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(19) **United States**(12) **Patent Application Publication****Jeong et al.**(10) **Pub. No.: US 2012/0073313 A1**(43) **Pub. Date: Mar. 29, 2012**(54) **REFRIGERANT SYSTEM AND A CONTROL METHOD THE SAME****Publication Classification**(51) **Int. Cl.****F25B 45/00** (2006.01)**F25B 49/02** (2006.01)(52) **U.S. Cl.** 62/77; 62/132; 62/149(57) **ABSTRACT**

The present invention relates to the refrigerant system in which the refrigerant amount stored in the accumulator may be adjusted by the super cooling adjustment unit according to the indoor conditioning load. Therefore, according to the present invention, the flow refrigerant amount on the refrigerant cycle may be optimally adjusted according to the indoor conditioning load, and there is an advantage that the operation efficiency may be more improved.

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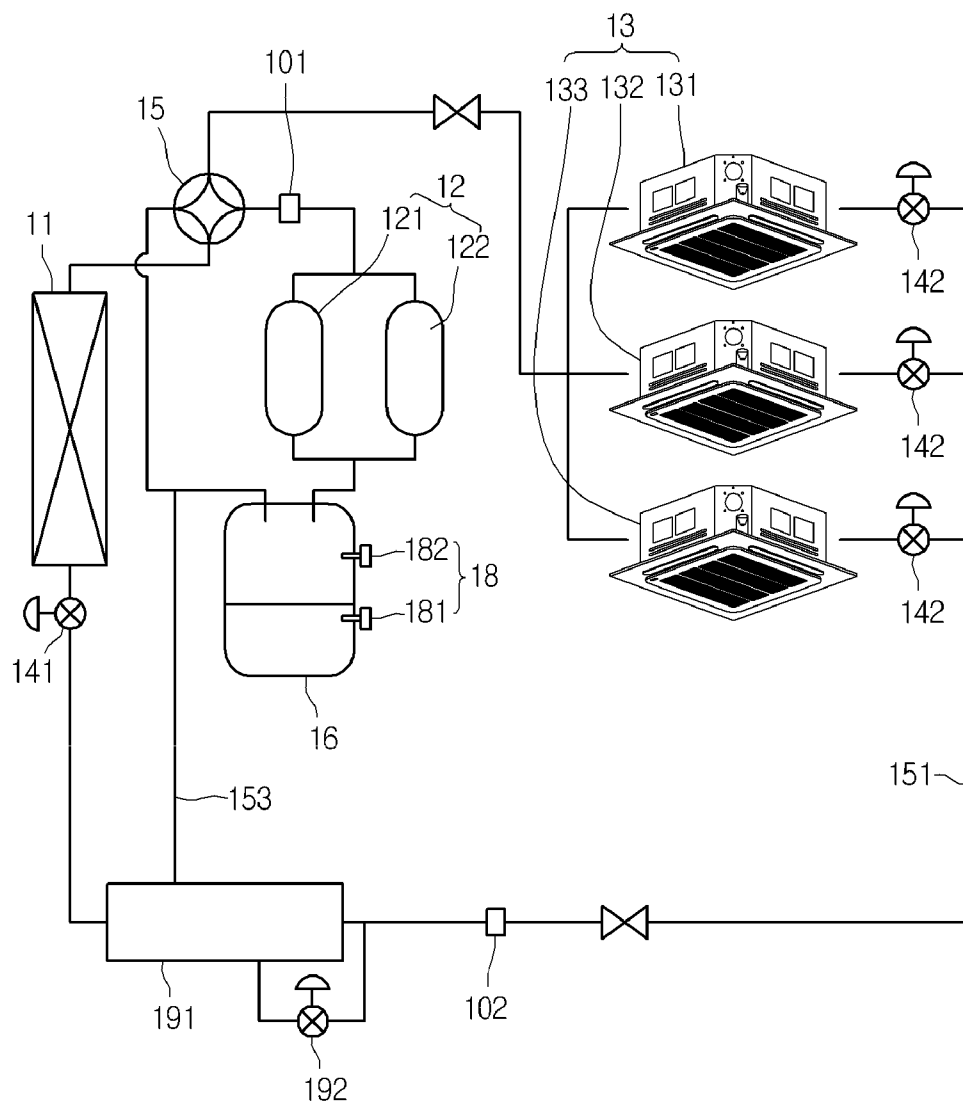


Fig. 1

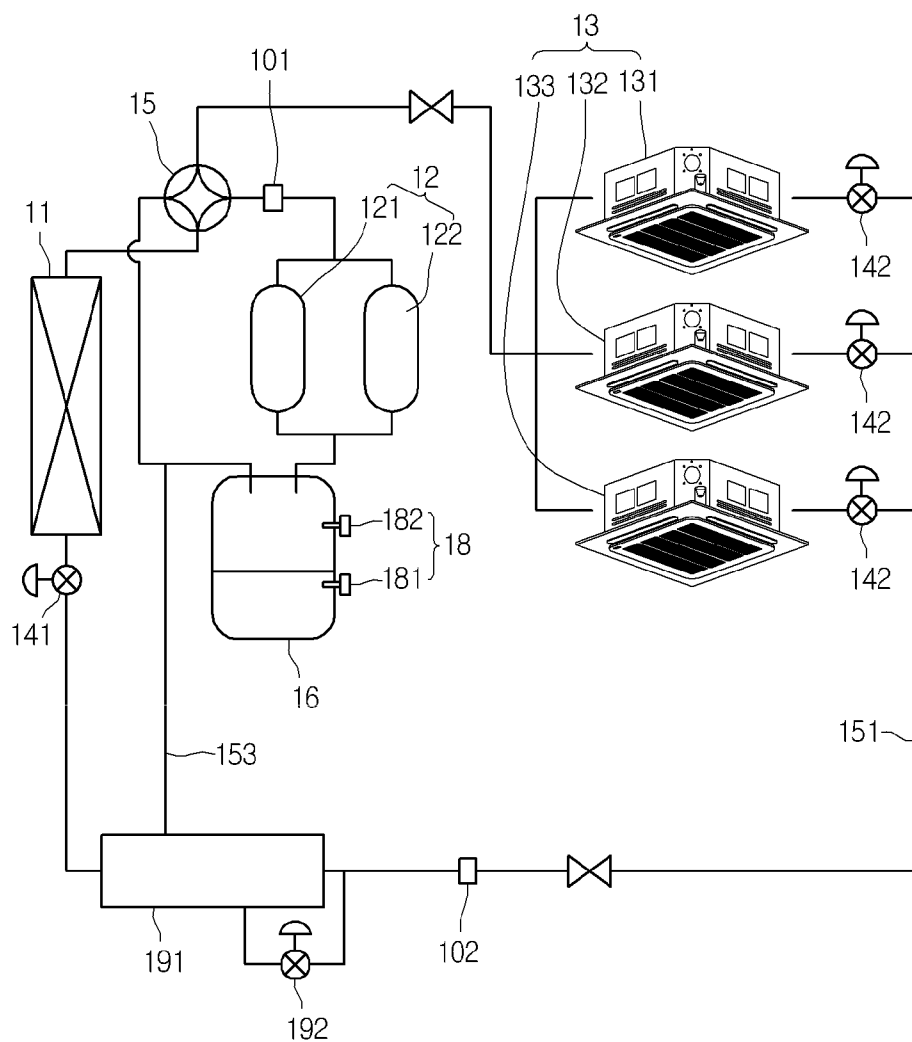


Fig. 2

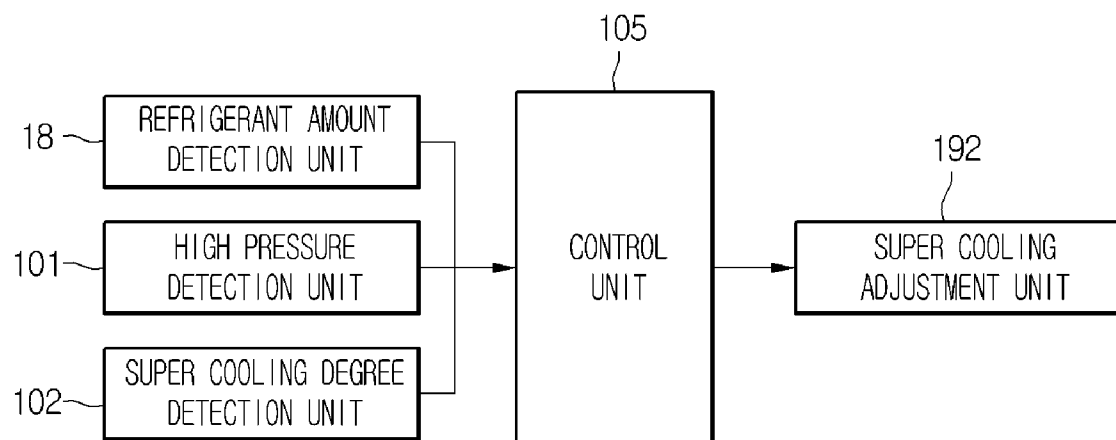


Fig. 3

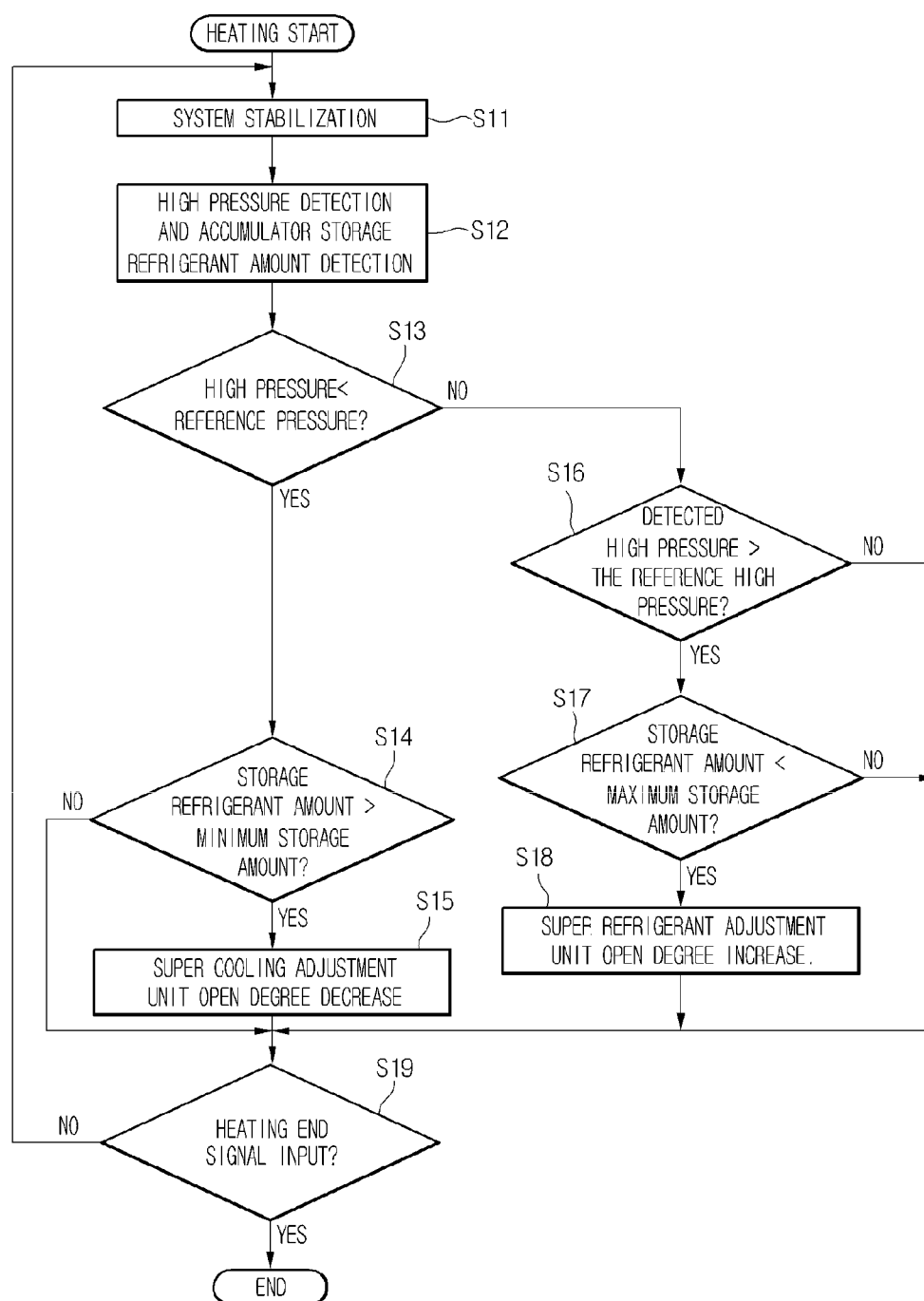
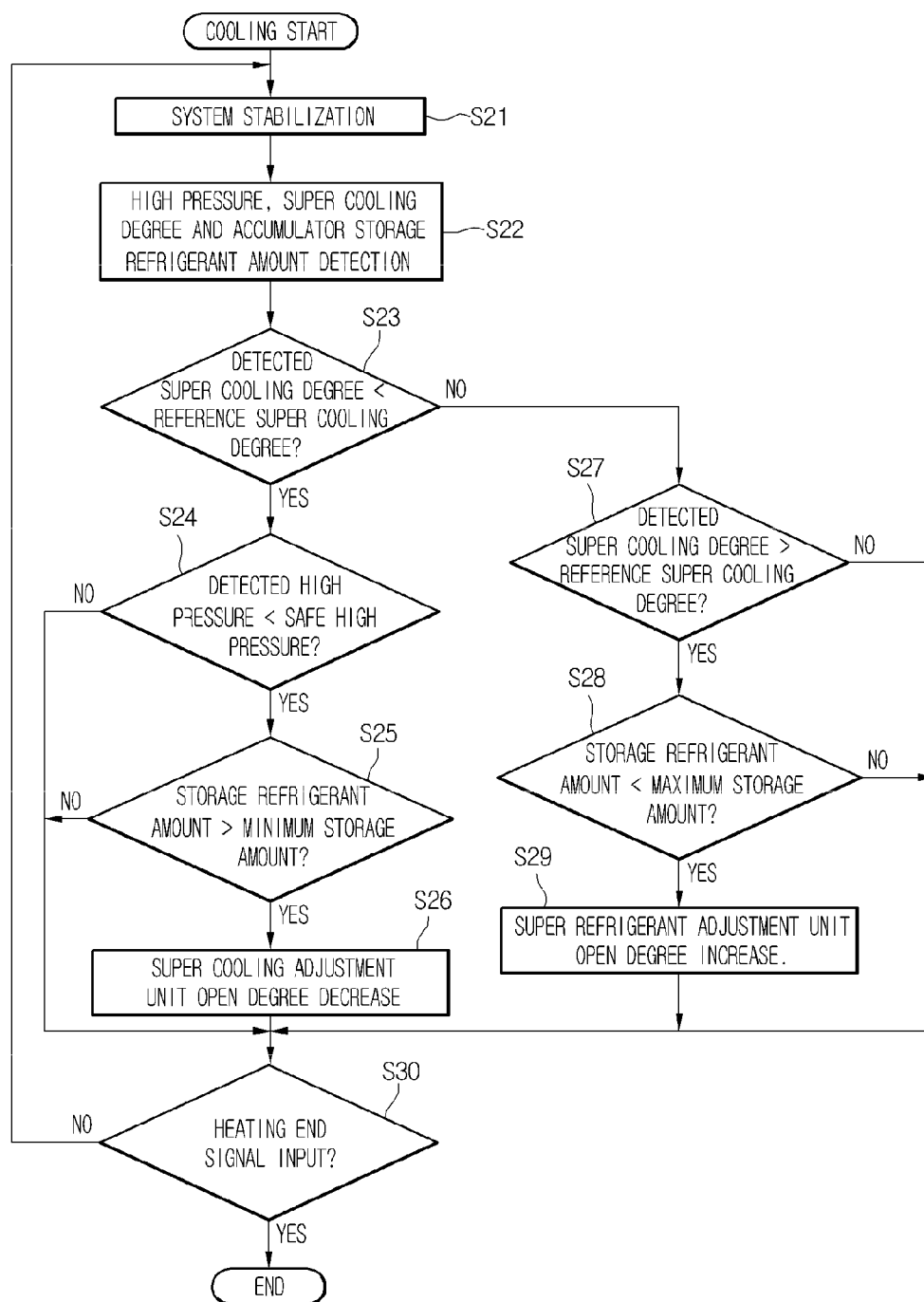


Fig. 4



REFRIGERANT SYSTEM AND A CONTROL METHOD THE SAME

CROSS REFERENCES RELATED APPLICATIONS

[0001] The present application claims priority under 35 U.S.C. 119 and 35 U.S.C. 365 to Korean Patent Application No. 2010-0093470 (filed on Sep. 27, 2010), which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a refrigerant system to perform a refrigerant cycle.

[0004] 2. Description of the Related Art

[0005] In general, the refrigerant system is a cooling or heating device for conditioning indoor air by performing a refrigerant cycle composed of compression-condensation-expansion-evaporation.

[0006] The refrigerant system includes an indoor unit for heat-exchanging indoor air with a refrigerant and an outdoor unit for heat-exchanging outdoor air with the refrigerant. The indoor unit includes an indoor heat exchanger for heat-exchanging indoor air with the refrigerant, a fan for blowing the indoor air, and a motor for rotating the fan. The outdoor unit includes an outdoor heat exchanger for heat exchanging outdoor air with a refrigerant, a fan for blowing the outdoor air, a motor for rotating the fan, a compressor for compressing the refrigerant, expanding unit for expanding the refrigerant, and a 4-way valve for changing flow direction of the refrigerant.

[0007] In addition, when performing a cooling operation of the indoor, the indoor heat exchanger is become evaporating unit and the outdoor heat exchanger is become a condensing unit. In addition, when performing a heating operation of the indoor, the indoor heat exchanger is become evaporating unit and the outdoor heat exchanger is become a condensing unit. The conversion of the cooling and heating operations is performed by changing flow direction of the refrigerant by the 4-way valve.

[0008] According to the conventional refrigerant system, refrigerant amount of the system required to the cooling or the heating operation varies with each other, and an unbalance between the required refrigerant amount and the refrigerant amount circulated on the actual system occurs. Accordingly, there is a problem that the operating efficiency of the system is reduced.

SUMMARY OF THE INVENTION

[0009] The present invention is to provide a refrigerant system through which optimal refrigerant amount can be flowed according to the operating conditions.

[0010] In addition, the present invention is to provide a refrigerant system in which the operating efficiency can be improved.

[0011] In one embodiment, a refrigerant system comprises: a compressor which compresses a refrigerant; a condenser which condenses the refrigerant discharged from the compressor; an expanding unit which expands the refrigerant passed through the condenser; an evaporator which evaporates the refrigerant passed through the expanding unit; a main refrigerant pipe which forms a refrigerant cycle by connecting the compressor, the condenser, the expanding unit and the evaporator; an accumulator filtering a liquid refriger-

ant among refrigerants flowing into the compressor; a super cooler in which a portion of the refrigerants is distributed and guided to introduce the portion into the accumulator after super cooling the refrigerant of the main refrigerant pipe; a super cooling adjustment unit which adjusts a portion of refrigerant amount passed through the super cooler; and a control unit which controls refrigerant amount stored in the accumulator by the super cooling adjustment unit so that flow refrigerant amount on the refrigerant cycle is optimized according to operation states.

[0012] In another embodiment, a control method of a refrigerant system comprises a compressor, a condenser, an expanding unit and an evaporator, the refrigerant system includes a refrigerant cycle which performs the conversion of cooling or heating operations, a refrigerant pipe which guides the refrigerant circulating the refrigerant cycle, and an accumulator which filters a liquid refrigerant of the refrigerants introduced into the compressor, the control method comprising: detecting a discharge pressure of the compressor; detecting the refrigerant amount stored in the accumulator; comparing the detected discharge pressure or refrigerant amount with a predetermined reference value; and adjusting refrigerant amount introduced into the accumulator, among refrigerants circulating the refrigerant pipe, based on the compared result.

[0013] As mentioned above, according to the refrigerant system of the present invention, flow refrigerant amount on a refrigerant cycle can be adjusted by adjusting refrigerant amount stored in an accumulator according to the indoor conditioning load. In more detail, if the indoor conditioning load is increased, the flow refrigerant amount on a refrigerant cycle may be increased and condensing energy amount and evaporating energy amount may be increased, by reducing refrigerant amount stored in the accumulator. In addition, if the indoor conditioning load is decreased, the flow refrigerant amount on a refrigerant cycle may be decreased and condensing energy amount and evaporating energy amount may be decreased, by increasing refrigerant amount stored in the accumulator. That is, there is an advantage that optimal refrigerant amount can be flowed according to the operating status.

[0014] In addition, since the performance of the refrigerant system to cover the indoor conditioning load may be varied by only varying flow refrigerant amount on the refrigerant cycle without varying operating rates, there is an advantage capable of improving the overall operating efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a diagram illustrating a system configuration of an embodiment of a refrigerant system according to the present invention.

[0016] FIG. 2 is a diagram illustrating the flow of control signal of the embodiment of the refrigerant system according to the present invention.

[0017] FIG. 3 is a flow chart illustrating the flow of control during a heating operation in the embodiment of the refrigerant system according to the present invention.

[0018] FIG. 4 is a flow chart illustrating the flow of control during a cooling operation in the embodiment of the refrigerant system according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Hereafter, a refrigerant system according to the present invention will be described with reference to the accompanying drawings in more detail.

[0020] FIG. 1 is a diagram illustrating a system configuration of the embodiment of the refrigerant system according to the present invention.

[0021] Referring to FIG. 1, the refrigerant system further includes an outdoor heat exchanger 11 which is heat-exchanged between outdoor air and a refrigerant, a compressor 12 compressing the refrigerant, an indoor heat exchanger 13 which is heat-exchanged between indoor air and the refrigerant, expanding units 141, 142 for expanding the refrigerant, a main refrigerant pipe 151 forming a refrigerant cycle by connecting the outdoor heat exchanger 11, the compressor 12, the indoor heat exchanger 13 and the expanding units 141, 142, an accumulator 16 filtering liquid refrigerant among refrigerants flowing into the compressor 12, and a flow conversion unit 15 converting any one of the outdoor heat exchanger 11 and the indoor heat exchanger 13.

[0022] The outdoor heat exchanger 11 and the indoor heat exchanger 13 may function as a condenser or a compressor according to operation modes of the refrigerant system. For example, when the refrigerant system is operated in the heating operation, the outdoor heat exchanger 11 and the indoor heat exchanger 13 may function as an evaporator or a condenser respectively and when the refrigerant system is operated in the cooling operation, the outdoor heat exchanger 11 and the indoor heat exchanger 13 may function as a condenser or an evaporator respectively. In this case, according to the operation mode of the refrigerant system, refrigerant flow directions on the refrigerant cycle may be changed by converting the flow direction of the refrigerant through the flow conversion unit 15.

[0023] That is, the refrigerant system includes the compressor 12, a condenser condensing the refrigerant passed through the compressor 12, an expanding units 141, 142 expanding the refrigerant passed through the condenser, an evaporator evaporating the refrigerant passed through the expanding units 141, 142, the main refrigerant pipe 151 forming the refrigerant cycle by connecting the compressor 12, the condenser, the expanding units 141, 142 and the evaporator, and the accumulator 16.

[0024] The outdoor heat exchanger 11 is installed on one side of the outdoor to be exposed on the outdoor air. In addition, the indoor heat exchanger 13 is installed on one side of an indoor space to perform an indoor conditioning. In this case, the indoor heat exchanger 13 may include a plurality of indoor heat exchangers 131, 132, 133 installed on a plurality of indoor spaces respectively.

[0025] The compressor 12 may include a constant displacement compressor 121 constantly maintaining a compression capacity and an inverter compressor 122 varying the compression capacity.

[0026] The expanding units 141, 142 may include an outdoor expanding unit 141 mounted on one side of the main refrigerant pipe 151 adjacent to the outdoor heat exchanger 11 and an indoor expanding unit 142 mounted on one side of the main refrigerant pipe 151 adjacent to the indoor heat exchanger 13.

[0027] The outdoor expanding unit 141 and the indoor expanding unit 142 are mounted on the one side of the main refrigerant pipe 151 connecting the outdoor heat exchanger 11 and the indoor heat exchanger 13 each other. In this case, the indoor expanding unit 142 may include a plurality of indoor expanding units 142 installed to correspond to each one side of the plurality of indoor heat exchangers 131, 132, 133. In this case, the indoor expanding unit 142 may function

that refrigerants introduced into a plurality of indoor heat exchanger units 131, 132, 133 are selectively blocked according to whether a plurality of indoor heat exchanger units 131, 132, 133 are operated.

[0028] The outdoor expanding unit 141 and the indoor expanding unit 142 include a valve, for example, an electronic expanding valve (EEV), capable of adjusting an open degree and the open degree may be adjusted according to the operation mode of the refrigerant system.

[0029] In more detail, when the refrigerant system is operated in the heating operation, the indoor expanding unit 142 is completely opened, the outdoor expanding unit 141 is partially opened, and accordingly the refrigerant passed through the indoor heat exchanger 13 is passed through the indoor expanding unit 142 without changing the state and expanded through the outdoor expanding unit 141, and then the expanded refrigerant may be introduced into the outdoor heat exchanger 11.

[0030] In addition, when the refrigerant system is operated in the cooling operation, the outdoor expanding unit 141 is completely opened, the indoor expanding unit 142 is partially opened, and accordingly the refrigerant passed through the outdoor heat exchanger 11 is passed through the outdoor expanding unit 141 without changing the state and expanded through the indoor expanding unit 142, and then the expanded refrigerant may be introduced into the indoor heat exchanger 13.

[0031] Meanwhile, the refrigerant system may further include a refrigerant amount detection unit 18 which detects refrigerant amount stored in the accumulator 16.

[0032] In more detail, the accumulator 16 is a device capable of storing a liquid refrigerant of refrigerants introduced into the compressor 12, for example, as a tank capable of receiving refrigerants. That is, the accumulator 16 is to store a portion of the refrigerants on the refrigerant cycle.

[0033] In addition, the refrigerant amount detection unit 18 is installed in one side of the accumulator 16 to detect refrigerant amounts stored in the accumulator 16. The refrigerant amount detection unit 18 may include a plurality of water level sensors 181, 182, installed in one side of the accumulator 16, with a plurality of different heights to detect various refrigerant water levels of the accumulator 16.

[0034] For example, a first sensor 181 of the plurality of water level sensors 181, 182 is installed at the lower location of the inside space of the accumulator 16, and a second sensor 182 is installed at the upper location of the inside space of the accumulator 16. The second sensor 182 is separately disposed on the upper side of the first sensor 181 from the first sensor 181.

[0035] The first sensor 181 may detect whether the refrigerant of the accumulator 16 is located below a predetermined water level (a first water level) and the second sensor 182 may detect whether the accumulator 16 is filled above the predetermined water level (a second water level).

[0036] The first water level may be a level corresponding to a minimum storage amount as described in later, and the second water level may be a level corresponding to a maximum storage amount as described in later.

[0037] In addition, a third sensor (not shown) may be further installed at a location corresponding to one point between the first sensor 181 and the second sensor 182 of the internal space of the accumulator 16. The third sensor may

also detect whether the storage refrigerant amount of the accumulator 16 is corresponded to a standard refrigerant amount.

[0038] In this case, the standard refrigerant amount may mean an appropriate refrigerant amount which can be stored in the accumulator 16 to flow an appropriate reference refrigerant amount at the initial operation of the refrigerant cycle.

[0039] Meanwhile, the refrigerant system may further include a super cooler which super-cools the refrigerants passed through the condenser.

[0040] The super cooler may further include a bypass pipe 153 which bypasses a portion of refrigerants passed through the condenser to guide the portion into an inlet side of the accumulator 16, a super cooling heat exchanger 191 which performs the heat-exchange between the portion of the refrigerants bypassed and the refrigerant of the main refrigerant pipe 151, and a super cooling adjustment unit 192 which adjusts a portion of refrigerant amounts passed through the super cooling heat exchanger 191.

[0041] The refrigerant of the main refrigerant pipe 151 may be super-cooled by the heat-exchange between the portion of the refrigerants bypassed and the refrigerant of the main refrigerant pipe 151.

[0042] The super cooling adjustment unit 192 may perform a function of adjusting a liquid refrigerant amount stored in accumulator 16 by adjusting the portion of refrigerant amounts passed through the super cooling heat exchanger 119. The super cooling adjustment unit 192 may include a valve, for example, an electronic expanding valve (EEV), capable of consecutively adjusting an open degree.

[0043] When the open degree of the super cooling adjustment unit 192 is increased, the refrigerant amount stored in the accumulator 16 is increased, but the flow refrigerant amount on refrigerant system may be decreased. Meanwhile, when the open degree of the super cooling adjustment unit 192 is decreased, the refrigerant amount stored in the accumulator 16 is decreased, but the flow refrigerant amount on refrigerant system may be increased.

[0044] When a lot of refrigerant amounts are circulated in the system, the super cooling adjustment unit 192 is opened, and accordingly the bypassed refrigerants may be introduced into the accumulator.

[0045] According to the detected result of the water level sensor 18, when the water level of refrigerant stored in accumulator 16 is above the predetermined water level, the open degree of the super cooling adjustment unit 192 is decreased, and then the refrigerant amount introduced into the accumulator 16 may be decreased.

[0046] When the refrigerant amount circulated on the system is insufficient, the super cooling adjustment unit 192 is closed or the open degree is decreased, and accordingly the refrigerant amount introduced into the accumulator 16 is decreased. At this time, the refrigerant stored in the accumulator 16 is evaporated and introduced into the compressor 12, and the refrigerant amount circulated on the system may be supplemented.

[0047] As one example, the refrigerant amount required in the heating operation may be higher than the refrigerant amount required in the cooling operation. Accordingly, the closure or open degree decrease control of the super cooling adjustment unit 192 may be performed when converting from the cooling operation to the heating operation.

[0048] In contrast, the closure or open degree increase control of the super cooling adjustment unit 192 may be performed when converting from the heating operation to the cooling operation.

[0049] Hereafter, a control flow of an embodiment of a refrigerant system according to the present invention will be described with reference to the accompanying drawings in detail.

[0050] FIG. 2 is a control configuration diagram illustrating the flow of control signal of the embodiment of the refrigerant system according to the present invention; FIG. 3 is a flow chart illustrating the flow of control during a heating operation in the embodiment of the refrigerant system according to the present invention; and FIG. 4 is a flow chart illustrating the control flow during a cooling operation in the embodiment of the refrigerant system according to the present invention.

[0051] Referring to FIG. 2, the refrigerant system includes the refrigerant amount detection unit 18, a high pressure detection unit 101 which detects a high pressure, that is, a pressure of the refrigerant discharged from the compressor 12, and a super cooling degree detection unit 102 which detects a super cooling degree, that is, a temperature of the refrigerant passed through the condenser.

[0052] In addition, the refrigerant system includes the super cooling adjustment unit 192 and a control unit 105 which controls the super cooling adjustment unit 192 based on information detected from the refrigerant amount detection unit 18, the high pressure detection unit 101 and the super cooling detection unit 102.

[0053] The high pressure detection unit 101 may install at one side of the main refrigerant pipe 151 corresponding to the discharge side of the compressor 12 so as to easily detect the refrigerant pressure of the discharge side of the compressor 12.

[0054] In addition, the super cooling detection unit 102 may install at one side of the main refrigerant pipe 151 corresponding to the discharge side of the condenser so as to easily detect the refrigerant temperature passed through the condenser. In detail, the super cooling detection unit may install at one side of the main refrigerant pipe 151 corresponding to the discharge side of the super cooler.

[0055] The refrigerant amount detection unit 18, the high pressure detection unit 101, the super cooling detection unit 102, the super cooling adjustment unit 192 and the control unit 105 are electrically connected each other so as to receive or transmit the control signal.

[0056] Referring to FIG. 3, the control flow when the refrigerant system is operated in a heating operation will be described.

[0057] First, when the heating operation of the refrigerant system starts, a process that the refrigerant system is generally stabilized is performed (S11). For example, when the heating operation of the refrigerant system starts, since the flow state of refrigerant is changed, the time may be needed until the heating operation of the refrigerant system is stabilized. In this case, the stabilization process of the refrigerant system may be the elapsed time until the heating operation of the refrigerant system is stabilized.

[0058] When the refrigerant system is stabilized, the high pressure and the refrigerant amount stored in the accumulator are detected. (S12). In this case, the high pressure and the storage refrigerant amount may be detected by the high pressure detection unit 101 and the refrigerant amount detection unit 18.

[0059] In addition, when the high pressure detected by the high pressure detection unit 10, that is, a detected high pressure, is below a reference pressure and the storage refrigerant amount detected by the refrigerant amount detection unit 18 exceeded the minimum storage amount (S14), the open degree of the super cooling adjustment unit 192 is controlled to decrease (S15).

[0060] In this case, the high reference pressure may mean a high pressure to achieve the indoor heating, that is, a proper high pressure value to cover the indoor conditioning load. The reference high pressure may be a specific pressure value and may be a range of a proper pressure value to cover the indoor conditioning load.

[0061] Accordingly, when the detected high pressure is below the reference high pressure, it may mean that the high pressure on the refrigerant cycle is insufficient to cover the indoor conditioning load. In contrast when the detected high pressure exceeded the reference high pressure, it may mean that the high pressure on the refrigerant cycle is sufficient to cover the indoor conditioning load and the rest is excessive.

[0062] In addition, the minimum storage amount may mean a minimum value of the allowable refrigerant amount to be stored in accumulator 16. For example, when the accumulator 16 has no the refrigerant and an empty state is possible, the minimum storage amount will be become "0".

[0063] That is, the minimum storage amount may be previously set as a minimum limit value to be stored in accumulator 16. For one example, the first sensor 181 may detect whether the storage refrigerant amount is higher or lower than the minimum storage amount.

[0064] Accordingly, when the storage refrigerant amount is below the minimum storage amount, without operating the super cooling adjustment unit 192, that is, without decreasing the open degree of the super cooling adjustment unit 192, the next step is progressed. Therefore, even when the refrigerant storage of the accumulator 16 is a minimum limit state, loss such as system efficiency degradation caused by decreasing the open degree of the super cooling adjustment unit 192 may be prevented.

[0065] Meanwhile, when the detected high pressure exceeded the reference high pressure (S16) and the storage refrigerant amount is below the maximum storage amount (S17), the open degree of the super refrigerant adjustment unit 192 is controlled to increase (S18).

[0066] In this case, the minimum storage amount may mean a maximum value of the allowable refrigerant amount to be stored in accumulator 16. For example, when the refrigerant can be filled in the inside space of the accumulator 16, the refrigerant amount filled in the inside of the accumulator 16 may be the maximum storage amount.

[0067] That is, the maximum storage amount may be previously set as a maximum limit value to be stored in accumulator 16. For one example, the second sensor 182 may detect whether the storage refrigerant amount is higher or lower than the minimum storage amount.

[0068] Accordingly, when the storage refrigerant amount is equal to or higher than the maximum storage amount (S17), without operating the super cooling adjustment unit 192, that is, without increasing the open degree of the super cooling adjustment unit 192, the next step is progressed. Therefore, even when the refrigerant storage of the accumulator 16 is a maximum limit state, damage and the like of the accumulator 16 caused by opening the super cooling adjustment unit 192 may be prevented.

[0069] Meanwhile, when the detected high pressure is not below the reference high pressure (S13) and not exceeded the reference high pressure (S16), that is, the detected high pressure is corresponded to the reference high pressure, the current state is maintained.

[0070] In addition, unless a signal for ending the heating operation of the refrigerant system is not inputted (S11), the stabilization process of the refrigerant system is again performed (S11).

[0071] In this case, the signal input for ending the heating operation of the refrigerant system may be performed by inputting separate signal through the user or by the end conditions internally set.

[0072] Meanwhile, referring to FIG. 4, the control flow when the refrigerant system is operated in a cooling operation will be described. First, when the cooling operation of the refrigerant system starts, a process that the refrigerant system is generally stabilized is performed (S21).

[0073] In addition, when the refrigerant system is stabilized, the high pressure, the super cooling degree and the refrigerant amount stored in the accumulator 16 are detected (S22). In this case, the high pressure and the storage refrigerant amount may be detected by the high pressure detection unit 101, the super cooling degree detection unit 102 and the refrigerant amount detection unit 18.

[0074] In addition, when the super cooling degree detected by the super cooling degree detection unit 102, that is, a detected super cooling degree, is degree below a reference super cooling degree (S23), the high pressure (detected high pressure) detected by the high detection unit 101 is below a safe high pressure (S24), and the storage refrigerant amount detected by the refrigerant amount detection unit 18 exceeded the minimum storage amount (S25), the open degree of the super cooling adjustment unit 192 is controlled to decrease (S26).

[0075] In this case, the reference super cooling degree may mean a super cooling degree to achieve the indoor cooling, that is, a proper super cooling degree value to cover the indoor conditioning load. The reference super cooling degree may be a specific super cooling degree value and may be a range of a proper super cooling degree value to cover the indoor conditioning load.

[0076] Accordingly, when the detected super cooling degree is below the reference super cooling degree, it may mean that the supercooling degree on the refrigerant cycle is insufficient to cover the indoor conditioning load. In contrast when the detected super cooling degree exceeded the reference super cooling degree, it may mean that the super cooling degree on the refrigerant cycle is sufficient to cover the indoor conditioning load and the rest is excessive.

[0077] Meanwhile, as the high pressure and the super cooling degree are variable state amount according to the indoor conditioning load of the refrigerant system, comparing the high pressure and the super cooling degree with the reference high pressure and the reference super cooling degree may mean comparing the indoor conditioning load of the refrigerant system with the reference load.

[0078] In addition, the safe high pressure may mean a minimum high pressure value that damage may be applied to the compressor 12 and the refrigerant pipe. That is, the high pressure on the refrigerant cycle is above the safe high pressure, the compressor 12 and the refrigerant pipe may be damaged.

[0079] Accordingly, when the detected high pressure is above the safe high pressure, without operating the super cooling adjustment unit 192, that is, without decreasing the open degree of the super cooling adjustment unit 192, the next step is progressed. Therefore, the damage of the compressor 12 and the refrigerant pipe may be prevented.

[0080] Accordingly, when the storage refrigerant amount is below the minimum storage amount (S25), without operating the super cooling adjustment unit 192, that is, without decreasing the open degree of the super cooling adjustment unit 192, the next step is progressed. Therefore, loss such as system efficiency degradation caused by decreasing the open degree of the super cooling adjustment unit 192 may be prevented.

[0081] Meanwhile, when the detected super cooling degree exceeded the reference super cooling degree (S27) and the storage refrigerant amount is below the maximum storage amount (S28), the open degree of the super refrigerant adjustment unit 192 is controlled to increase (S29).

[0082] However, when the storage refrigerant amount is equal to or higher than the maximum storage amount (S28), without operating the super cooling adjustment unit 192, that is, without increasing the open degree of the super cooling adjustment unit 192, the next step is progressed. Therefore, even when the refrigerant storage of the accumulator 16 is a maximum limit state, damage and the like of the accumulator 16 caused by increasing open degree of the super cooling adjustment unit 192 may be prevented.

[0083] Meanwhile, when the detected super cooling degree is not below the reference super cooling degree (S23) and not exceeded the reference super cooling degree (S27), that is, the detected super cooling degree is corresponded to the reference super cooling degree, the current state is maintained.

[0084] In addition, unless a signal for ending the heating operation of the refrigerant system is not inputted (S30), the stabilization process of the refrigerant system is again performed (S21). In this case, the signal input for ending the cooling operation of the refrigerant system may be performed by inputting separate signal through the user or by the end conditions internally set.

[0085] According to the refrigerant system, there is an advantage that the flow the refrigerant amount on the refrigerant cycle may be optimally adjusted according to the operation state of the refrigerant system.

[0086] In more detail, during the heating operation, when the detected high pressure is below the reference high pressure, the open degree of the super cooling adjustment unit 192 is decreased, and accordingly the refrigerant amount introduced in the accumulator 16 may be decreased.

[0087] In addition, refrigerant amounts stored in the accumulator 16 are introduced into the compressor 12 and may be supplemented into the main refrigerant pipe 151. That is, by increasing the flow refrigerant amount on the refrigerant cycle, the high pressure is increased and may be controlled to reach the reference high pressure.

[0088] Meanwhile, when the detected high pressure is above the reference high pressure, the open degree of the super cooling adjustment unit 192 is increased, and accordingly the refrigerant amount introduced in the accumulator 16 may be increased. Accordingly, refrigerant amounts stored in the accumulator 16 of the main refrigerant pipe 151 are increased. That is, by decreasing the flow refrigerant amount on the refrigerant cycle, the high pressure is decreased and may be controlled to reach the reference high pressure.

[0089] During the cooling operation, when the detected super cooling degree is below the reference super cooling degree, the open degree of the super cooling adjustment unit 192 is decreased, and accordingly the refrigerant amount introduced in the accumulator 16 is decreased.

[0090] In addition, refrigerant stored in the accumulator 16 is introduced into the compressor 12 and may be supplemented into the main refrigerant pipe 151. That is, by increasing the flow refrigerant amount on the refrigerant cycle, the super cooling degree is increased and may be controlled to reach the reference supercooling degree.

[0091] Meanwhile, when the detected super cooling degree is above the reference super cooling degree, the open degree of the super cooling adjustment unit 192 is increased, and accordingly the refrigerant amount introduced in the accumulator 16 is increased.

[0092] Accordingly, refrigerant amounts stored in the accumulator 16 of refrigerants of the main refrigerant pipe 151 is increased. That is, by decreasing the flow refrigerant amount on the refrigerant cycle, the super cooling degree is decreased and may be controlled to reach the reference super cooling degree.

[0093] In addition, according to the refrigerant, there is an advantage that the overall operating efficiency of the refrigerant system may be improved. In more detail, for example, without changing an operating rate of the compressor 12, the rotation speed of a fan (not shown) and the like, the performance of the refrigerant system to cover the indoor conditioning load may be varied by only the flow refrigerant amount on the refrigerant cycle. Therefore, the overall operation efficiency of the refrigerant system may be improved.

[0094] In addition, according to the refrigerant system, there is an advantage that the overall operating efficiency of the refrigerant system may be optimized within the scope that damage of refrigerant system may be prevented.

[0095] In more detail, during the cooling operation, even when the detected super cooling degree is below the reference super cooling degree, when the high pressure is above the safe high pressure, without operating the super cooling adjustment unit 192, that is, without decreasing the open degree of the super cooling adjustment unit 192, the next step is progressed.

[0096] In other words, in order to increase the detected super cooling degree, when the open degree of the super cooling adjustment unit 192, the flow refrigerant amount on the refrigerant cycle is increased together with the high pressure, and damage the compressor 12 and the refrigerant pipe occurs. Therefore, in this case, a control to not decrease the open degree of the super cooling adjustment unit 192 is performed and, as a result, the refrigerant introduced into the accumulator 16 is maintained or increased.

[0097] As described above, although the present invention is described by specific matters such as concrete components, and the like, exemplary embodiments, and drawings, they are provided only for assisting in the entire understanding of the present invention. Therefore, the present invention is not limited to the exemplary embodiments. Various modifications and changes may be made by those skilled in the art to which the present invention pertains from this description.

[0098] Therefore, the spirit of the present invention should not be limited to the above-described exemplary embodiment and the following claims as well as all modified equally or equivalently to the claims are intended to fall within the scopes and spirits of the invention.

What is claimed is:

1. A refrigerant system, comprising:
 - a compressor which compresses a refrigerant;
 - a condenser which condenses the refrigerant discharged from the compressor;
 - an expanding unit which expands the refrigerant passed through the condenser,
 - an evaporator which evaporates the refrigerant passed through the expanding unit;
 - a main refrigerant pipe which forms a refrigerant cycle by connecting the compressor, the condenser, the expanding unit and the evaporator;
 - an accumulator filtering a liquid refrigerant among refrigerants flowing into the compressor;
 - a super cooler in which a portion of the refrigerants is distributed to super cool the refrigerant of the main refrigerant pipe, the super cooler configured to guide to introduce the portion into the accumulator;
 - a super cooling adjustment unit which adjusts a portion of refrigerant amount passed through the super cooler; and
 - a control unit which controls refrigerant amount stored in the accumulator by the super cooling adjustment unit so that flow refrigerant amount on the refrigerant cycle is optimized according to operation states; and
2. The refrigerant system according to claim 1, wherein the control unit controls the super cooling adjustment unit to increase or decrease the refrigerant amount stored in the accumulator according to an indoor conditioning load.
3. The refrigerant system according to claim 2, wherein the control unit controls the super cooling adjustment unit to decrease the refrigerant amount stored in the accumulator when the indoor conditioning load is increased, and,
 - the control unit controls the super cooling adjustment unit to increase the refrigerant amount stored in the accumulator when the indoor conditioning load is decreased.
4. The refrigerant system according to claim 2, further comprising:
 - a high pressure detection unit which detects high pressure of refrigerants in the discharge side of the compressor; and
 - a super cooling degree detection unit which detects a refrigerant super cooling degree of a discharge side of the condenser,
 wherein the control unit controls the super cooling adjustment unit to adjust the refrigerant amount stored in the accumulator according to at least one of the high pressure of refrigerants and the refrigerant super cooling degree when the indoor conditioning load is decreased
5. The refrigerant system according to claim 4, wherein the control unit controls the super cooling adjustment unit to decrease the refrigerant amount stored in the accumulator when the high pressure of refrigerants is equal to or higher than a reference high pressure, and
 - the control unit controls the super cooling adjustment unit to increase the refrigerant amount stored in the accumulator when the high pressure of refrigerants is lower than the reference high pressure.
6. The refrigerant system according to claim 4, wherein the control unit controls the super cooling adjustment unit to decrease flow refrigerant amount on the refrigerant cycle when the refrigerant super cooling degree is equal to or higher than a reference super cooling degree, and the control unit controls the super cooling adjustment unit to increase the flow refrigerant amount on the refrigerant cycle when the refrigerant super cooling degree is lower than the reference super cooling degree.
7. The refrigerant system according to claim 1, further comprising:
 - a refrigerant amount detection unit which detects refrigerant amount stored in the accumulator.
8. The refrigerant system according to claim 7, wherein the refrigerant amount detection unit includes:
 - a first detection unit which detects whether the a refrigerant water level of the accumulator is lower than a first water level, and
 - a second detection unit which is separately disposed into the upper side of the first detection unit to detect whether the refrigerant water level of the accumulator is equal to or higher than a second water level.
9. The refrigerant system according to claim 8, wherein the control unit controls such that an open degree of the super cooling adjustment unit is decreased when the refrigerant water level stored in the accumulator is higher than the first water level.
10. The refrigerant system according to claim 9, wherein the first water level is a level corresponded to a minimum of storage amount of the allowable refrigerants to be stored in the accumulator.
11. The refrigerant system according to claim 8, wherein the control unit controls such that the open degree of the super cooling adjustment unit is increased when the refrigerant water level stored in the accumulator is lower than the second water level.
12. The refrigerant system according to claim 11, wherein the second water level is a level corresponded to a maximum of storage amount of the allowable refrigerants to be stored in the accumulator.
13. The refrigerant system according to claim 1, wherein the super cooler includes a bypass pipe which bypasses the portion of refrigerants passed through the condenser to guide the portion into an inlet side of the accumulator, and
 - a super cooling heat exchanger which performs the heat-exchange between the portion of the refrigerants bypassed and the refrigerant of the main refrigerant pipe.
14. The refrigerant system according to claim 2, wherein the control unit controls such that the open degree of the super cooling adjustment is closed or decreased during converting the cooling operation into the heating operation.
15. A control method of a refrigerant system comprising a compressor, a condenser, an expanding unit and an evaporator, the refrigerant system includes a refrigerant cycle which performs the conversion of cooling or heating operations, a refrigerant pipe which guides the refrigerant circulating the refrigerant cycle, and an accumulator which filters a liquid refrigerant of the refrigerants introduced into the compressor, the control method comprising:
 - detecting a discharge pressure of the compressor;
 - detecting the refrigerant amount stored in the accumulator;
 - comparing the detected discharge pressure or refrigerant amount with a predetermined reference value; and
 - adjusting refrigerant amount introduced into the accumulator, among refrigerants circulating the refrigerant pipe, based on a compared result.
16. The control method according to claim 15, wherein the refrigerant amount introduced into the accumulator is decreased when the discharge pressure is lower than the reference pressure and the refrigerant amount is higher than the predetermined minimum storage amount, during the cooling or heating operation.

17. The control method according to claim 15, wherein the refrigerant amount introduced into the accumulator is increased when the discharge pressure is higher than the reference pressure and the refrigerant amount is lower than the predetermined maximum storage amount, during the cooling or heating operation.

18. The control method according to claim 15, further comprising detecting a super cooling degree passed through the condenser during the cooling operation,

wherein refrigerant amount introduced into the accumulator is decreased when a detected super cooling degree is lower than the reference super cooling degree and a detected discharge pressure is lower than the reference pressure.

19. The control method according to claim 18, wherein the refrigerant amount introduced into the accumulator is maintained or increased when the detected super cooling

degree is lower than the reference super cooling degree and the detected discharge pressure is higher than the reference pressure.

20. The control method according to claim 18, wherein the refrigerant amount introduced into the accumulator is increased when the detected super cooling degree is higher than the reference super cooling degree and the detected refrigerant amount is lower than the predetermined maximum storage amount.

21. The control method according to claim 18, wherein the refrigerant amount introduced into the accumulator is decreased when the detected super cooling degree is lower than the reference super cooling degree and the detected refrigerant amount is higher than the predetermined minimum storage amount.

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