A method for selectively operating compressors of a dual type unitary air conditioner includes respectively sensing compressor operation requiring signals outputted from a plurality of centralized warm and cold air circulators and a compressor operation requiring signal outputted from at least one individual warm and cold air circulator; changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weights to the signals; and selectively operating the compressors connected in parallel according to the obtained total compressor capacity value, thereby correctly selectively operating the compressors corresponding to the amount of an actually required load, thus improving user's comfort and increasing an energy efficiency of the dual type unitary air conditioner.
FIG. 1 (related art)
FIG. 2 (related art)
FIG. 3 (related art)
FIG. 4 (related art)
FIG. 8

1. **Start**

2. Input compressor operation requiring signals of centralized warm and cold air circulators (S10)

3. Input compressor operation requiring signal of individual warm and cold air circulator (S20)

4. Calculate total compressor capacity value by respectively applying weights to compressor operation requiring signals (S30)

5. Determine whether or not plural compressors are respectively operated according to total compressor capacity value (S40)

6. Operate selected compressor(s) (S50)

7. **End**
FIG. 9A

Compressor operation requiring signal

Y2
Y2
ON

Z1 indoor unit
Z2 indoor unit
Individual indoor unit

FIG. 9B

Total compressor capacity value

5
4
3
2.8
2
1

(a) (b) (c)

Time
METHOD FOR SELECTIVELY OPERATING COMPRESSORS OF DUAL TYPE UNITARY AIR CONDITIONER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

The present invention relates to a dual type unitary air conditioner, and more particularly to a method for selectively operating a plurality of compressors of a dual type unitary air conditioner using a centralized heating and cooling system and an individual heating and cooling system so that the compressors can be effectively operated.

[0002] 2. Description of the Related Art

Generally, a unitary air conditioner is a type of centralized heating and cooling system, which generates hot air or cool air using a heating and cooling unit installed in a basement of a building, such as a factory, an office, a hotel, or a house, and transfers the air to individual spaces through ducts installed in a wall of the building.

The unitary air conditioner has zone controllers installed in the ducts for independently supplying warm or cold air to regions required to be heated and cooled and regions not required to be heated or cooled, or heat or cold independently installed in proportion to the number of the regions.

[0005] The unitary air conditioner has zone controllers installed in the ducts for independently supplying warm or cold air to regions required to be heated and cooled and regions not required to be heated or cooled, or a plurality of heating and cooling units independently installed in proportion to the number of the regions.

[0006] FIG. 1 is a schematic view of a conventional unitary air conditioner. FIG. 2 is a circuit diagram of the conventional unitary air conditioner. FIG. 3 is a schematic view of another conventional unitary air conditioner. FIG. 4 is a circuit diagram of the conventional unitary air conditioner, and FIG. 5 is a circuit diagram of yet another conventional unitary air conditioner.

[0007] As shown in FIGS. 1 and 2, a conventional unitary air conditioner comprises one outdoor unit 1 fixedly installed at the outside of a building (a two-story house in the drawings), a warm and cold air circulator 2 connected to a first heat exchanger 1b of the outdoor unit 1 and fixedly installed in a basement or an outside the building, an air supply duct 3 and an air discharge duct 4 respectively connected to an air supply hole and an air discharge hole of the warm and cold air circulator 2 and divisionally buried in a wall of each of stories of the building, and zone controllers 5a-5d installed in the air supply duct 3 and the air discharge duct 4 for controlling air supplied to each of the stories and air discharged from each of the stories.

[0008] The outdoor unit 1 comprises at least one compressor 1a installed in a case for compressing a refrigerant gas, the first heat exchanger 1b connected to the compressor 1a by a refrigerant pipe for condensing the refrigerant gas (in a cooling mode) or absorbing latent heat (in heating mode), an expansion device 1e for decompressing and expanding the refrigerant gas, and an outdoor fan (not shown) for supplying external air to the first heat exchanger 1b to increase the heat exchange capacity of the first heat exchanger 1b.

[0009] The warm and cold air circulator 2 comprises a second heat exchanger 2a installed in a case and having one end connected to the first heat exchanger 1b and the other end connected to the expansion device 1e, and an air supply fan (not shown) located at the lower stream of the second heat exchanger 2a for guiding warm air or cold air to the air supply duct 3. The case of the warm and cold air circulator 2 has an air channel having an approximately U shape so that the second heat exchanger 2a and the air supply fan (not shown) are installed in the air channel. The air supply duct 3 is connected to an air supply hole of the air channel, and the air discharge duct 4 is connected to an air discharge hole of the air channel.

[0010] As described above, the air supply duct 3 and the air discharge duct 4 are respectively connected to the air supply hole and the air discharge hole of the warm and cold air circulator 2, and are divisionally branched into unit ducts buried in corresponding regions Z1 and Z2. Discharge ports 3a for supplying warm air or cold air to the corresponding regions Z1 and Z2, and intake ports 4a for sucking internal air for circulation are respectively formed through the unit ducts of the air supply duct 3 and the air discharge duct 4.

[0011] The zone controllers 5a-5d are valves installed in the unit ducts of the air supply duct 3 and the air discharge duct 4 buried in the corresponding regions Z1 and Z2 so that warm air or cold air can be divisionally supplied to the corresponding regions Z1 and Z2. The zone controllers 5a-5d are connected to a controller (not shown) and are automatically manipulated so that the zone controllers 5a-5d can be switched on/off by detecting temperatures or humidities of the corresponding regions Z1 and Z2 and comparing the detected temperatures or humidities to predetermined values, or are manually manipulated.

[0012] The above heat pump-type unitary air conditioner having the zone controllers 5a-5d will be operated as follows.

[0013] That is, in a two-story house, loads of respective stories (the corresponding regions) Z1 and Z2 are detected. When it is determined that both the detected loads of the respective stories Z1 and Z2 are more than a predetermined value, the unit ducts of the air supply duct 3 simultaneously supply warm air or cold air to the respective stories Z1 and Z2, and when it is determined that one of the detected loads of the respective stories Z1 and Z2 is more than the predetermined value, the corresponding unit duct of the air supply duct 3 supplies warm air or cold air to the story Z1 or Z2.

[0014] For example, in a cooling mode, the compressor 1a of the outdoor unit 1 is driven to compress the refrigerant gas, and the refrigerant gas is condensed by the first heat exchanger 1b of the outdoor unit 1, passes through the expansion device 1e of the outdoor unit 1, and passes through the second heat exchanger 2a of the warm and cold air circulator 2 so that the refrigerant gas exchanges heat with air sucked into the air channel through the air discharge duct 4, thereby generating cold air. The cold air is supplied to the air supply duct 3 through the air supply hole by the air supply fan (not shown). Here, when all the loads of the respective stories Z1 and Z2 are more than the predetermined value, the zone controllers 5a-5d, which are automatically manipulated, are opened by the controller, or the zone controllers 5a-5d, which are manually manipulated, are opened by the manipulation of a user. Thereby, the cold air generated by the warm and cold air circulator 2 is supplied to the respective unit ducts of the air supply duct 3, thus cooling the respective stories Z1 and Z2. On the other hand, when one of the loads of the respective stories Z1 and Z2 is less than the predetermined value, only the zone controllers
5a–5d, which are installed in the story Z₁ or Z₂, the load of which is not less than the predetermined value, are automatically or manually opened. Thereby, the cold air is supplied only to the unit ducts of the air supply duct 3 installed in the corresponding story Z₁ or Z₂, thus cooling the corresponding story Z₁ or Z₂.

[0015] The operation of the heat pump-type unitary air conditioner having the zone controllers 5a–5d in a heating mode is the same as that in the cooling mode except that the circulation of the refrigerant in the heating mode is performed in the reverse order according to a heat pump-type refrigerating cycle.

[0016] The above conventional unitary air conditioner having the zone controllers 5a–5d selectively supplies warm air or cold air according to a variation of the temperatures of the corresponding regions Z₁ or Z₂ using one indoor unit 1, thus reducing a power consumption rate. However, the above unitary air conditioner has a difficulty in installing new zone controllers in the air supply duct 3 and the air discharge duct 4 when an additional warm and cold air circulator is installed in a space having a high load (for example, a kitchen, an attic, or an exercise chamber). Further, the above unitary air conditioner is operated using a centralized heating and cooling system and thus has a limit in the capacity of the warm and cold air circulator 2, thereby causing a deterioration of efficiency.

[0017] In view of the above problem, FIGS. 3 and 4 illustrate another conventional unitary air conditioner. This unitary air conditioner does not comprise zone controllers, but comprises a plurality of outdoor units and a plurality of warm and cold air circulators independently installed according to the respective regions Z₁ or Z₂.

[0018] That is, the above unitary air conditioner comprises a first outdoor unit 11, a first warm and cold air circulator 12, a first air supply duct 13, and a first air discharge duct 14, which are used to heat and cool a first story of a two-story house, and a second outdoor unit 21, a second warm and cold air circulator 22, a second air supply duct 23, and a second air discharge duct 24, which are used to heat and cool a second story of a two-story house.

[0019] The first outdoor unit 11 comprises a first compressor 11a, a first heat exchanger 11b connected to the first compressor 11a by a four-way valve, and a first expansion device 11c connected to the first heat exchanger 11b.

[0020] The first warm and cold air circulator 12 comprises a third heat exchanger 12a connected to the first expansion device 11c, and a first air supply fan (not shown) installed at the lower stream of the third heat exchanger 12a.

[0021] The second outdoor unit 21 comprises a second compressor 21a, a second heat exchanger 21b connected to the second compressor 21a by a four-way valve, and a second expansion device 21c connected to the second heat exchanger 21b.

[0022] The second warm and cold air circulator 22 comprises a fourth heat exchanger 22a connected to the second expansion device 21c, and a second air supply fan (not shown) installed at the lower stream of the fourth heat exchanger 22a.

[0023] The above independent unitary air conditioner will be operated as follows.

[0024] That is, in a cooling mode in a two-story house, when loads of respective stories Z₁ and Z₂ are more than a predetermined value, the first compressor 11a and the second compressor 21a are simultaneously operated so that the refrigerant is compressed by the first and second compressors 11a and 21a, and the refrigerant is condensed by the first heat exchanger 11b and the second heat exchanger 21b. The obtained refrigerant gas is supplied to the third heat exchanger 12a and the fourth heat exchanger 22a through the first and second expansion devices 11c and 21c so that the refrigerant gas is evaporated by air introduced through the air discharge ducts 14 and 24 of the first and second warm and cold air circulators 12 and 22, thereby generating cold air. The cold air is supplied to the first air supply duct 13 and the second air supply duct 23 through the first air supply fan (not shown) and the second air supply fan (not shown), and is supplied to the respective stores Z₁ and Z₂ through the first and second air supply ducts 13 and 23, thereby cooling the respective stores Z₁ and Z₂.

[0025] Then, the air is repeatedly circulated to the warm and cold air circulators 12 and 22 through the first and second discharge ducts 14 and 24 of the stores Z₁ and Z₂.

[0026] The operation of the above unitary air conditioner in a heating mode is the same as that in the cooling mode except that the circulation of the refrigerant in the heating mode is performed in the reverse order according to a heat pump-type refrigerating cycle.

[0027] The above conventional unitary air conditioner does not require zone controllers in the first and second air supply and discharge ducts 13, 23, 14, and 24, thus being easily installed and controlled. Further, this conventional unitary air conditioner independently heats and cools the regions Z₁ and Z₂, thus having excellent efficiency. However, the above unitary air conditioner has a difficulty in installing an additional warm and cold air circulator in a space having a high load. Further, the above unitary air conditioner has the outdoor units 11 and 21 independently installed in the regions Z₁ and Z₂, thus increasing production costs.

[0028] In order to overcome the limit of the capacity of compressors, yet another conventional unitary air conditioner as shown in FIG. 5 comprises a large-capacity compressor 31a and a small-capacity compressor 31a', which are connected in parallel. Other components of the above unitary air conditioner are the same as those of the conventional unitary air conditioner having zone controllers.

[0029] The two compressors 31a and 31a' of the above heat pump-type air conditioner will be selectively operated, as follows.

[0030] Compressor operation requiring signals are set to a strong signal (Y2) or a weak signal (Y1) by a difference of temperatures between the refrigerant supplied to indoor units 32 and 32' and the refrigerant discharged from the indoor units 32 and 32'. That is, the compressors 31a and 31a' are operated by the compressor operation requiring signals, as described in the below Table.
In the selective operation of the large-capacity compressor 31a and the small-capacity compressor 31a', when both the signals of the two regions Z₁ and Z₂ are Y₁, only the small-capacity compressor 31a' is operated, and when one of the signals of the two regions Z₁ and Z₂ is Y₂, both the large-capacity compressor 31a and the small-capacity compressor 31b are operated.

When both the signals of the two regions Z₁ and Z₂ are Y₁, only the small-capacity compressor 31a' is operated. Although the total load when both the signals of the two regions Z₁ and Z₂ are Y₁ is substantially larger than the total load when one of the signals of the two regions Z₁ and Z₂ is Y₂, the total capacity of the compressors 31a and 31a' are reversed. That is, the total capacity of the compressor 31a and 31a' does not correspond to the actual total load. Accordingly, when the air conditioner employs at least two compressors, the correspondence to the actual load is reduced, thereby causing a reduction in comfort of users of the air conditioner and decreasing the energy efficiency of the air conditioner.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a method for selectively operating compressors of a dual type unitary air conditioner, which essentially uses duct-shaped centralized heating and cooling units and additionally uses individual heating and cooling units at spaces requiring subsidiary heating and cooling units, corresponding to load signals of the respective heating and cooling units.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a method for selectively operating compressors of a dual type unitary air conditioner comprising: respectively sensing compressor operation requiring signals outputted from a plurality of centralized warm and cold air circulators and a compressor operation requiring signal outputted from at least one individual warm and cold air circulator; changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weighs to the signals; and selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.

The compressor operation requiring signals outputted from a plurality of the centralized warm and cold air circulators may include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator may include ON and OFF signals.

The weight applied to the signal indicating the supply of a small amount of air may be 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

The centralized warm and cold air circulators may be independently installed in corresponding regions of a building, in which the dual type unitary air conditioner is installed, so that the number of the centralized warm and cold air circulators coincides with the number of the regions, and be independently connected in parallel to an outdoor heat exchanger.

The individual warm and cold air circulator may be independently installed in a designated place, and be independently connected in parallel to the outdoor heat exchanger.

A plurality of the compressors may have different capacities.

A plurality of the compressors may be operated by different methods.

In accordance with another aspect of the present invention, there is provided a method for selectively operating compressors of a dual type unitary air conditioner, which has a plurality of centralized warm and cold air circulators installed independently in corresponding regions of a building, in which the dual type unitary air conditioner is installed, so that the number of the centralized warm and cold air circulators coincides with the number of the regions, and independently connected in parallel to an outdoor heat exchanger, comprising: respectively sensing compressor operation requiring signals outputted from the centralized warm and cold air circulators and a compressor operation requiring signal outputted from the individual warm and cold air circulator; changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weighs to the signals; and selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.

The compressor operation requiring signals outputted from a plurality of the centralized warm and cold air circulators may include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator may include ON and OFF signals.

The weight applied to the signal indicating the supply of a small amount of air may be 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

The centralized warm and cold air circulators respectively may heat and cool two regions, and one individual warm and cold air circulator may be provided; a plurality of the compressors may comprise a first compres-
A plurality of the compressors may have different capacities. A plurality of the compressors may be operated by different methods.

In accordance with yet another aspect of the present invention, there is provided a method for selectively operating compressors of a dual type unitary air conditioner, which has centralized warm and cold air circulators for respectively heating and cooling two regions, one individual warm and cold air circulator, a first compressor having a capacity corresponding to 60% of a total compressor capacity, and a second compressor having a capacity corresponding to 40% of the total compressor capacity, respectively sensing compressor operation requiring signals outputted from the centralized warm and cold air circulators and a compressor operation requiring signal outputted from the individual warm and cold air circulator; changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weights to the signals; and selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.

The compressor operation requiring signals outputted from the centralized warm and cold air circulators may include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator may include ON and OFF signals.

The weight applied to the signal indicating the supply of a small amount of air may be 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

The weight applied to the signal indicating the supply of a large amount of air may be 2, the weight applied to the signal indicating the supply of a small amount of air may be 1.3, the weight applied to the signal indicating non supply of air may be 0, the weight applied to the ON signal may be 0.8, and the weight applied to the OFF signal may be 0; and when the obtained total compressor capacity value is more than 4.0, both the first and second compressors may be operated, when the obtained total compressor capacity value is between 4.0 and 2.8, only the first compressor may be operated, and when the obtained total compressor capacity value is between 2.8 and 0, only the second compressor may be operated.

A plurality of the compressors may be operated by different methods.

The centralized warm and cold air circulators may be independently installed in corresponding regions of a building, in which the dual type unitary air conditioner is installed, and be independently connected in parallel to an outdoor heat exchanger.

The individual warm and cold air circulator may be independently installed in a designated place, and be independently connected in parallel to the outdoor heat exchanger.

Since the compressors are correctly selectively operated corresponding to the amount of an actually required load, user’s comfort is improved and an energy efficiency of the dual type unitary air conditioner is increased.

Further, although a plurality of the centralized warm and cold air circulators and the individual warm and cold air circulator are connected in parallel to one outdoor unit, since weights are applied to respective loads, a refrigerant circulating along a heating and cooling cycle is sufficiently supplied to respective indoor units.

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 schematic view of a conventional unitary air conditioner;
FIG. 2 is a circuit diagram of the conventional unitary air conditioner;
FIG. 3 is a schematic view of another conventional unitary air conditioner;
FIG. 4 is a circuit diagram of the conventional unitary air conditioner;
FIG. 5 is a circuit diagram of yet another conventional unitary air conditioner;
FIG. 6 is a schematic view of a dual type unitary air conditioner in accordance with the present invention;
FIG. 7 is a circuit diagram of the dual type unitary air conditioner in accordance with the present invention;
FIG. 8 is a flow chart illustrating a method for selectively operating compressors of the dual type unitary air conditioner in accordance with the present invention; and
FIGS. 9A and 9B are graphs illustrating the selection of the compressors according to the method of 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. 6 is a schematic view of a dual type unitary air conditioner in accordance with the present invention, FIG. 7...
is a circuit diagram of the dual type unitary air conditioner in accordance with the present invention. FIG. 8 is a flow chart illustrating a method for selectively operating compressors of the dual type unitary air conditioner in accordance with the present invention, and FIGS. 9A and 9B are graphs illustrating the selection of the compressors according to the method of the present invention.

As shown in FIGS. 6 and 7, the dual type unitary air conditioner in accordance with the present invention comprises one outdoor unit 110 fixedly installed at the outside of a building, a plurality of centralized warm and cold air circulators 120 and 130 connected to the outdoor unit 110 and installed in an indoor chamber of the building, such as a basement or an outbuilding, and an individual warm and cold air circulator 140 connected to the outdoor unit 110 and installed at a designated space of the building, such as a kitchen or an attic.

Preferably, the individual warm and cold air circulator 140 is configured using a free joint method so that the individual warm and cold air circulator 140 is easily attachable and detachable as occasion demands.

The outdoor unit 110 comprises a first compressor 111 having a capacity corresponding to 60% of the total compressor capacity, a second compressor 111’ having a capacity corresponding to 40% of the total compressor capacity, an outdoor heat exchanger 112 installed at one side of the first and second compressors 111 and 111’, an expansion device 113 connected to the outdoor heat exchanger 112 for decompressing and expanding a refrigerant, and a blast fan (not shown) installed at one side of the outdoor heat exchanger 112 for sucking external air and discharging the air to the outdoor heat exchanger 112.

Although the outdoor unit 110 of the air conditioner of the present invention comprises two compressors 111 and 111’, three or more compressors may be connected in parallel in consideration of the dimensions of the building. Preferably, in order to reduce a power consumption rate of the air conditioner and to stably maintain the operation of the air conditioner, the compressors 111 and 111’, which are connected in parallel, are compressors operated by different methods, i.e., an inverter-operated compressor and a constant-speed compressor. In this case, it is preferable that the two compressors 111 and 111’, which are operated by different methods, have different capacities so as to variously adjust the amount of air discharged from the air conditioner according to operating conditions.

Further, preferably, a directional selecting valve 117, i.e., a four-way valve, for selecting the circulation order of the refrigerant so that the air conditioner can be used as a heat pump, such as a warm air circulator or a cold air circulator, is installed at the output side of the first and second compressors 111 and 111’.

Refrigerant pipes, which prepared in the number the same as the number of indoor heat exchangers 123, 133, and 141, which will be described later, and are connected in parallel, are connected to the inlet side and the outlet side of the outdoor heat exchanger 112, and refrigerant control valves 114a, 114b, 115a, 115b, 116a, and 116b are electric valves for automatically adjusting the opening degrees of the refrigerant pipes by a controller.

The expansion device 113 may use an orifice tube, or an electric valve for adjusting the opening degrees of the refrigerant pipes, as occasion demands.

Preferably, the number of the centralized warm and cold air circulators 120 and 130 corresponds to the number of regions Z₁ and Z₂ of the building so that the centralized warm and cold air circulators 120 and 130 are independently connected to the regions Z₁ and Z₂. When the two-story building is divided into two regions Z₁ and Z₂ according to stories, the air supply ducts 121 and 131 and the air discharge ducts 122 and 132 are independently buried in the walls of the respective stories and are independently installed in the casings of the centralized warm and cold air circulators 120 and 130.

Air channels (not shown) having an approximately U shape, which are respectively connected to the air supply ducts 121 and 131 and the air discharge ducts 122 and 132, are respectively installed in the casings of the centralized warm and cold air circulators 120 and 130. The first indoor heat exchangers 123 and 133 are respectively installed at the respective regions Z₁ and Z₂ of the air channels, and the first indoor heat exchanger 123 and 133 are connected in parallel to the outdoor heat exchanger 112 and the outdoor air conditioners 140 so that each of the first indoor heat exchangers 123 and 133 and the outdoor heat exchanger 112 forms a closed curved line. Designated sides of the first indoor heat exchangers 123 and 133 are connected in parallel to the expansion device 113.

The individual warm and cold air circulator 140 may have various structures, such as a wall-mounted structure, a slim structure, and a ceiling-mounted structure. The individual warm and cold air circulator 140 comprises a second indoor heat exchanger 141 installed in a casing and connected to the outdoor heat exchanger 112, and a second air supply fan (not shown) installed at the lower side of the second indoor heat exchanger 141.

The above dual type unitary air conditioner of the present invention will be operated, as follows.

For example, in a two-story house, in a cooling mode, a part or all of the first and second compressors 111 and 111’ are selected and operated to compress a refrigerant. The refrigerant is supplied to the outdoor heat exchanger 112 through the directional selecting valve 117 and condensed by the outdoor heat exchanger 112, and the refrigerant then passes through the expansion device 113. Simultaneously, the electric valves 114a, 114b, 115a, and 115b of the refrigerant pipes connected to the first indoor heat exchangers 123 and 133 of the centralized warm and cold air circulators 120 and 130 are opened so that the condensed refrigerant is divided into the refrigerant pipes, supplied to the first indoor heat exchangers 123 and 133, and evaporated by the first indoor heat exchangers 123 and 133, thereby generating cold air. The cold air is transferred to the air supply ducts 121 and 131 by the air supply fans (not shown), and is supplied to the respective regions Z₁ and Z₂ through
discharge holes 121a and 131a. On the other hand, warm air in the respective regions Z1 and Z2 is sucked into the air discharge ducts 122 and 132 through suction holes 122a and 123a, is transferred along the air channels of the centralized warm and cold air circulators 120 and 130, and passes through the first indoor heat exchangers 123 and 133, thereby being changed into cold air. Then, the cold air is circulated to the air supply ducts 121 and 131. The above circulation process is repeated.

In order to heat or cool a space having a high load of the respective regions Z1 and Z2, such as a kitchen or an attic, the corresponding electric valves 116a and 116b are opened. Then, the refrigerant, having passed through the outdoor heat exchanger 112 and the expansion device 113, is transferred to the second indoor heat exchanger 141 of the individual warm and cold air circulator 140 through the refrigerant pipe connected to the second indoor heat exchanger 141, and passes through the second indoor heat exchanger 141, thereby generating cold air. The cold air is additionally supplied to the corresponding region Z2 by the second air supply fan (not shown), thereby additionally cooling the region Z2.

For reference, the operation of the above dual type unitary air conditioner in a heating mode is the same as that in the cooling mode except that the circulation of the refrigerant by the directional selecting valve 117 in the heating mode is performed in the reverse order according to a heat pump-type refrigerating cycle.

The selection of the first and second compressors 111 and 1111 must be appropriately achieved according to the capacity of the load of indoor units. Hereinafter, with reference to FIG. 8, a method for selectively operating the first and second compressors 111 and 1111 will be described.

First, the first indoor heat exchangers 123 and 133 of the centralized warm and cold air circulators 120 and 130 corresponding to the regions Z1 and Z2 sense a difference of temperatures between the refrigerant supplied to the first indoor heat exchangers 123 and 133 and the refrigerant discharged from the first indoor heat exchangers 123 and 133, and compressor operation requiring signals, selected from the group consisting of a signal Y2 indicating the supply of a large amount of air, a signal Y1 indicating the supply of a small amount of air, and a signal 0 indicating non-supply of air, for determining whether or not the compressors 111 and 1111 are respectively operated and the operation capacities of the compressors 111 and 1111, are outputted in a 2-stage system (S10). Here, sensors (not shown), which are installed indoors, output the compressor operation requiring signals.

Further, when the individual warm and cold air circulator 140, which is installed in the designated region Z2, senses a temperature of the refrigerant supplied to the second indoor heat exchanger 141 and a temperature of the refrigerant discharged from the second indoor heat exchanger 141 and is automatically operated or stopped by the sensed results, a compressor operation requiring signal for determining whether or not the compressors 111 and 1111 are respectively operated is outputted in an ON/OFF system (S20). Preferably, the compressor operation requiring signal is transmitted through communication lines in the same manner as a Ducted Free System (DFS).

The outputted compressor operation requiring signals are respectively sensed and predetermined weights are respectively applied to the signals so that the signals are changed to numerical values. The obtained numerical values are added, thereby producing a total compressor capacity value (S30).

Here, the weight applied to the signal Y2 outputted from the centralized warm and cold air circulators 120 and 130 is 2, the weight applied to the signal Y1 outputted from the centralized warm and cold air circulators 120 and 130 is 1, and the weight applied to the signal 0 outputted from the centralized warm and cold air circulators 120 and 130 is 0. Further, the weight applied to the ON signal outputted from the individual warm and cold air circulator 140 is 0.8, and weight applied to the OFF signal outputted from the individual warm and cold air circulator 140 is 0.

The weight applied to the signal Y1 indicating the supply of a small amount of air is 0.65 of the weight applied to the signal Y2 indicating the supply of a large amount of air.

When the obtained total compressor capacity value is more than 4.0, both the first and second compressors 111 and 1111 are operated so that the operation capacity of the air conditioner corresponds to 100% of the total compressor capacity, when the obtained total compressor capacity value is between 4.0 and 2.8, only the first compressor 111 is selected so that the operation capacity of the air conditioner corresponds to 60% of the total compressor capacity, and when the obtained total compressor capacity value is between 2.8 and 0, only the second compressor 1111 is operated so that the operation capacity of the air conditioner corresponds to 40% of the total compressor capacity (S40).

When the selected compressor(s) is(are) operated (S50), the refrigerant having an amount correctly corresponding to the loads of the regions Z1, Z2, and Z3 is circulated along a heating and cooling cycle. All combinations of the compressor operation requiring signals of the centralized warm and cold air circulators and the individual warm and cold air circulator are shown in the below Table.

<table>
<thead>
<tr>
<th>Z1</th>
<th>Z2</th>
<th>Z3</th>
<th>Total compressor capacity value</th>
<th>Total capacity of selected compressor(s) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y2</td>
<td>Y2</td>
<td>4.8</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Y2</td>
<td>Y2</td>
<td>8.0</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Y2</td>
<td>Y1</td>
<td>4.1</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>Y2</td>
<td>Y1</td>
<td>3.3</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>Y2</td>
<td>0</td>
<td>2.8</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>Y2</td>
<td>0</td>
<td>2.0</td>
<td>40</td>
</tr>
<tr>
<td>7</td>
<td>Y1</td>
<td>Y2</td>
<td>4.1</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>Y1</td>
<td>Y2</td>
<td>3.3</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>Y1</td>
<td>Y1</td>
<td>3.4</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>Y1</td>
<td>Y1</td>
<td>2.6</td>
<td>60</td>
</tr>
<tr>
<td>11</td>
<td>Y1</td>
<td>0</td>
<td>2.1</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>Y1</td>
<td>0</td>
<td>1.3</td>
<td>40</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>Y2</td>
<td>2.8</td>
<td>60</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>Y2</td>
<td>2.0</td>
<td>40</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>Y1</td>
<td>2.1</td>
<td>40</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>Y1</td>
<td>1.3</td>
<td>40</td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
<td>40</td>
</tr>
</tbody>
</table>

For example, when compressor capacity requiring signals in the regions Z1, Z2, and Z3 are sensed, as shown in FIG. 9A, the total compressor capacity value is determined from the above Table, as shown in FIG. 9B. When the
obtained total compressor capacity value is more than 4.0, both the first and second compressors are operated as shown in a region “a”, when the obtained total compressor capacity value is between 4.0 and 2.8, only the first compressor is operated as shown in a region “b”, and when the obtained total compressor capacity value is between 2.8 and 0, only the second compressor is operated as shown in a region “c”.

Accordingly, a part or all of a plurality of the compressors are selected and operated according to the regions “a”, “b”, and “c”.

In the case that a dual type unitary air conditioner comprises three or more compressors connected in parallel (not shown in the drawings), a total compressor capacity value is calculated, and the compressors are selectively operated by the predetermined method according to the calculated total compressor capacity value. Thereby, the compressors can be optimally operated corresponding to a cooling or heating load. Further, in the case that a dual type unitary air conditioner comprises compressors operated by different methods, when a total compressor capacity value exceeds 50% of the maximum cooling load, the operation amount of an inverter-operated compressor is determined according to the method of the present invention so that a constant-speed compressor is operated and the inverter-operated compressor is operated so as to correspond to the exceeding cooling load.

Further, in the case that the number of the centralized warm and cold air circulators is increased or two or more individual warm and cold air circulators are installed, the compressors can be selectively operated by the predetermined combinations, thus being selectively operated corresponding to an actually required load.

In the case that compressor operation requiring signals are set in a 3 or more-stage system differing from this embodiment of the present invention, when weights applied to the signals are reset, the compressors can be operated more sensitively corresponding to loads of indoor regions.

As apparent from the above description, the present invention provides a method for selectively operating compressors of a dual type unitary air conditioner, in which the compressors are correctly selectively operated corresponding to the amount of an actually required load, thus improving user’s comfort and increasing an energy efficiency of the dual type unitary air conditioner.

Although a plurality of centralized warm and cold air circulators and an individual warm and cold air circulator are connected in parallel to one outdoor unit, since weights are applied to respective loads, a refrigerant circulating along a heating and cooling cycle is sufficiently supplied to respective indoor units.

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.

What is claimed is:

1. A method for selectively operating compressors of a dual type unitary air conditioner comprising:

respectively sensing compressor operation requiring signals outputted from a plurality of centralized warm and cold air circulators and a compressor operation requiring signal outputted from at least one individual warm and cold air circulator;
changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weights to the signals; and
selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.

2. The method as set forth in claim 1, wherein the compressor operation requiring signals outputted from a plurality of the centralized warm and cold air circulators include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator includes ON and OFF signals.

3. The method as set forth in claim 2, wherein the weight applied to the signal indicating the supply of a small amount of air is 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

4. The method as set forth in claim 1, wherein the centralized warm and cold air circulators are independently installed in corresponding regions of a building, in which the dual type unitary air conditioner is installed, so that the number of the centralized warm and cold air circulators coincides with the number of the regions, and are independently connected in parallel to an outdoor heat exchanger.

5. The method as set forth in claim 1, wherein the individual warm and cold air circulator is independently installed in a designated place, and is independently connected in parallel to the outdoor heat exchanger.

6. The method as set forth in claim 1, wherein a plurality of the compressors have different capacities.

7. The method as set forth in claim 1, wherein a plurality of the compressors are operated by different methods.

8. A method for selectively operating compressors of a dual type unitary air conditioner, which has a plurality of centralized warm and cold air circulators independently installed in corresponding regions of a building, in which the dual type unitary air conditioner is installed, so that the number of the centralized warm and cold air circulators coincides with the number of the regions, and independently connected in parallel to an outdoor heat exchanger, and at least one individual warm and cold air circulator independently installed in a designated place and independently connected in parallel to the outdoor heat exchanger, comprising:

respectively sensing compressor operation requiring signals outputted from the centralized warm and cold air circulators and a compressor operation requiring signal outputted from the individual warm and cold air circulator;
changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weights to the signals; and
selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.
9. The method as set forth in claim 8, wherein the compressor operation requiring signals outputted from a plurality of the centralized warm and cold air circulators include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator includes ON and OFF signals.

10. The method as set forth in claim 9, wherein the weight applied to the signal indicating the supply of a small amount of air is 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

11. The method as set forth in claim 9, wherein:

the centralized warm and cold air circulators respectively heat and cool two regions, and one individual warm and cold air circulator is provided;

a plurality of the compressors comprise a first compressor having a capacity corresponding to 60% of a total compressor capacity, and a second compressor having a capacity corresponding to 40% of the total compressor capacity;

the weight applied to the signal indicating the supply of a large amount of air is 2, the weight applied to the signal indicating the supply of a small amount of air is 1.3, the weight applied to the signal indicating non supply of air is 0; the weight applied to the ON signal is 0.8, and the weight applied to the OFF signal is 0; and

when the obtained total compressor capacity value is more than 4.0, both the first and second compressors are operated, when the obtained total compressor capacity value is between 4.0 and 2.8, only the first compressor is operated, and when the obtained total compressor capacity value is between 2.8 and 0, only the second compressor is operated.

12. The method as set forth in claim 8, wherein a plurality of the compressors have different capacities.

13. The method as set forth in claim 8, wherein a plurality of the compressors are operated by different methods.

14. A method for selectively operating compressors of a dual type unitary air conditioner, which has centralized warm and cold air circulators for respectively heating and cooling two regions, one individual warm and cold air circulator, a first compressor having a capacity corresponding to 60% of a total compressor capacity, and a second compressor having a capacity corresponding to 40% of the total compressor capacity, comprising:

respectively sensing compressor operation requiring signals outputted from the centralized warm and cold air circulators and a compressor operation requiring signal outputted from the individual warm and cold air circulator;

changing the compressor operation requiring signals to numerical values for defining a total compressor capacity value by respectively applying weights to the signals; and

selectively operating the compressors connected in parallel according to the obtained total compressor capacity value.

15. The method as set forth in claim 14, wherein the compressor operation requiring signals outputted from the centralized warm and cold air circulators include three signals respectively indicating the supply of a large amount of air, the supply of a small amount of air, and non supply of air, and the compressor operation requiring signal outputted from the individual warm and cold air circulator includes ON and OFF signals.

16. The method as set forth in claim 15, wherein the weight applied to the signal indicating the supply of a small amount of air is 0.65 of the weight applied to the signal indicating the supply of a large amount of air.

17. The method as set forth in claim 15, wherein:

the weight applied to the signal indicating the supply of a large amount of air is 2, the weight applied to the signal indicating the supply of a small amount of air is 1.3, the weight applied to the signal indicating non supply of air is 0; the weight applied to the ON signal is 0.8, and the weight applied to the OFF signal is 0; and

when the obtained total compressor capacity value is more than 4.0, both the first and second compressors are operated, when the obtained total compressor capacity value is between 4.0 and 2.8, only the first compressor is operated, and when the obtained total compressor capacity value is between 2.8 and 0, only the second compressor is operated.

18. The method as set forth in claim 14, wherein a plurality of the compressors are operated by different methods.

19. The method as set forth in claim 14, wherein the centralized warm and cold air circulators are independently installed in corresponding regions of a building, in which the dual type unitary air conditioner is installed, and are independently connected in parallel to an outdoor heat exchanger.

20. The method as set forth in claim 14, wherein the individual warm and cold air circulator is independently installed in a designated place, and is independently connected in parallel to the outdoor heat exchanger.