodiment, lubricant oil is used for the sake of lubrication for a sliding part in each compressor 3. The lubricant oil flows along with part of the refrigerant discharged from each compressor through the refrigerant circuit including the indoor heat exchanger, the outdoor heat exchanger and other components, and then is collected into the compressor again.

[0032] If the lubricant oil flowing in the refrigerant circuit adheres to the inner walls of the heat exchangers and the refrigerant pipe, this hinders heat transfer and reduces the lubricant oil amount to be returned to the compressor, which causes lubrication shortage to the compressor. To counter this problem, in the air conditioning system 10 of the present embodiment, an oil return operation to periodically collect the lubricant oil to each compressor is carried out so as to collect the lubricant oil adhering to the inner walls of the heat exchangers and the refrigerant pipes remaining stagnant there.

[0033] In the oil return operation, a controller 5 controls the flow rate of the refrigerant such that the compressors of all the outdoor units 3 suck and discharge the refrigerant at the same flow rate. Accordingly, the same amount of the lubricant oil is collected to all the outdoor units 3.

[0034] The oil return operation will be described, hereinafter.

in the cooling operation, the controller 5 starts the lubricant oil collecting operation at specified timing. In the lubricant oil collecting operation at the time of the cooling operation, the rotation frequency of a fan (not illustrated) of the indoor unit 4 is reduced, or the opening of a flow regulating valve (not illustrated) is set to be greater than the specified opening. As a result, the evaporation amount in the indoor heat exchanger is reduced, so that the refrigerant can be circulated in a liquid phase state. The lubricant oil adhering to the pipe walls of the indoor heat exchangers and the gas pipes 12, 13, 14, 15 along with the liquid refrigerant are collected into an accumulator (not illustrated) of each outdoor unit 3, and then the lubricant oil is returned from an oil return pipe of the accumulator into each compressor.

[0035] On the other hand, during the heating operation, the controlled 5 starts the lubricant oil collecting operation at specified timing. In the lubricant oil collecting operation during the heating operation, the fan of each indoor unit 4 is stopped so as to stop the room air conditioning. In order to circulate the refrigerant in the same way as that in the cooling operation, the four-way valve is switched to a different way from that in the normal heating operation. Then, the high temperature and high pressure gas refrigerant compressed by the compressor of each outdoor unit 3 is led to the outdoor heat exchanger so as to be condensed into the liquid refrigerant. The liquid refrigerant flows into the fluid pipe 6 and then is led through the fluid pipes 7, 8, 9, 11 into the indoor unit 4. The liquid refrigerant, without being heat exchanged in the indoor heat exchanger, flows into the gas pipe 12 staying in the liquid refrigerant state, and is led through the gas pipes 13, 14, 15, 16 into each outdoor unit 3 again. The liquid refrigerant flowing into the outdoor unit 3 is returned through the accumulator to the compressor. Accordingly, the lubricant oil distributed in the indoor heat exchanger and the fluid pipes 6, 7, 8, 9 can be returned to the compressor.

[0036] With reference to Fig. 2 and Fig. 3, the branch pipe 1 according to the present embodiment will be described. The branch pipe 1 is provided for the refrigerant pipes, and is applied to the branch section 28 as illustrated in Fig. 1. During the oil return operation, the branch pipe 1 distributes the refrigerant and the lubricant oil to the plural outdoor units 3.

[0037] The branch pipe 1 includes an inflow portion 17, a first outflow portion 18 and a second outflow portion 19. The branch pipe 1 has a substantially Y shape.

[0038] The inflow portion 17 has a circular cross section, for example, into which the refrigerant and the lubricant oil flow during the oil return operation. The inflow portion 17, as illustrated in Fig. 4, is connected to the gas pipe 14 by brazing.

[0039] The first outflow portion 18 has a circular cross section, for example, and delivers the refrigerant and the lubricant oil flowing from the inflow portion 17 to the outdoor unit 3 at the time of the oil return operation. The first outflow portion 18, as illustrated in Fig. 4, is connected to the gas pipe 15 by brazing.

[0040] The second outflow portion 19 delivers the refrigerant and the lubricant oil flowing from the inflow portion 17 at the time of the oil return operation into the outdoor unit or units 3 different from the outdoor unit 3 as the outflow destination from the first outflow portion 18. The second outflow portion 19, as illustrated in Fig. 4, is connected to the gas pipe 16 by brazing.

[0041] When the flow rate of the refrigerant is controlled to be the same for all the outdoor units 3 at the time of the oil return operation, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 is determined depending on the ratio of the number of units between the outdoor units 3 that are the outflow destination of the first outflow portion 18 and the outdoor units 3 that are outflow destinations of the second outflow portion 19.

[0042] For example, in the case of the branch section 28 as illustrated in Fig. 1, there is one outdoor unit 3 that is an outflow destination from the first outflow portion 18, and there are two outdoor units 3 that are outflow destinations from the second outflow portion 19. Therefore, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 is determined as  $S1:S2 = 1:2$ . At this time, the cross section ratio between the gas pipe 15 and the gas pipe 16 is also set to be 1:2.

[0043] If the flow rate of the refrigerant is controlled to be the same for all the outdoor units 3, in the example as illustrated in Fig. 1, there is one outdoor unit 3 that is the outflow destination of the first outflow portion 18, and there are two outdoor units 3 that are outflow destinations of the second outflow portion 19, so that the target flow ratio between the first outflow portion 18 and the second outflow portion 19 is 1:2.

[0044] In the case of the air conditioning system 10 having three outdoor units 3, the lubricant oil can be equally distributed to all the outdoor units 3 through the oil return operation by applying the branch pipe 1 having the above configuration to the branch section 28 and by applying the branch pipe 2 having the conventional configuration to the branch section 29.

[0045] The flow speed in a cylindrical portion is expressed by "flow speed = flow rate/cross sectional area". Therefore, if the flow rate of the refrigerant is controlled to be equal for all the outdoor units 3, both the first outflow portion 18 and the second outflow portion 19 of the branch pipe 1 according to the present embodiment have the same flow speed. Contrary to the case in which the conventional branch pipe 2 whose two outflow portions 21 have a cross section ratio of  $S3:S4 = 1:1$  is applied to the branch section 28, and the cross section ratio is adjusted at the gas pipes 15, 16 that are located on the downstream side and that are connected respectively to the outflow portions 21; in the present embodiment, the cross section ratio is adjusted at a closer position to the point where the refrigerant is branched.

[0046] Accordingly, it can be appreciated that the refrigerant flowing from the first outflow portion 18 and the second outflow portion 19 of the branch pipe 1 of the present embodiment into the outdoor units 3 is distributed depending on the number of the outdoor units 3 that are the outflow destinations. As a result, for example, if the lubricant oil is included in the refrigerant flowing from the indoor units 4 to the outdoor units 3, the lubricant oil can be equally distributed to each outdoor unit 3.

[0047] In the present embodiment, the case in which the ratio of the number of the outflow destinations of the branch pipe 1 is 1:2 has been described, but the present invention is not limited to this. For example, if the ratio of the number of the outflow destinations is 1:3, in order to set the flow rate for all the outdoor units 3 to be equal at the time of the oil return operation, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 of the branch pipe 1 is set to be 1:3. If the ratio of the number of units at the outflow destinations is 2:3, in order to set the flow rate for all the outdoor units 3 to be equal at the time of the oil return operation, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 of the branch pipe 1 is set to be 2:3.

[0048] In the above described embodiment, the case of the branch pipe having two outlets on the outflow side has been described, but even in the case of the branch pipe having three outlets or more, it is possible to equally distribute the lubricant oil to all the outdoor units 3 by setting the cross section ratio in the same manner.

[0049] Further, in the above described embodiment, it has been described that, in order to set the flow rate to be equal for all the outdoor units 3 at the time of the oil return operation, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 is configured to correspond to the ratio of the number of the outdoor units at the outflow destinations, but the present invention is not limited to this. For example, the present invention is also applicable even to such a case in which the outdoor units 3 that are the outflow destinations of the first outflow portion 18 and the

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second outflow portion 19 have different capacities, and the lubricant oil amount required inside each outdoor unit 3 is different, so that the flow rate for each outdoor unit 3 is also different from one another at the time of the oil return operation.

**[0050]** In this case, the cross section ratio between the first outflow portion 18 and the second outflow portion 19 is determined depending on the target flow ratio between the first outflow portion 18 and the second outflow portion 19.

The above described formula: flow speed = flow rate / cross sectional area is also applicable to this case, so that the flow speed of the refrigerant becomes equal between the first outflow portion 18 and the second outflow portion 19. If the lubricant oil is included in the refrigerant flowing from the indoor units 4 to the outdoor units 3, the lubricant oil can be distributed to each outdoor unit 3 at a more appropriate ratio, compared to the application of the conventional branch pipe 2.

### Reference Signs List

#### **[0051]**

15	1, 2	Branch pipes
	3	Outdoor unit
	4	Indoor unit
	5	Controller
	6, 7, 8, 9, 11	Fluid pipes
20	10	Air conditioning system
	12, 13, 14, 15, 16	Gas pipes
	17, 20	Inflow portions
	18	First outflow portion
	19	second outflow portion
25	21	Outflow portion
	22, 23, 24, 25, 26, 27, 28, 29	Branch sections

### Claims

1. A branch pipe (1) provided for gas pipes for communicating at least one indoor unit with outdoor units, and used at a branch section of the gas pipes for distributing refrigerant to the outdoor units, the branch pipe being **characterized in that** it comprises:

an inflow portion (17) into which the refrigerant flows;

a first outflow portion (18) for discharging the refrigerant flowing from the inflow portion (17) toward the outdoor units; and

a second outflow portion (19) for discharging the refrigerant flowing from the inflow portion (17) toward the outdoor units different from the outdoor units that are outflow destinations of the first outflow portion (18) at a target flow rate different from a target flow rate of the first outflow portion, and

a cross section ratio between the first outflow portion (18) and the second outflow portion (19) is determined depending on a target flow ratio between the first outflow portion (18) and the second outflow portion (19).

2. A branch pipe (1) provided for gas pipes for communicating at least one indoor unit with outdoor units, and used at a branch section of the gas pipes for distributing refrigerant to the outdoor units, the branch pipe being **characterized in that** it comprises:

an inflow portion (17) into which the refrigerant flows;

a first outflow portion (18) for discharging the refrigerant flowing from the inflow portion (17) toward at least one outdoor unit; and

a second outflow portion (19) for discharging the refrigerant flowing from the inflow portion (17) toward outdoor units other than and different in the number of units from the outdoor unit that is an outflow destination of the first outflow portion (18), and

if a flow rate of the refrigerant is controlled to be equal for all the outdoor units, a cross section ratio between the first outflow portion (18) and the second outflow portion (19) is determined depending on a ratio of the number of units between the outdoor unit that is the outflow destination of the first outflow portion (18) and the outdoor units that are the outflow destinations of the second outflow portion (19).

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3. An air conditioning system (10), **characterized in that** it comprises:

at least one indoor unit;

outdoor units; and

5 gas pipes (12,13,14,15,16) for communicating the at least one indoor unit with the outdoor units, wherein  
the pipes (12,13,14,15,16) are provided with the branch pipe (1) according to claim 1 or claim 2.

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FIG. 1

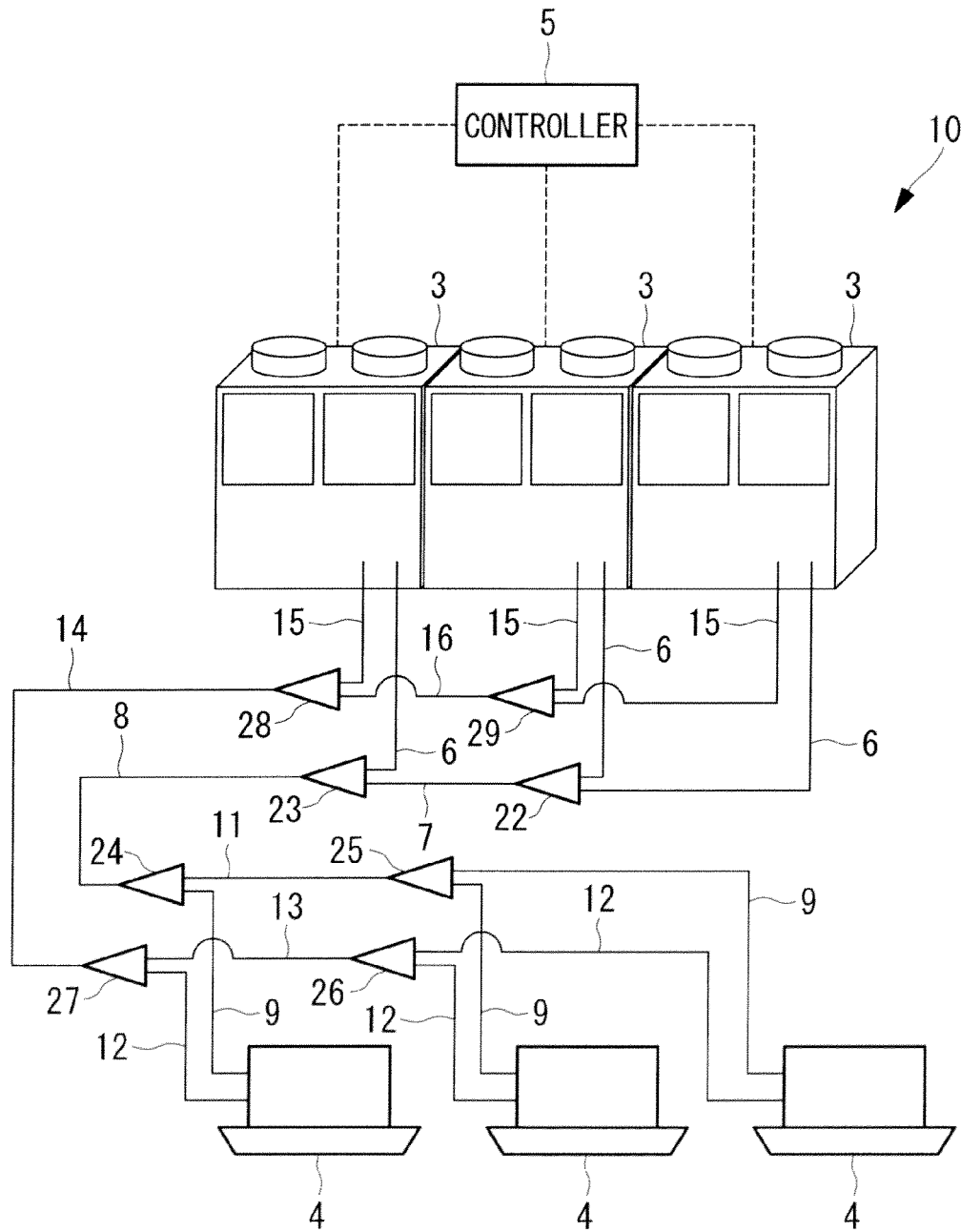


FIG. 2

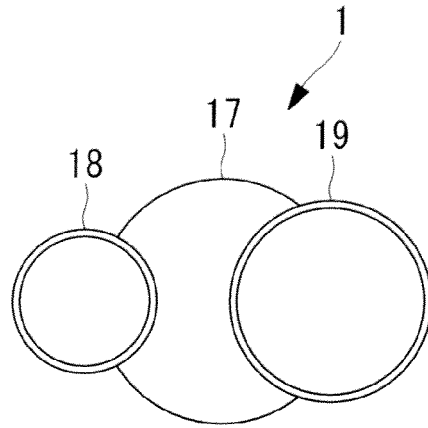


FIG. 3

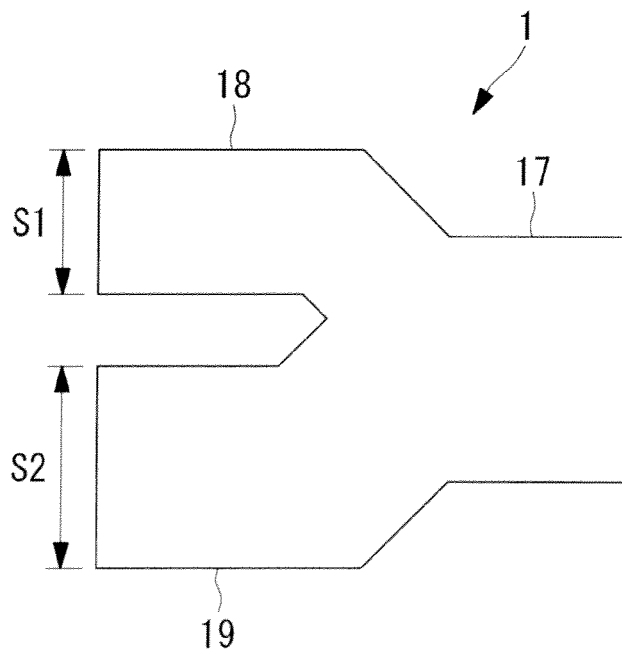


FIG. 4

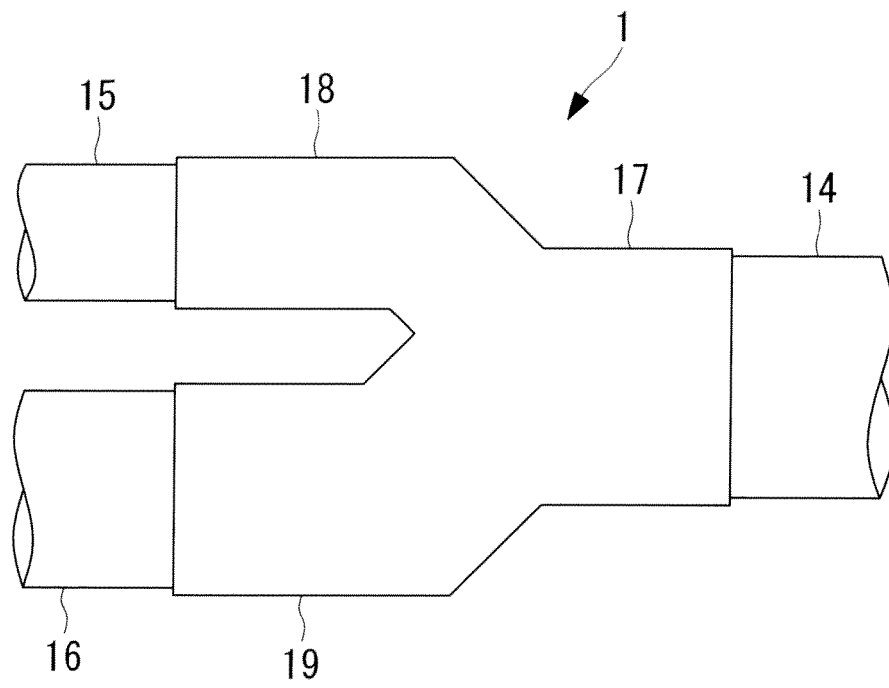


FIG. 5

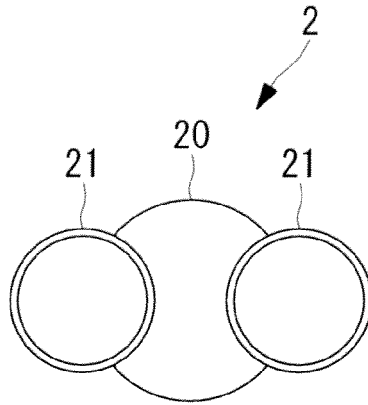
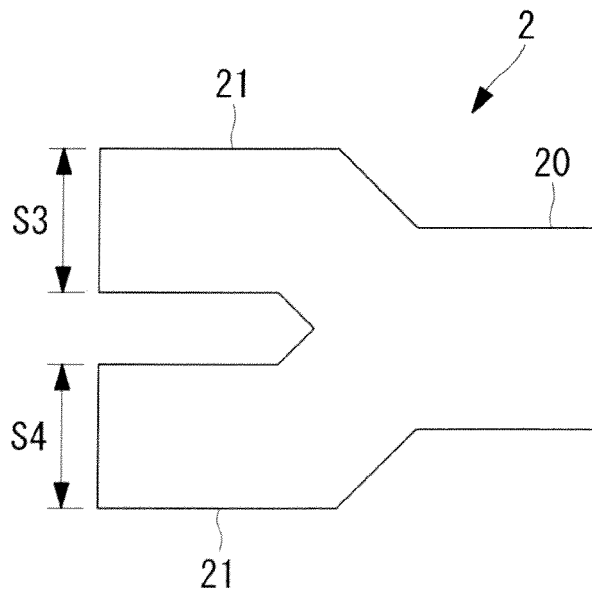


FIG. 6





EUROPEAN SEARCH REPORT

Application Number  
EP 12 16 5788

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 034 261 A1 (DAIKIN IND LTD [JP]) 11 March 2009 (2009-03-11) * paragraph [0110] *	1-3	INV. F24F1/32 F25B41/00
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