Publication Classification

(51) Int. Cl.
F25B 41/00 (2006.01)

(52) U.S. Cl. ........................................ 62/197; 62/198

(57) ABSTRACT

A method for controlling a multi-type air conditioner, includes selecting, from among a plurality of indoor units connected to an outdoor unit, at least one currently operating indoor unit; determining whether the at least one currently operating indoor unit is in an overcooling state; selecting, from among the plurality of indoor units connected to the outdoor unit, at least one currently stopped indoor unit. Further, if it is determined that the at least one currently operating indoor unit is operating in the overcooling state the refrigerant bypasses the at least one currently operating indoor unit such that refrigerant discharged from the outdoor unit is introduced into the at least one currently stopped indoor unit.
FIG. 2

COMPRESSOR DRIVING UNIT

CONDENSING FAN DRIVING UNIT

COMMAND INPUT UNIT

CONTROL UNIT

TEMPERATURE DETECTING UNIT

SOLENOID VALVE DRIVING UNIT

EXPANSION DEVICE DRIVING UNIT

EVAPORATING FAN DRIVING UNIT
FIG. 3

START

IS OPERATION COMMAND INPUT?

NO

YES

DETERMINATION ON INDOOR UNIT

PERFORM OPERATION

DETERMINATION ON INDOOR TEMPERATURE AND PRESET TEMPERATURE

INDOOR TEMPERATURE < PRESET TEMPERATURE?

NO

YES

MINIMUM REFRIGERANT COMPRESSION CAPACITY?

NO

YES

SELECT INDOOR UNIT THAT IS NOT IN OPERATION

OPERATION WITH REDUCED REFRIGERANT COMPRESSION CAPACITY

BYPASS REFRIGERANT TO SELECTED INDOOR UNIT

STANDBY FOR PREDETERMINED PERIOD OF TIME
APPARATUS AND METHOD FOR CONTROLLING MULTI-TYPE AIR CONDITIONER

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND

[0002] The present invention relates to a method for controlling a multi-type air conditioner.

[0003] In general, an air conditioner withdraws hot air from a room and the hot air is heat exchanged at an evaporator in a cooling cycle. Cool air generated by the heat exchange is discharged into the room, and repeated operation thereof cools the room.

[0004] The cooling cycle typically includes a closed circuit having a compressor, a condenser, an expansion device and an evaporator.

[0005] The compressor compresses a gaseous refrigerant of low temperature and pressure for conversion into a gaseous refrigerant of high temperature and pressure. The gaseous refrigerant of high temperature and pressure converted by the compressor is condensed in the condenser and then converted into a liquid refrigerant of high temperature and pressure.

[0006] The liquid refrigerant of high temperature and pressure condensed in the condenser is expanded in the expansion device and then converted into a liquid refrigerant of low temperature and pressure. The liquid refrigerant of low temperature and pressure expanded in the expansion device is subjected to heat exchange with indoor air in the evaporator and then evaporated and converted into the gaseous refrigerant of low temperature and pressure.

[0007] The gaseous refrigerant of low temperature and pressure generated by the heat exchange in the evaporator is converted again into the gaseous refrigerant of high temperature and pressure in the compressor.

[0008] That is, the cooling cycle including a closed circuit having a compressor, a condenser, an expansion device and an evaporator repeatedly performs a compression, condensation, expansion and evaporation of a refrigerant. The cooling cycle carries out the heat exchange of indoor air with the refrigerant evaporated in the evaporator to generate cool air and then discharges the generated cool air into the room so that the room can be cooled.

[0009] In an air conditioner provided with such a cooling cycle, the compressor generates much noise when operating, and the condenser is provided with an additional condensing fan to dissipate heat generated from the condenser. Accordingly, the compressor, the condenser and the condensing fan are provided in an outdoor unit.

[0010] Noise is scarcely generated in the expansion device and an additional evaporating fan is provided in the evaporator for generating cool air through heat exchange with indoor air. The evaporation fan generates very little noise.

Thus, the expansion device, the evaporator and the evaporating fan are provided in an indoor unit.

[0011] The indoor and outdoor units are connected to each other through a connecting pipe, so that the refrigerant supplied from the condenser of the outdoor unit can be introduced into the evaporator through the connecting pipe and the expansion device of the indoor unit and the refrigerant discharged from the evaporator can be introduced into the compressor through the connecting pipe.

[0012] Generally, one indoor unit in such an air conditioner is connected to an outdoor unit. Recently, in order to improve energy consumption efficiency, a multi-type air conditioner has been widely used, wherein a plurality of indoor units are connected to an outdoor unit and can be selectively operated to selectively cool a plurality of rooms.

[0013] In the multi-type air conditioner, the outdoor unit is generally provided with two compressors for supplying sufficient liquid refrigerant of high temperature and pressure to a plurality of indoor units. A gas refrigerant of high temperature and pressure generated through compression by the two compressors is condensed into a liquid refrigerant of high temperature and pressure by a condenser and then supplied to the plurality of indoor units.

[0014] Here, the compression capacities of the two compressors may be identically set. For example, each of the first compressor and the second compressor has a 50% refrigerant compression capacity of a total refrigerant compression capacity of 100%.

[0015] On the other hand, the compression capacities of the two compressors provided in the outdoor unit may be differently set from each other. For example, the first compressor may have a 40% refrigerant compression capacity of the total refrigerant compression capacity while the second compressor may have a 60% refrigerant compression capacity of the total refrigerant compression capacity.

[0016] Each of the plurality of indoor units includes a solenoid valve for passing or blocking the liquid refrigerant of high temperature and pressure; an expansion device for expanding the liquid refrigerant of high temperature and pressure, which has passed through the solenoid valve, into a liquid refrigerant of low temperature and pressure; and an evaporator for performing heat exchange of the liquid refrigerant, which has been expanded in the expansion device, with outdoor air to generate cold air and to convert the liquid refrigerant into a gas refrigerant of low temperature and pressure.

[0017] In the multi-type air conditioner, if only some of the indoor units connected to the outdoor unit are to be operated, there may occur a case where the minimum refrigerant compression capacity of the compressors is larger than the cooling capacity of the evaporators provided in the indoor units in operation.

[0018] If the minimum refrigerant compression capacity of the compressors is larger than the cooling capacity of the evaporators provided in the indoor units in operation, there may occur a case where the indoor units are operated in an overcooling state and indoor temperature is lower than a preset temperature, thereby causing a user to feel a chill, which in some cases may be detrimental to a user’s health.
[0019] In order to prevent the indoor units from operating in the overheating state, the conventional multi-type air conditioner is configured such that the gas refrigerant of high temperature and pressure discharged from the compressor is not introduced into the condenser but is expanded and converted, by the expansion device, into the gas refrigerant of low temperature and pressure that in turn is bypassed to an accumulator or a suction side of the compressor.

[0020] However, the conventional air conditioner is often provided with an additional solenoid valve and expansion device for bypassing the gas refrigerant of high temperature and pressure discharged from the compressor.

SUMMARY

[0021] Accordingly, an object of the present invention is to provide a method for controlling a multi-type air conditioner having one outdoor unit and a plurality of indoor units, wherein a refrigerant supplied from the outdoor unit is efficiently bypassed to prevent an overheating operation without the need for an additional solenoid valve and expansion device.

[0022] Another object of the present invention is to provide a method for controlling a multi-type air conditioner, wherein it is determined whether an operating indoor unit is operated in an overheating state, based on a preset temperature of the indoor unit and an indoor temperature, and if the indoor unit is operating in an overheating state, a refrigerant is bypassed to a currently inoperative indoor unit to thereby reduce the amount of the refrigerant introduced into the operating indoor unit and to prevent the overheating operation of the indoor unit.

[0023] According to a control method of the present invention for achieving the above objects, if a user manipulates a key disposed at a predetermined indoor unit to give off an operation command, in response, the relevant indoor unit generates the operation command and outputs it to a control unit. The control unit determines which indoor unit has generated the operation command. The indoor unit and the outdoor unit are operated in response to the operation command, while a refrigerant discharged from the outdoor unit is supplied to the indoor unit which has generated the operation command.

[0024] The control unit determines whether the indoor unit is operating in an overheating state, based on a preset temperature for the operating indoor unit and indoor temperature detected by the operating indoor unit.

[0025] For example, the overheating operation of the indoor unit is determined if the preset temperature for the indoor unit is below the temperature of indoor air.

[0026] If the control unit determines that the indoor unit is operating in the overheating state, the control unit selects an indoor unit which is not in operation among the plurality of indoor units connected to the outdoor unit, and bypasses some of the refrigerant discharged from the outdoor unit to the selected indoor unit. That is, the control unit may select an indoor unit (from among the plurality of indoor units) which is currently stopped.

[0027] The control method of the present invention includes a control unit supplying a refrigerant discharged from an outdoor unit to at least one first indoor unit currently operating among a plurality of indoor units connected to the outdoor unit; determining whether the first indoor unit (e.g., at least one currently operating indoor unit) is currently operating in an overheating state; and bypassing the refrigerant discharged from the outdoor unit to at least one second indoor unit (e.g., that is at least one currently stopped indoor unit) which is not currently in operation if it is determined that the first indoor unit is operating in the overheating state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The present invention is further described in the detail description which follows, in reference to the noted plurality of drawings, by way of non-limiting examples of preferred embodiments of the present invention, in which like characters represent like elements throughout the several views of the drawings, and wherein:

[0029] FIG. 1 is a view showing the configuration of a refrigeration cycle of an air conditioner to which a control method of the present invention is applied;

[0030] FIG. 2 is a block diagram of the air conditioner to which the control method of the present invention is applied; and

[0031] FIG. 3 is a flowchart illustrating the control method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0032] The present invention is further described in the detail description which follows, in reference to the noted plurality of drawings, by way of non-limiting examples of preferred embodiments of the present invention, in which like characters represent like elements throughout the several views of the drawings, and wherein:

[0033] FIG. 1 is a view showing the configuration of a refrigeration cycle of an air conditioner to which a control method of the present invention is applied. Here, reference numeral “100” designates an outdoor unit, and reference numerals “110-1”, “110-2”, . . . , “110-N” designate a first indoor unit to a N-th indoor unit connected to the outdoor unit (100).

[0034] The outdoor unit (100) includes an accumulator (101), first and second compressors (103, 103a), back-flow preventers or preventing means (105, 105a), a condenser (107) and a condensing fan (109).

[0035] The accumulator (101) stores a gas refrigerant of low temperature and pressure discharged from the first to N-th indoor units (110-1, 110-2, . . . , 110-N) and supplies the stored gas refrigerant of low temperature and pressure to the first and second compressors (103, 103a). Further, the accumulator (101) prevents a liquid refrigerant from being supplied to the first and second compressors (103, 103a). The first and second compressors (103, 103a) withdraws the gas refrigerant of low temperature and pressure stored in the accumulator (101) and then converts it into a gas refrigerant of high temperature and pressure.

[0036] Here, for example, the first compressor (103) has a 40% refrigerant compression capacity out of the total refrigerant compression capacity of a system, and the second
compressor (103a) has a 60% refrigerant compression capacity of the total refrigerant compression capacity.

[0037] The back-flow preventers or preventing means (105, 105a) prevents the gas refrigerant of high temperature and pressure compressed in the first and second compressors (103, 103a) from flowing backward. For example, check valves may be used as the back-flow preventing means (105, 105a) to prevent backflow of the refrigerant.

[0038] The condenser (107) condenses the gas refrigerant of high temperature and pressure, which has been compressed in the first and second compressors (103, 103a) and which has passed through the back-flow preventing means (105, 105a), into the liquid refrigerant of high temperature and pressure for supply to the first to the N-th indoor units (110-1, 110-2, . . . , 110-N).

[0039] The condensing fan (109) dissipates heat thus generated when the condenser (107) condenses the gas refrigerant of high temperature and pressure into the liquid refrigerant of high temperature and pressure.

[0040] The first to the N-th indoor units (110-1, 110-2, 110-N) are provided with solenoid valves (111-1, 111-2, . . . , 111-N), expansion devices (113-1, 113-2, . . . , 113-N), evaporators (115-1, 115-2, . . . , 115-N), evaporating fans (117-1, 117-2, . . . , 117-N) and temperature sensors (119-1, 119-2, . . . , 119-N), respectively.

[0041] The solenoid valves (111-1, 111-2, . . . , 111-N) pass or block the liquid refrigerant of high temperature and pressure that has been condensed in the condenser (107).

[0042] The expansion devices (113-1, 113-2, . . . , 113-N) expand the liquid refrigerant of high temperature and pressure, which has passed through the solenoid valves (111-1, 111-2, 111-N), such that the liquid refrigerant of high temperature and pressure is converted into a liquid refrigerant of low temperature and pressure.

[0043] The evaporators (115-1, 115-2, . . . , 115-N) perform heat exchange of the liquid refrigerant of low temperature and pressure, which has been expanded in the expansion devices (113-1, 113-2, . . . , 113-N) with indoor air to generate cool air while converting the liquid refrigerant into a gas refrigerant of low temperature and pressure. Further, the gas refrigerant of low temperature and pressure is introduced into the accumulator (101) of the outdoor unit (100).

[0044] The evaporating fans (117-1, 117-2, . . . , 117-N) withdraw the indoor air so that the indoor air can be subjected to heat exchange in the evaporators (115-1, 115-2, . . . , 115-N) to generate cold air, and then discharge the generated cold air into rooms.

[0045] The temperature sensors (119-1, 119-2, . . . , 119-N) detect the temperature of indoor air withdrawn when the evaporating fans (117-1, 117-2, . . . , 117-N) are driven.

[0046] FIG. 2 is a block diagram of the air conditioner to which the control method of the present invention is applied. Here, reference numeral “200” designates a control unit. The control unit (200) controls a cooling operation of the air conditioner in response to a user’s operation command.

[0047] According to the control method of the present invention, the control unit (200) determines whether an indoor unit is operating in an overcooling state, on the basis of the temperature of indoor air and a user’s preset temperature for the operating indoor unit. If it is determined that the indoor unit is operating in the overcooling state, the control unit bypasses the refrigerant to an indoor unit, which is not in operation, to prevent the overcooling operation of the operating indoor unit. For example, assuming that the indoor unit (110-1) performs a cooling operation and other indoor units (110-2, . . . , 110-N) are not in operation, the control unit (200) determines whether the indoor unit is operating in the overcooling state, on the basis of the temperature of indoor air and a user’s preset temperature for the operating indoor unit (110-1). If it is determined that the indoor unit is operating in the overcooling state, the control unit makes bypasses the refrigerant to the indoor units (110-2, . . . , 110-N), which are not in operation, to prevent the overcooling operation of the operating indoor unit (110-1).

[0048] Reference numeral “210” designates a compressor driving unit. The compressor driving unit (210) selectively drives the first compressor (103) or the second compressor (103a) under the control of the control unit (200), thereby compressing the refrigerant.

[0049] Reference numeral “220” designates a condensing fan driving unit. The condensing fan driving unit (220) drives the condensing fan (109) under the control of the control unit (200), thereby cooling the condenser (107).

[0050] Reference numeral “230” designates a command input unit. The command input unit (230) includes a plurality of function keys provided on the indoor units (110-1, 110-2, . . . , 110-N). As a user manipulates the function keys to generate a user’s command such as an operation command for the air conditioner and a preset temperature signal, the command input unit (230) transmits the command to the control unit (200).

[0051] Reference numeral “240” designates a temperature detecting unit. The temperature detecting unit (240) includes the temperature sensors (119-1, 119-2, . . . , 119-N) provided in the indoor units (110-1, 110-2, . . . , 110-N), respectively. The temperature detecting unit detects the temperature of indoor air and transmits the detected temperature to the control unit (200).

[0052] Reference numeral “250” designates a solenoid valve driving unit. The solenoid valve driving unit (250) selectively drives the solenoid valves (111-1, 111-2, . . . , 111-N) provided in the first to N-th indoor units (110-1, 110-2, . . . , 110-N) under the control of the control unit (200), thereby passing or blocking the refrigerant condensed in the condenser (107).

[0053] Reference numeral “260” designates an expansion device driving unit. The expansion device driving unit (260) selectively drives the expansion devices (113-1, 113-2, . . . , 113-N) provided in the first to N-th indoor units (110-1, 110-2, . . . , 110-N) under the control of the control unit (200), thereby expanding the refrigerant that has passed through the solenoid valves (111-1, 111-2, . . . , 111-N).

[0054] Reference numeral “270” designates an evaporating fan driving unit. The evaporating fan driving unit (270) selectively drives the evaporating fans (117-1, 117-2, . . . , 117-N) provided in the first to N-th indoor units (110-1, 110-2, . . . , 110-N) under the control of the control unit (200), thereby withdrawing indoor air and performing heat.
exchange for the withdrawn air in the evaporators (115-1, 115-2, ..., 115-N) and discharging cold air into rooms.

[0055] In the air conditioner thus constructed as above, if a user manipulates the function keys provided on the first to N-th indoor units [110-1, 110-2, ..., 110-N] in order to instruct the air conditioner to operate, the command inputting unit (230) generates an operation command for the air conditioner.

[0056] Here, assume that the user manipulates the function keys on the first indoor unit (110-1) to instruct the air conditioner to operate.

[0057] If the command inputting unit (230) generates an operation command for the first indoor unit (110-1), the control unit (200) begins to operate the air conditioner. That is, the control unit (200) controls the compressor driving unit (210) to drive the compressors (103, 103α) provided in the first indoor unit (110-1) and also controls the condensing fan driving unit (220) to cool the condenser (107).

[0058] Moreover, the control unit (200) determines the status of the first indoor unit (110-1) which is instructed to operate, and performs control such that the first indoor unit (110-1) is to operate. That is, the control unit (200) controls the solenoid valve driving unit (250) and the expansion device driving unit (260) to supply the refrigerant to the evaporator (115-1) of the first indoor unit (110-1) and also controls the evaporating fan driving unit (270) to drive the evaporating fan (117-1) and to evaporate the refrigerant in the evaporator (115-1).

[0059] In such a state, the control unit (200) determines the indoor temperature of a room with the first indoor unit (110-1) installed therein, which is detected by the temperature detecting unit (240), and a preset temperature set by user manipulation on the function keys provided on the first indoor unit (110-1). If it is determined that the indoor temperature is below the preset temperature, the control unit (200) determines that the first indoor unit (110-1) is operating in the overcooling state.

[0060] If it is determined that the first indoor unit (e.g., at least one currently operating indoor unit) is operating in the overcooling state, the control unit (200) determines whether the compressors (103, 103α) are operating with the minimum refrigerant compression capacity. If the compressors (103, 103α) are not operating with the minimum refrigerant compression capacity, the control unit (200) controls the operations of the first and second compressors (103, 103α) through the compressor driving unit (210) to reduce the refrigerant compression capacity (S312).

[0061] If it is determined that the first indoor unit (110-1) continues to operate in the overcooling state even though the first and second compressors (103, 103α) are driven with the minimum refrigerant compression capacity, the control unit (200) selects one indoor unit to which the refrigerant is not bypassed among the second to N-th indoor units (110-2, ..., 110-N) which are not currently in operation (S316). For example, the control unit selects the second indoor unit (at least one currently stopped indoor unit,) (110-2) as an indoor unit to which the refrigerant is to be bypassed.

[0062] Once the second indoor unit (110-2) is selected to bypass the refrigerant thereto, the control unit (200) controls the selected solenoid valve driving unit (250) and the expansion device driving unit (260) to bypass the refrigerant to the evaporator (115-2) of the second indoor unit (110-2).

[0063] If the first indoor unit (110-1) continues to operate in the overcooling state even though the refrigerant is bypassed to the second indoor unit (110-2), the control unit (200) sequentially selects the third to N-th indoor units (110-3, ..., 110-N) to bypass the refrigerant thereto.

[0064] Accordingly, it is possible to prevent the overcooling operation of the first indoor unit (110-1) that is operating currently.

[0065] At this time, the control unit (200) does not drive the evaporating fans (117-2, ..., 117-N) provided in the second to N-th indoor units (110-2, ..., 110-N) to which the refrigerant is bypassed, so that the refrigerant cannot be subjected to heat exchange with indoor air in the evaporators (115-2, ..., 115-N) of the second to N-th indoor units (110-2, ..., 110-N).

[0066] Referring now to FIG. 3, if the user manipulates the function keys provided on the first indoor unit (110-1) or the second to N-th indoor units (110-2, ..., 110-N) to instruct the air conditioner to operate, the command inputting unit (230) generates an operation command for the air conditioner in response to the user’s manipulation on the function keys, and the generated operation command is inputted into the control unit (200) (S300).

[0067] To this end, the control unit (200) determines whether an indoor unit, which is instructed to operate, is the first indoor unit (110-1) or the second to N-th indoor units (110-2, ..., 110-N) (S302).

[0068] Here, assume that the user manipulates the first indoor unit (110-1) so that the first indoor unit can operate, and all the second to N-th indoor units (110-2, ..., 110-N) are not in operation.

[0069] When the control unit determines that the first indoor unit (110-1) is instructed to operate, the control unit (200) performs the operation of the air conditioner (S304).

[0070] In other words, the control unit (200) controls the compressor driving unit (210) to drive the first compressor (103) or the second compressor (103α) provided in the outdoor unit (100) so that the refrigerant can be compressed. Further, the control unit (200) controls the condensing fan driving unit (220) to drive the condensing fan (109) provided in the outdoor unit (100) so that heat generated in the condenser (107) can be dissipated.

[0071] Further, the control unit (200) operates the first indoor unit (110-1). That is, the control unit (200) controls the solenoid valve driving unit (250) to open the solenoid valve (111-1) provided in the first indoor unit (110-1) and controls the expansion device driving unit (260) to cause the solenoid valve (111-1) to expand the refrigerant. Moreover, the control unit controls the evaporating fan driving unit (270) to drive the evaporating fan (117-1) and to perform heat exchange of the refrigerant with indoor air in the evaporator (115-1).

[0072] When the air conditioner is operating in this way, the control unit (200) determines the temperature of the room with the first indoor unit (110-1) installed therein on the basis of a detection signal of the temperature sensor (119-1) of the temperature detecting unit (240) provided in
the first indoor unit (110-1). Furthermore, the control unit (200) makes the determination by receiving, through the command input unit (230), a preset temperature set by user’s manipulation on the function keys provided on the first indoor unit (110-1) (S306).

[0073] The control unit (200) compares the indoor temperature with the preset temperature to determine whether the indoor temperature is below the preset temperature (S308).

[0074] If it is determined that the indoor temperature is not below the preset temperature, the control unit (200) determines that the first indoor unit (110-1) is not operating in the overcooling state. Then, the control unit repeats the determination on the indoor temperature and the preset temperature (S306) and the determination on whether the indoor temperature is below the preset temperature (S308).

[0075] On the contrary, if the indoor temperature is below than the preset temperature, the control unit (200) determines that the first indoor unit (110-1) is operating in the overcooling state and then determines whether the compressor is operating with the minimum refrigerant compression capacity (S310).

[0076] That is, the control unit (200) determines whether only the first compressor (103) with a 40% refrigerant compression capacity is operating.

[0077] If it is determined that the compressor is operating with the minimum refrigerant compression capacity, the control unit (200) controls the operations of the first and second compressors (103, 103a) through the compressor driving unit (210) to reduce the refrigerant compression capacity (S312).

[0078] To be more specific, if all the first and second compressors (103, 103a) are operated to ensure a 100% refrigerant compression capacity, the control unit stops the operation of the first compressor (103) and maintains the operation of only the second compressor (103a) to reduce the refrigerant compression capacity to 60% of the total refrigerant compression capacity. 

[0079] If only the second compressor (103a) is operated to ensure the 60% refrigerant compression capacity, the control unit stops the operation of the second compressor (103a) and operates the first compressor (103) to reduce the refrigerant compression capacity to 40% of the total refrigerant compression capacity.

[0080] Then, the control unit is put on standby for a predetermined period of time (S314) and returns to step S306 where it makes determination on indoor temperature and the preset temperature. The control unit repeats the step of determining whether the indoor temperature is below the preset temperature.

[0081] If it is determined in step S310 that the compressor is operating with the minimum refrigerant compression capacity, the control unit (200) selects one indoor unit to which the refrigerant is not bypassed among the second to N-th indoor units (110-2, . . . , 110-N) that are not currently in operation (S316). For example, the control unit selects the second indoor unit (110-2) as an indoor unit to which the refrigerant is bypassed.

[0082] Once the second indoor unit (110-2) is selected as an indoor unit to which the refrigerant is bypassed, the control unit bypasses the refrigerant to the selected second indoor unit (110-2) (S318) and reduces the amount of the refrigerant introduced into the first indoor unit (110-1), thereby preventing the overcooling operation of the first indoor unit (110-1).

[0083] That is, the control unit (200) controls the solenoid valve driving unit (250) to open the solenoid valve (113-2) provided in the second outdoor unit (110-2) and controls the expansion device driving unit (260) to open the expansion device (115-2) provided in the second outdoor unit (110-2).

[0084] Successively, some of the refrigerant supplied from the condenser (107) is supplied to the evaporator (115-2) through the solenoid valve (113-2) and the expansion device (115-2) of the second indoor unit (110-2), and the amount of the refrigerant supplied to the evaporator (115-1) of the first indoor unit (110-1) is reduced to prevent the overcooling operation of the first indoor unit (110-1).

[0085] At this time, the control unit (200) does not drive the evaporating fan (117-2) provided in the second indoor unit (110-2) so that the refrigerant cannot be subjected to heat exchange with indoor air in the evaporator (115-2) of the second indoor unit (110-2), whereby a corresponding room is not cooled.

[0086] According to the present invention, in a multi-type air conditioner having a plurality of indoor units connected to an outdoor unit, if the cooling capacity of an indoor unit which is currently operating is lower than the refrigerant compression capacity of the compressor, a refrigerant is bypassed to an indoor unit which is not in operation.

[0087] Therefore, according to the present invention, there is no need for an additional solenoid valve and expansion device for bypassing a refrigerant supplied from a condenser, resulting in reduction of production costs. It is also possible to reduce the amount of the refrigerant supplied to an operating indoor unit, thereby preventing an overcooling operation.

[0088] Further, since evaporating fans provided in indoor units to which a refrigerant is bypassed are not driven in the present invention, heat exchange does not occur between indoor air and the refrigerant in evaporators of the indoor units to which the refrigerant is by passed. Therefore, rooms in which the indoor units to which the refrigerant is bypassed are installed are not cooled.

[0089] Although the present invention has been described and illustrated in connection with the preferred embodiment, it will be readily understood by those skilled in the art that various changes and modifications can be made thereto without departing from the spirit and scope of the present invention defined by the appended claims.

[0090] For example, in a state where only one of a plurality of indoor units is operating, and if two or more indoor units are intended to be operated, the control unit determines whether all indoor temperature detected by temperature sensors of the plurality of indoor units which are operating is below a preset temperature. If it is determined that all the indoor temperature detected by the temperature sensors are below the preset temperature, the control unit can select an indoor unit which is not in operation and bypasses a refrigerant to the selected indoor unit.
It is further noted that the foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting the present invention. While the present invention has been described with reference to a preferred embodiment, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Changes may be made, within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the present invention in its aspects. Although the present invention has been described herein with reference to particular means, materials and embodiments, the present invention is not intended to be limited to the particulars disclosed herein; rather, the present invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims.

What is claimed is:

1. A method for controlling a multi-type air conditioner, comprising:
   
   selecting, from among a plurality of indoor units connected to an outdoor unit, at least one currently operating indoor unit;
   
   determining whether the at least one currently operating indoor unit is in an overcooling state;
   
   selecting, from among the plurality of indoor units connected to the outdoor unit, at least one currently stopped indoor unit; and
   
   bypassing the at least one currently operating indoor unit such that refrigerant discharged from the outdoor unit is introduced into the at least one currently stopped indoor unit, when it is determined that the at least one currently operating indoor unit is operating in the overcooling state.

2. The method as claimed in claim 1, further comprising:
   
   operating the at least one currently operating indoor unit in response to an operation command inputted from a command input unit.

3. The method as claimed in claim 1, wherein determining whether the at least one currently operating indoor unit is operating in the overcooling state comprises:
   
   selecting a preset temperature of the at least one currently operating indoor unit;
   
   detecting a detected temperature via a temperature sensor;
   
   comparing the preset temperature with the detected temperature; and
   
   determining that the at least one currently operating indoor unit is operating in the overcooling state, when the detected temperature is less than the preset temperature.

4. The method as claimed in claim 1, wherein the at least one currently operating indoor unit is a plurality of currently operating indoor units.

5. The method as claimed in claim 3, wherein the at least one currently operating indoor unit is a plurality of currently operating indoor units.

6. The method as claimed in claim 5, further comprising:
   
   providing each of the plurality of currently operating indoor units with respective temperature sensors.

7. The method as claimed in claim 1, further comprising:
   
   prior to bypassing the refrigerant to the at least one stopped indoor unit, determining a refrigerant compression capacity of the outdoor unit, and
   
   reducing the refrigerant compression capacity of the outdoor unit when the determined refrigerant compression capacity is greater than a minimum refrigerant compression capacity.

8. The method as claimed in claim 1, further comprising:
   
   operating the at least one currently operating indoor unit by opening a solenoid valve; and
   
   providing an expander in the at least one currently operating indoor unit such that the refrigerant discharged from the outdoor unit is introduced into an evaporator, and an evaporating fan is driven to perform heat exchange between the refrigerant and air while in the evaporator.

9. The method as claimed in claim 1, wherein the refrigerant bypasses at least two currently operating indoor units such that the refrigerant is introduced into at least two currently stopped indoor units.

10. The method as claimed in claim 1, further comprising:
   
   selecting the at least one currently stopped indoor unit having a solenoid valve, an expander, an evaporator, and an evaporating fan;
   
   opening the solenoid valve such that the refrigerant discharged from the outdoor unit bypasses the at least one currently operating indoor unit such that the refrigerant is introduced into an evaporator; and
   
   preventing an operation of the evaporating fan.

11. An apparatus for controlling a multi-type air conditioner, comprising:
   
   a controller that selects, from among a plurality of indoor units connected to an outdoor unit, at least one currently operating indoor unit;
   
   wherein the controller determines whether the at least one currently operating indoor unit is in an overcooling state;
   
   wherein the controller selects, from among the plurality of indoor units connected to the outdoor unit, at least one currently stopped indoor unit; and
   
   wherein when the controller determines that the at least one currently operating indoor unit is operating in the overcooling state, the refrigerant discharged from the outdoor unit bypassing the at least one currently operating indoor unit, and is introduced into the at least one currently stopped indoor unit.

12. The apparatus according to claim 11, further comprising:
   
   a command input unit that operates the at least one currently operating indoor unit in response to an operation command inputted by a user.

13. The apparatus according to claim 11, wherein
   
   the controller selects a preset temperature of the at least one currently operating indoor unit, and compares the preset temperature with a detected temperature detected by a temperature sensor; and
wherein when the detected temperature is less than the preset temperature, the controller determines that the at least one currently operating indoor unit is operating in the overcooling state.

14. The apparatus according to claim 11, wherein the at least one currently operating indoor unit is a plurality of currently operating indoor units.

15. The apparatus according to claim 13, wherein the at least one currently operating indoor unit is a plurality of currently operating indoor units.

16. The method as claimed in claim 5, further comprising:

providing each of the plurality of currently operating indoor units with respective temperature sensors.

17. The apparatus according to claim 11, wherein, prior to bypassing the refrigerant to the at least one stopped indoor unit, the controller determines a refrigerant compression capacity of the outdoor unit, and

wherein when the controller determines that the refrigerant compression capacity is greater than a minimum refrigerant compression capacity, the refrigerant compression capacity of the outdoor unit is reduced.

18. The apparatus according to claim 11, further comprising:

a solenoid valve that opens to operate the at least one currently operating indoor unit;

an expander provided in the at least one currently operating indoor unit, and configured to allow refrigerant discharged from the outdoor unit to be introduced into an evaporator; and

an evaporating fan driven to perform heat exchange between the refrigerant and air while in the evaporator.

19. The apparatus according to claim 11, wherein the refrigerant bypasses at least two currently operating indoor units such that the refrigerant is introduced into at least two currently stopped indoor units.

20. The apparatus according to claim 11, wherein

the at least one currently stopped indoor unit includes a solenoid valve, an expander, an evaporator, and an evaporating fan;

wherein the solenoid valve, when opened, is configured to allow the refrigerant discharged from the outdoor unit to bypass the at least one currently operating indoor unit such that the refrigerant is introduced into an evaporator; and

wherein an operation of the evaporating fan is prevented.

* * * * *