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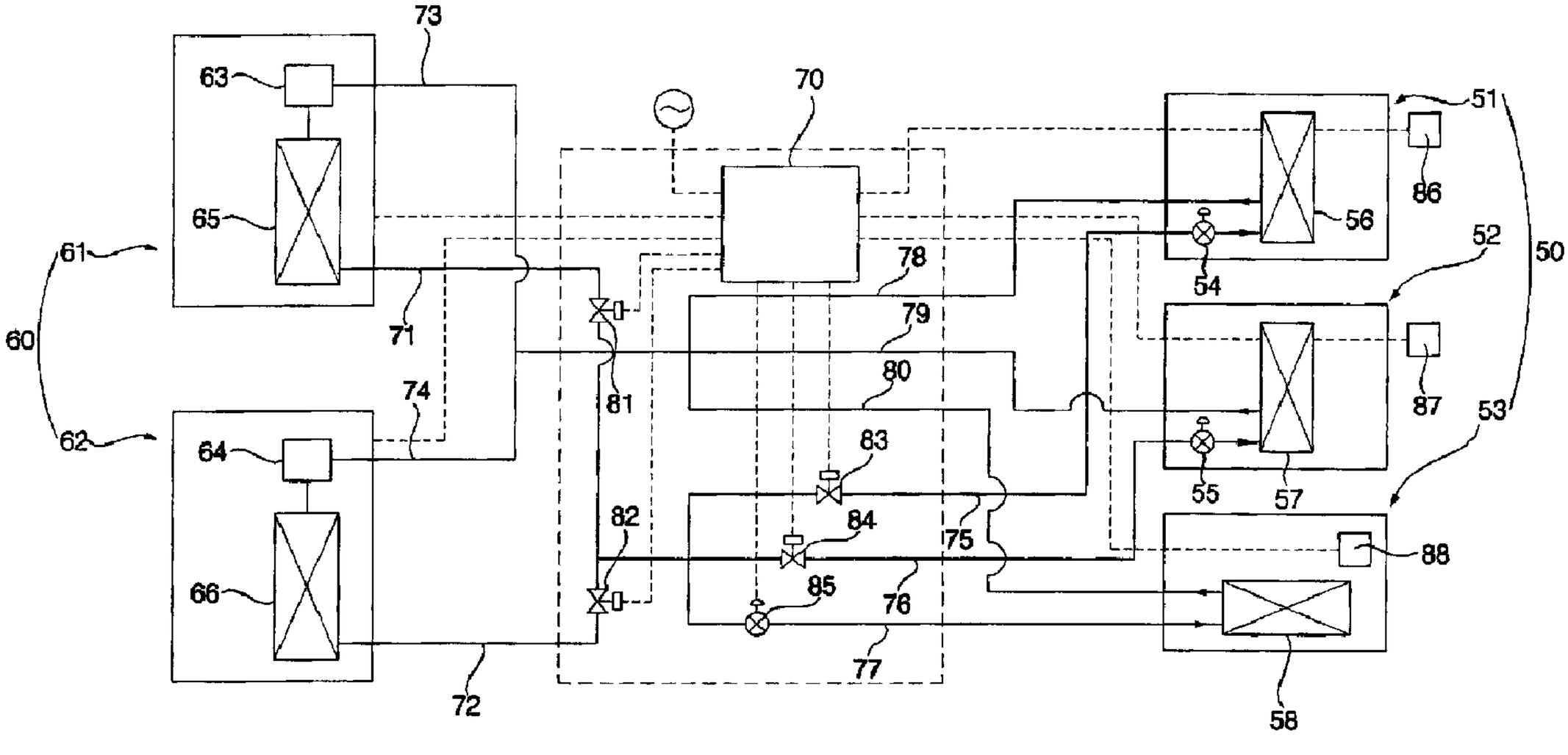


(57) Abrégé/Abstract:
An air conditioner, in which a controller is installed separately from a plurality of indoor units and a plurality of outdoor units so that only the controller is added and conventional outdoor units are used when plural indoor units are required, thereby reducing costs due to the omission of other outdoor units. The controller determines whether or not the outdoor units are respectively operated according to a signal of a temperature sensing unit, and selectively operates the outdoor units according to a required capacity, thereby increasing the operating efficiency of the air conditioner.

AIR CONDITIONER

ABSTRACT OF THE DISCLOSURE

An air conditioner, in which a controller is installed separately from a plurality of indoor units and a plurality of outdoor units so that only the controller is added and conventional outdoor units are used when plural indoor units are required, thereby reducing costs due to the omission of other outdoor units. The controller determines whether or not the outdoor units are respectively operated according to a signal of a temperature sensing unit, and selectively operates the outdoor units according to a required capacity, thereby increasing the operating efficiency of the air conditioner.

AIR-CONDITIONING SYSTEM WITH MULTIPLE INDOOR AND OUTDOOR UNITS AND CONTROL SYSTEM THEREFORE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an air conditioner, and more particularly to an air conditioner, in which a controller is installed separately from a plurality of indoor units and a plurality of outdoor units so that only the controller is added and conventional outdoor units are used when plural indoor units are required, thereby reducing costs due to the omission of other outdoor units.

Description of the Related Art

Generally, air conditioners include a heating apparatus for heating an indoor space, a cooling apparatus for cooling an indoor space, and an air purifier for purifying air, thereby providing a comfortable environment for people. Particularly, a unitary air conditioner uses duct-shaped indoor units for cooling or heating a plurality of chambers.

FIG. 1 is a circuit diagram schematically illustrating a conventional air conditioner.

As shown in FIG. 1, the conventional air conditioner comprises one outdoor unit 10, one indoor unit 20, and refrigerant pipes 30 for connecting the outdoor unit 10 and the indoor unit 20 to each other so that a refrigerant is circulated in the air conditioner through a refrigerating cycle, thereby cooling or heating an indoor space.

A compressor 12 for sucking a refrigerant in a low-temperature and low-pressure gaseous state and compressing the refrigerant into a high-temperature and high-pressure state and a condenser 14 for condensing the refrigerant in the high-temperature and high-pressure state, supplied from the compressor 12, by radiating heat from the refrigerant using outdoor air are installed in the outdoor unit 10. An expansion device 22 for expanding the refrigerant, supplied from the condenser 14 through the refrigerant pipes 30 of the outdoor unit 10, into a low-temperature and low-pressure state is installed in the indoor unit 20.

The refrigerant pipes 30 of the outdoor unit 10 and the refrigerant pipes 30 of the indoor unit 20 are interconnected by service valves 32.

In the above conventional split air conditioner, when the indoor unit 20 is switched on, the compressor 12 is driven. Then, the refrigerant in the high-temperature and high-pressure state is discharged from the compressor 12, and is introduced into the condenser 14.

The refrigerant, introduced into the condenser 14, is condensed by exchanging heat with outdoor air, and is discharged from the condenser 14. Then, when the refrigerant, discharged from the condenser 14, passes through the expansion device 22, the refrigerant is decompressed into a low-temperature and low-pressure liquid state. The refrigerant in the low-temperature and low-pressure liquid state is sucked into an evaporator 24 of the indoor unit 20.

The refrigerant, sucked into the evaporator 24, cools indoor air by exchanging heat with the indoor air.

Then, the refrigerant is discharged from the evaporator 24, and is supplied again to the compressor 12. Thereby, the refrigerant is circulated.

Since one outdoor unit 10 is connected to one indoor unit 20 in the conventional air conditioner, when a plurality of indoor units 20 for cooling or heating a plurality of chambers are required, a plurality of outdoor units 10 are respectively connected to the indoor units 20.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention there is provided an air conditioner, which comprises a controller for interconnecting a plurality of indoor units and a plurality of outdoor units so that the plural indoor units can be operated using conventional outdoor units, thereby reducing costs due to the omission of other outdoor units.

In accordance with one aspect of the invention there is provided an air conditioner. The air conditioner includes a plurality of indoor units, a plurality of outdoor units connected to the indoor units, and a temperature sensing unit installed indoors for sensing the temperature of indoor air and producing a signal representing the temperature of the indoor air. The air conditioner also includes a flow rate controller provided between the indoor units and the outdoor units for adjusting flow rates of a refrigerant introduced into each of the indoor units and each of the outdoor units. The air conditioner further includes a controller installed separately from the indoor units and the outdoor units and being operable to determine, in response to receiving the

signal of the temperature sensing unit, whether or not the outdoor units are to be respectively operated and to determine respective flow rates to be introduced into the indoor units and the outdoor units, the controller being operably configured to output an adjusting signal directly to the flow rate controller for controlling the respective flow rates.

The flow rate controller may include outdoor refrigerant pipes respectively connected to the outdoor units, outdoor flow rate adjusting units installed in the outdoor refrigerant pipes for adjusting the flow rates of the refrigerant flowing along the outdoor refrigerant pipes, indoor refrigerant pipes communicating with the outdoor refrigerant pipes and respectively connected to the indoor units, and indoor flow rate adjusting units installed in the indoor refrigerant pipes for adjusting the flow rates of the refrigerant flowing along the indoor refrigerant pipes.

The outdoor flow rate adjusting units may be outdoor switching valves for opening and closing the outdoor refrigerant pipes.

The outdoor flow rate adjusting units may be installed in outdoor refrigerant discharge pipes for discharging the refrigerant out of the outdoor refrigerant pipes, and the indoor flow rate adjusting units may be installed in indoor refrigerant suction pipes for sucking the refrigerant out of the indoor refrigerant pipes.

The indoor flow rate adjusting units may be indoor switching valves respectively installed in the indoor

refrigerant pipes for opening and closing the indoor refrigerant pipes.

At least one of the indoor units may have a cooling capacity smaller than the other indoor units.

The indoor flow rate adjusting units may include solenoid valves respectively installed in the refrigerant pipes connected to the other indoor units, and electronic expansion valves respectively installed in the refrigerant pipes connected to an indoor unit having the smallest cooling capacity.

The temperature sensing unit may include thermostats respectively installed in the other indoor units and temperature sensors respectively installed in the indoor units having the smallest cooling capacity.

Since the controller is installed separately from a plurality of the indoor units and a plurality of the outdoor units so that only the controller is added and conventional outdoor units are used when plural indoor units are required, the air conditioner of the present invention reduces costs due to the omission of other outdoor units. Further, since controller determines whether or not the outdoor units are respectively operated according to a signal of a temperature sensing unit, the air conditioner of the present invention selectively operates the outdoor units according to a required capacity, thereby increasing operating efficiency.

Moreover, since switching valves are respectively installed in the outdoor units and the indoor units, the air conditioner of the present invention prevents the loss of a

refrigerant introduced into the outdoor and indoor units, which are not operated.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a circuit diagram schematically illustrating a conventional air conditioner; and

FIG. **2** is a circuit diagram schematically illustrating a multi-type unitary air conditioner in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, a preferred embodiment of the present invention will be described in detail with reference to the annexed drawings.

FIG. **2** is a circuit diagram schematically illustrating a multi-type unitary air conditioner in accordance with the present invention.

As shown in FIG. **2**, the multi-type unitary air conditioner of the present invention comprises a plurality of indoor units **50**, a plurality of outdoor units **60** connected to the indoor units **50**, a temperature sensing unit installed in an indoor space for sensing the temperature of indoor air, and a controller **70** installed

separately from the indoor units **50** and the outdoor units **60** for determining whether or not the outdoor units **60** are respectively operated according to a signal of the temperature sensing unit and outputting an operating signal to the outdoor units **60**.

A plurality of the indoor units **50** include large-sized indoor units, each of which has an expansion device installed therein, and small-sized indoor units, each of which does not have an expansion device. In the present invention, as shown in FIG. **2**, the indoor units **50** include large-sized first and second indoor units **51** and **52** having the structure of a duct, such as an A-coil, and a small-sized third indoor unit **53** serving as a room air conditioner.

Further, a plurality of the outdoor units **60** include first and second outdoor units **61** and **62**, which are conventionally used.

That is, the first and second outdoor units **61** and **62** respectively comprise first and second compressors **63** and **64** for compressing a refrigerant, and first and second condensers **65** and **66** for condensing the refrigerant in a high-temperature and high-pressure gaseous state, supplied from the first and second compressors **63** and **64**.

The first and second indoor units **51** and **52** respectively comprise first and second expansion devices **54** and **55** for expanding the refrigerant, supplied from the first and second condensers **65** and **66**, and first and second evaporators **56** and **57** for evaporating the refrigerant, expanded by the first and second expansion devices **54** and **55**, by absorbing external heat. The third indoor unit **53** comprises a third evaporator **58**.

The air conditioner of the present invention further comprises a flow rate controller installed between the first, second, and third indoor units **51**, **52**, and **53** and the first and second outdoor units **61** and **62** for controlling the flow rates of the refrigerant respectively introduced into the first, second, and third indoor units **51**, **52**, and **53** and the first and second outdoor units **61** and **62**.

The controller **70** determines whether or not the first and second outdoor units **61** and **62** are respectively operated according to the signal of the temperature sensing unit, and determines the flow rates of the refrigerant introduced into the first, second, and third indoor units **51**, **52**, and **53** and the first and second outdoor units **61** and **62**, thereby outputting a signal to the flow rate controller.

The flow rate controller comprises first and second outdoor refrigerant pipes **71**, **72**, **73** and **74** respectively connected to the first and second outdoor units **61** and **62**, outdoor flow rate adjusting units installed in the first and second outdoor refrigerant pipes **71**, **72**, **73** and **74** for adjusting the flow rates of the refrigerant flowing along the first and second outdoor refrigerant pipes **71**, **72**, **73** and **74**, first, second, and third indoor refrigerant pipes **75**, **76**, **77**, **78**, **79**, and **80** communicating with the first and second outdoor refrigerant pipes **71**, **72**, **73** and **74** and respectively connected to the first, second, and third indoor units **51**, **52**, and **53**, and indoor flow rate adjusting units installed in the first, second, and third indoor refrigerant pipes **75**, **76**, **77**, **78**, **79**, and **80** for adjusting the flow rates of the refrigerant flowing along

the first, second, and third indoor refrigerant pipes **75**, **76**, **77**, **78**, **79**, and **80**.

Here, the first and second outdoor refrigerant pipes **71**, **72**, **73** and **74** include first and second outdoor refrigerant suction pipes **73** and **74** for guiding the refrigerant respectively sucked into the first and second outdoor units **61** and **62**, and first and second outdoor refrigerant discharge pipes **71** and **72** for guiding the refrigerant respectively discharged from the first and second outdoor units **61** and **62**.

The outdoor flow rate adjusting units are respectively installed in the first and second outdoor refrigerant discharge pipes **71** and **72** for closing the discharge pipe(s) of the outdoor unit(s), which is/are not operated, so as to prevent the loss of the refrigerant. Here, the outdoor flow rate adjusting units are first and second outdoor switching valves **81** and **82** for opening and closing the first and second outdoor refrigerant discharge pipes **71** and **72**.

The first, second, and third indoor refrigerant pipes **75**, **76**, **77**, **78**, **79**, and **80** are branched from a main pipe formed by joining the first and second outdoor refrigerant pipes **71**, **72**, **73** and **74**, and are respectively connected to the first, second, and third indoor units **51**, **52**, and **53**. The first, second, and third indoor refrigerant pipes **75**, **76**, **77**, **78**, **79**, and **80** include first, second, and third indoor refrigerant suction pipes **75**, **76**, and **77** for guiding the refrigerant respectively sucked into the first, second, and third indoor units **51**, **52**, and **53**, and first, second, and third indoor refrigerant discharge pipes **78**, **79**, and **80** for guiding

the refrigerant respectively discharged from the first, second, and third indoor units **51**, **52**, and **53**.

The indoor flow rate adjusting units are respectively installed in the first, second, and third indoor refrigerant suction pipes **75**, **76**, and **77** for closing the suction pipe(s) of the indoor unit(s), which is/are not operated, so as to prevent the loss of the refrigerant. Here, the indoor flow rate adjusting units are first, second, and third indoor switching valves **83**, **84**, and **85** for opening and closing the first, second, and third indoor refrigerant suction pipes **75**, **76**, and **77**.

Since the first and second expansion devices **54** and **55** are installed in the first and second indoor units **51** and **52**, solenoid valves for opening and closing the first and second indoor refrigerant suction pipes **75** and **76** are preferably used as the first and second indoor switching valves **83** and **84**. Further, since an expansion device is not installed in the third indoor unit **53**, an electronic expansion valve for expanding the refrigerant and for opening and closing the third indoor refrigerant suction pipes **77** is preferably used as the third indoor switching valve **85**.

The temperature sensing unit comprises first and second thermostats **86** and **87** provided in indoor spaces, where the first and second indoor units **51** and **52** are respectively installed, for sensing the temperatures of the indoor spaces, and a temperature sensor **88** installed on the third indoor unit **53** for sensing the temperature of indoor air. The first and second thermostats **86** and **87** and the temperature sensor **88** are connected to the controller **70**, thus transmitting signals sensed thereby to the controller **70**.

Here, the first and second thermostats **86** and **87** not only sense the indoor temperatures, but also compare the sensed indoor temperatures to designated temperatures and output signals so that the first and second indoor units **51** and **52** are respectively operated according to the obtained comparison results.

First, the controller **70** determines a target indoor temperature according to the signals inputted from the first and second thermostats **86** and **87** and the temperature sensor **88**. Then, the controller **70** selects the outdoor unit(s) to be operated, out of the first and second outdoor units **61** and **62**, controls the operation of the first and second outdoor units **61** and **62** and the operation of the first and second outdoor switching valves **81** and **82**, determines the flow rates of the refrigerant supplied to the first, second, and third evaporators **56**, **57**, and **58**, and controls the operation of the first, second, and third indoor switching valves **83**, **84**, and **85** according to the determined flow rates of the refrigerant.

The controller **70** is installed separately from the first, second, and third indoor units **51**, **52**, and **53** and the first and second outdoor units **61** and **62**. Accordingly, when a plurality of indoor units are required, conventional outdoor units and conventional indoor units are used and only the controller **70** is added.

Hereinafter, the operation of the air conditioner of the present invention will be described, as below.

First, the first and second thermostats **85** and **86** and the temperature sensor **87** senses temperatures of

indoor air, and transmit the sensed temperatures to the controller **70**.

The controller **70** determines a target indoor temperature according to the signals supplied from the first and second thermostats **85** and **86** and the temperature sensor **87**, selects the outdoor unit(s) to be operated, out of the first and second outdoor units **61** and **62**, and outputs an operating signal to the selected outdoor unit(s).

Here, the controller **70** selects only the first outdoor unit **61**. The controller **70** outputs the operating signal to the first outdoor unit **61**, controls the second outdoor switching valve **82** installed in the second outdoor refrigerant discharge pipe **72** so that the second outdoor switching valve **82** closes the second outdoor refrigerant discharge pipe **72**, thereby preventing the refrigerant, discharged from the first outdoor unit **61**, from being introduced into the second outdoor unit **62**.

Further, the controller **70** controls the first, second, and third indoor switching valves **83**, **84**, and **85** so that the refrigerant is introduced only into the operating indoor unit(s) from among the first, second, and third indoor units **51**, **52**, and **53** according to whether or not the first, second, and third indoor units **51**, **52**, and **53** are respectively operated.

Here, only the first indoor unit **51** and the third indoor unit **53** are operated. The controller **70** controls the second indoor switching valve **84** so that the second indoor switching valve **84** closes the second indoor refrigerant suction pipe **76**, thereby preventing the refrigerant from being introduced into the second indoor unit **52**.

Further, the controller **70** controls the first and third indoor switching valves **83** and **85** so that the refrigerant is introduced into the first and third indoor refrigerant suction pipes **75** and **77**. Since the third indoor switching valve **85** is an electronic expansion valve, the controller **70** controls the opening degree of the third indoor switching valve **85** so that the flow rate of the refrigerant introduced into the third indoor unit **53** is controlled and the refrigerant introduced into the third indoor unit **53** is expanded.

Accordingly, since whether or not the first and second outdoor units **61** and **62** are operated is determined by the temperatures of indoor air, and the flow rates of the refrigerant introduced into the first, second, and third indoor units **51**, **52**, and **53** are determined by the temperatures of the indoor air and whether or not the first, second, and third indoor units **51**, **52**, and **53** are operated, the multi-type unitary air conditioner of the present invention for conditioning air in a plurality of chambers is embodied by adding only the controller **70** to conventional indoor and outdoor units.

As apparent from the above description, the present invention provides an air conditioner, in which a controller is installed separately from a plurality of indoor units and a plurality of outdoor units so that only the controller is added and conventional outdoor units are used when plural indoor units are required, thereby reducing costs due to the omission of other outdoor units. Further, since the controller determines whether or not the outdoor units are respectively operated according to a signal of a temperature sensing unit, the air conditioner of the present invention

selectively operates the outdoor units according to a required capacity, thereby increasing operating efficiency.

Moreover, since switching valves are respectively installed in the outdoor units and the indoor units, the air conditioner of the present invention prevents the loss of a refrigerant introduced into the outdoor and indoor units, which are not operated.

Although the preferred embodiment of the present invention has been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An air conditioner comprising:

a plurality of indoor units;

a plurality of outdoor units connected to the indoor units;

a temperature sensing unit installed indoors for sensing the temperature of indoor air and producing a signal representing the temperature of the indoor air;

a flow rate controller provided between the indoor units and the outdoor units for adjusting flow rates of a refrigerant introduced into each of the indoor units and each of the outdoor units; and

a controller installed separately from the indoor units and the outdoor units and being operable to determine, in response to receiving the signal of the temperature sensing unit, whether or not the outdoor units are to be respectively operated and to

determine respective flow rates to be introduced into the indoor units and the outdoor units, the controller being operably configured to output an adjusting signal directly to the flow rate controller for controlling the respective flow rates.

2. The air conditioner as set forth in claim 1, wherein the flow rate controller comprises:

outdoor refrigerant pipes respectively connected to the outdoor units;

outdoor flow rate adjusting units installed in the outdoor refrigerant pipes for adjusting the flow rates of the refrigerant flowing along the outdoor refrigerant pipes;

indoor refrigerant pipes communicating with the outdoor refrigerant pipes and respectively connected to the indoor units; and

indoor flow rate adjusting units installed in the indoor refrigerant pipes for adjusting the flow rates of the refrigerant flowing along the indoor refrigerant pipes.

3. The air conditioner as set forth in claim 2, wherein the outdoor flow rate adjusting units are outdoor switching valves for opening and closing the outdoor refrigerant pipes.

4. The air conditioner as set forth in claim 2, wherein the outdoor flow rate adjusting units are installed in outdoor refrigerant discharge pipes for discharging the refrigerant out of the outdoor refrigerant pipes, and the indoor flow rate adjusting units are installed in indoor refrigerant suction pipes for sucking the refrigerant out of the indoor refrigerant pipes.

5. The air conditioner as set forth in claim 2, wherein the indoor flow rate adjusting units are indoor switching valves respectively installed in the indoor refrigerant pipes for opening and closing the indoor refrigerant pipes.

6. The air conditioner as set forth in claim 2, wherein at least one of the indoor units has a cooling capacity smaller than the other indoor units.

7. The air conditioner as set forth in claim 6, wherein the indoor flow rate adjusting units comprise solenoid valves

respectively installed in the refrigerant pipes connected to said other indoor units, and electronic expansion valves respectively installed in the refrigerant pipes connected to an indoor unit having the smallest cooling capacity.

8. The air conditioner as set forth in claim 6, wherein the temperature sensing unit comprises thermostats respectively installed in said other indoor units and temperature sensors respectively installed in the indoor units having the smallest cooling capacity.

FIG. 1 (Prior Art)

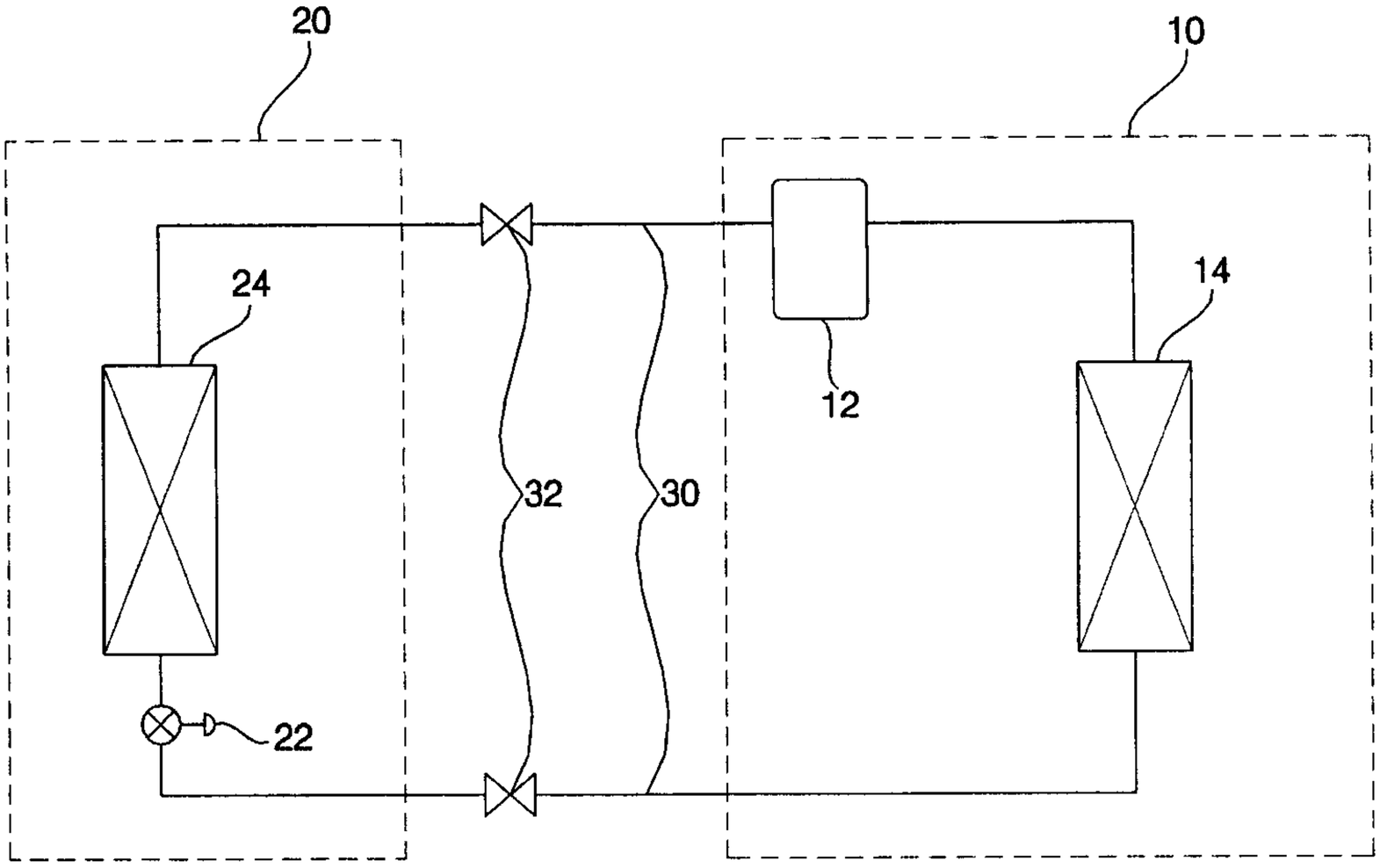
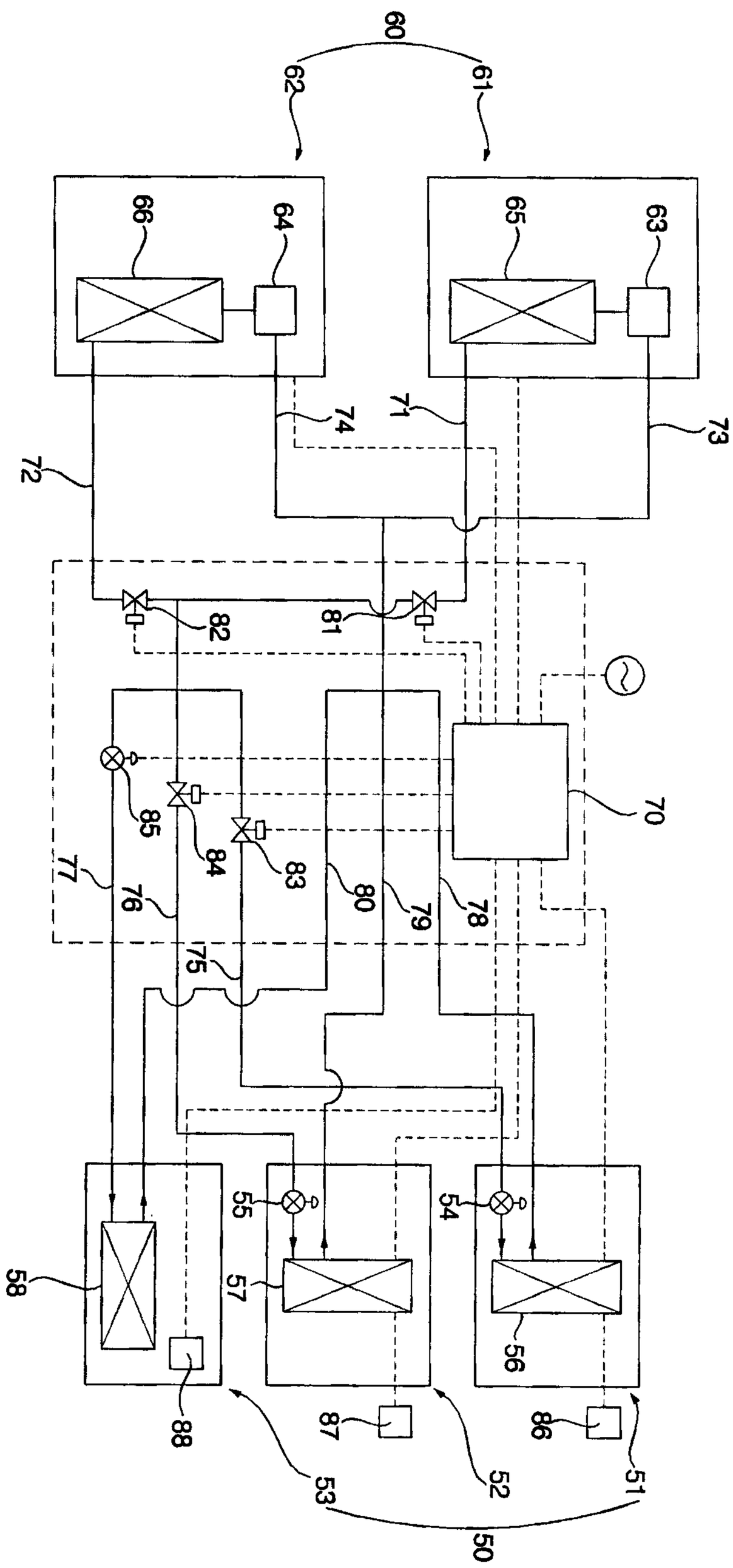


FIG. 2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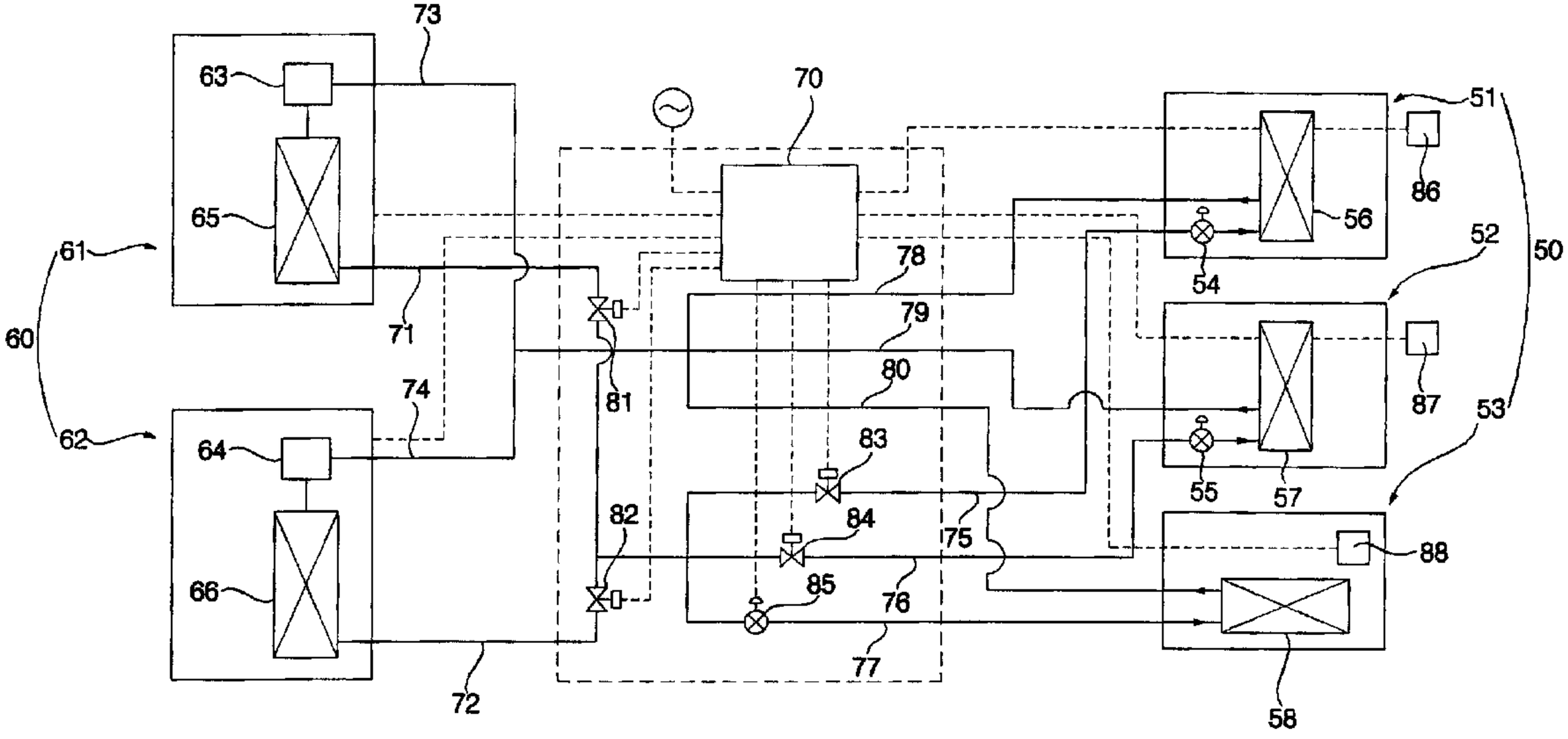
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