(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 282 782 A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 88102741.1

(22) Date of filing: 24.02.88

(51) Int. Cl.[4]: F25B 5/00 , F25B 13/00 , F25B 49/00 , F25B 41/04

(30) Priority: 20.03.87 JP 63855/87

(43) Date of publication of application: 21.09.88 Bulletin 88/38

(84) Designated Contracting States: DE FR GB

(71) Applicant: HITACHI, LTD.
6, Kanda Surugadai 4-chome
Chiyoda-ku Tokyo 101(JP)

(72) Inventor: Yamazaki, Kenji
Hitachi Fujimiryo 21, 9-14 Numatacho
Shimizu-shi(JP)
Inventor: Sotome, Kaname
Seiunryo, 556-1, Totsukacho Totsuka-ku
Yokohama(JP)
Inventor: Yoshikawa, Tomio
20-1, Hitachicho
Shimizu-shi(JP)
Inventor: Hiyoshi, Tsuyoshi
Hitachi Fujimiryo 43, 9-14 Numatacho
Shimizu-shi(JP)
Inventor: Seki, Osamu
19-22, Midorigaokacho
Shimizu-shi(JP)

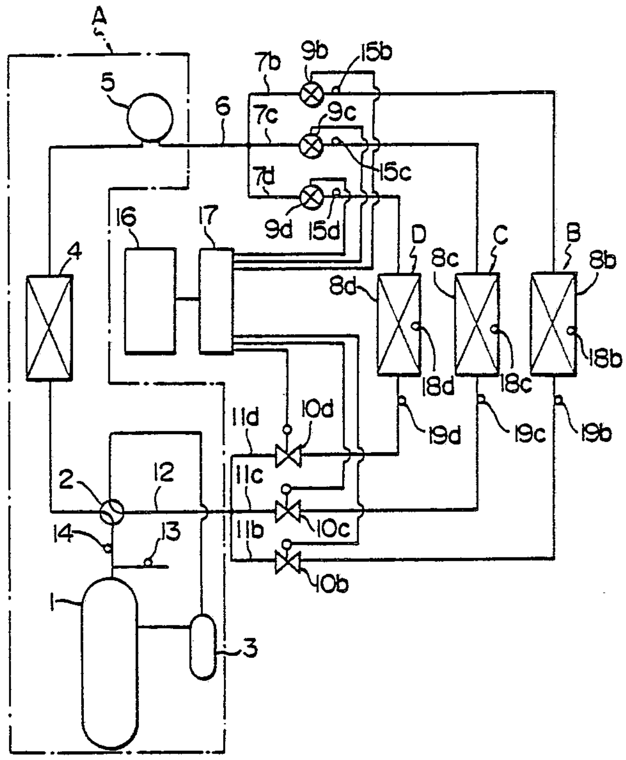
(74) Representative: Ebbinghaus, Dieter et al
v. FÜNER, EBBINGHAUS, FINCK
Patentanwälte European Patent Attorneys
Mariahilfplatz 2 & 3
D-8000 München 90(DE)

(54) **Multiple room type air conditioning system and control method therefor.**

(57) A heat pump type multiple room air conditioning system comprises a single outdoor unit (A) including a compressor (1) and an outdoor heat exchanger (4), a plurality of outdoor units (B, C, D) each including an indoor heat exchanger (8b, 8c, 8d), a plurality of electric reverse expansion valves (9b, 9c, 9d) and a plurality of solenoid valves (10b, 10c, 10d), the expansion valves associated with the inoperating indoor units of the indoor units, or such expansion valves and the solenoid valves associated with the inoperating indoor units of the indoor units, in operation of the system, are opened or closed to change the amount of refrigerant stored within the inoperating indoor units. The system further comprises a controller (16) for sampling a subcooling degree (SC) of the refrigerant in refrigeration circuit or super heating degree (SH) thereof periodically and for calculating and comparing the dampling data with predetermined values, and control signal outputting means (17) for receiving signals from the controller and for outputting command signals to the expansion valves and the solenoid valves associated with the inoperating indoor units to intermittently close or open the expan valves, or such expansion valves and the solenoid valves.

EP 0 282 782 A2

FIG. 1


A
5
6
7b
9b
15b
7c
9c
15c
7d
9d
15d
16
17
4
D
8c
C
B
8b
8d
18d
18c
18b
11d
10d
19d
19c
19b
11c
2
12
14
13
10c
11b
10b
1
3

MULTIPLE ROOM TYPE AIR CONDITIONING SYSTEM AND CONTROL METHOD THEREFOR

BACKGROUND OF THE INVENTION

The present invention relates to a multiple room type heat pump air conditioning system in which a single outdoor unit and a plurality of indoor units connected to the outdoor unit and to a method for controlling excess flow of refrigerant in refrigeration cycle when any indoor unit is inoperated.

In a conventional system, as shown in JP-A-61-114060, in order to control an excess flow of refrigerant when one or more indoor units are inoperated, electric expansion valves associated with the inoperating indoor units, or such expansion valves and solenoid valves associated with the inoperating indoor units are controlled to be opened or closed, on the operation of the system, to retain the subcooling degree of the operating indoor unit (in heating operation mode of the system) or the super heating degree thereof (in cooling operation mode thereof) in a predetermined value, whereby the amount of refrigerant circulating through the operating cycle becomes proper.

However, in such conventional system, it is not taken into the consideration that there is a time lag between the time when the above control is made for the valves and the time when the subcooling degree or the super heating degree is actually changed. In case that such control is continuously conducted to retain the subcooling degree or the super heating degree in the predetermined value, since the detected subcooling degree or the super heating degree changes gradually, i.e. the responsibility is not so good, it is difficult to stop conducting such control when the detected subcooling degree or the super heating degree just becomes to a level accurately identical to the predetermined value. Accordingly the excess flow of refrigerant is controlled inproper and immoderately, so that the problem is raised that the operation cycle of the refrigerant becomes unstable. Further in the conventional system, if the refrigerant flow circulating through the operating cycle is changed, another significant controlled variable is also changed, whereby making a considerable effect on another control. However, the conventional system does not take it into the consideration. Accordingly the excess flow control causes the problem that the refrigerant distribution control based on the super heating degree of the refrigerant from the compressor.

OBJECT AND SUMMARY OF THE INVENTION

An object of the present invention is to provide an air conditioning system by which the above mentioned problems are solved, and in which the excess flow of refrigerant is properly controlled corresponding to the conditions of the operating cycle to form an effective and steady refrigeration cycle, whereby obtaining a comfortable circumstance.

To this end, according to the present invention, the system comprises a controller for receiving data from the sensors for detecting the subcooling degree and the super heating degree of the refrigerant and for calculating signals regarding to the expansion valves associated with the inoperating indoor units, or not only to such expansion valves but also the solenoid valves associated with the inoperating indoor units on the basis of such data from the sensors, and a control signal outputting means for outputting open/close control command signals to such expansion valves, or such expansion valves and such solenoid valves, in compliance with the calculated signals in the controller, to intermittently open or close such valves. In addition, in another respect of the present invention, the controller receives the data corresponding to the super heating degree of the refrigerant from the compressor from the sensor for detecting such data and the controller outputs signals to the control signal outputting means so as to interrupt a discharge flow from the inoperating indoor units.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a circuit diagram showing a refrigeration cycle of one embodiment of the present invention;

Fig. 2 is a diagram showing the operation of the valves shown in Fig. 1;

Fig. 3 is a flow chart showing the control of the embodiment shown in Fig. 1;

Figs. 4 and 7 are flow charts showing the control of another embodiments;

Fig. 5 is a flow chart showing the process K in Fig. 4; and

Fig. 6 is a diagram showing the change of the super heating degree.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be described hereinunder with reference to one embodiment shown in Fig. 1. A refrigeration cycle of an air conditioning system comprises a single outdoor unit A and three indoor units B, C and D connected to the outdoor unit A. The indoor unit A includes a compressor 1, a four-way valve 2, an accumulator 3, an outdoor heat exchanger 4 and a receiver 5 disposed in a liquid side primary pipe 6 through which the liquid refrigerant flows. The pipe 6 branches out into three liquid side branching pipes 7b, 7c and 7d. The indoor units B, C and D comprise indoor heat exchangers 8b, 8c and 8d, respectively. Electric reversible expansion valves 9b, 9c and 9d are disposed in the respective liquid side branching pipes 7b, 7c and 7d through which the low temperature and low pressure liquid refrigerant flows. In the same manner, solenoid valves 10b, 10c and 10d are disposed in the respective gas side branching pipes 11b, 11c and 11d through which the low temperature and low pressure gaseous refrigerant flows. The branching pipes 11b, 11c and 11d are integrated into a gas side primary pipe 12 through which the low temperature and low pressure gaseous refrigerant flows. These elements are connected to each other as shown in Fig. 1 so as to form a heat pump type refrigeration cycle. A control system is also provided, which includes a sensor 13 for detecting a refrigerant condensation temperature, provided in a condensation pipe connected to a refrigerant discharge pipe from the compressor, a sensor 14 for detecting a temperature of a gaseous refrigerant discharged from the compressor, sensors 15b, 15c and 15d for detecting the respective temperatures of the refrigerant before pressure decrease by the expansion valves 9b, 9c and 9d in heating operation mode, a controller 16 for processing the data from these sensors 13, 14, 15b, 15c and 15d and a means 17 for outputting command signals, on the basis of the commands from the controller 16, to the expansion valves 9b, 9c and 9d to make the opening degrees thereof in determined levels and to the solenoid valves 10b, 10c and 10d to close or open them. The control system further includes sensors 18b, 18c and 18d provided in a conduit wall of the respective indoor heat exchangers 8b, 8c and 8d for detecting a saturation temperature of the refrigerant therein, and sensors 19b, 19c and 19d provided in the respective branching pipes 11b, 11c and 11d for detecting a temperature of the refrigerant therein.

In Fig. 2, reference numerals 20 and 21 designate a wave form representing an opening degree of the electric reversible expansion valve associated with the inoperating indoor unit and a wave form representing an open/close condition of the solenoid valve associated with the inoperating indoor unit, respectively.

The operation of the above mentioned embodiment will be described hereinunder with reference to Fig. 1 and Fig. 3 showing a flow chart of the control therefor.

In the heating operation mode, when only one indoor unit B is operated, the gaseous refrigerant is delivered from the compressor 1, via the gas side primary pipe 12, the gas side branching pipe 11b, and the solenoid valve 10b, to the heat exchanger 8b in which the gaseous refrigerant is heat-exchanged with the indoor air and radiates heat outsides to condense into condensation or liquid refrigerant. The liquid refrigerant is further delivered, through the expansion valve 9b, the liquid side branching pipe 7b, the liquid side primary pipe 6 and the receiver 5, to the heat exchanger 4 in which the liquid refrigerant is heat-exchanged with the outdoor air and absorbs heat to evaporate into gaseous refrigerant. The gaseous refrigerant returns to the compressor 1 through the four-way valve 2 and the accumulator 3. In this case, the expansion valves 9c and 9d, and the solenoid valves 10c and 10d associated with the inoperating indoor units C and D are fully closed.

The controller 16 calculates a temperature difference between the refrigerant temperature detected by the sensor 18b and the refrigerant temperature detected by the sensor 19b, or the subcooling degree SC of the refrigerant (step 301). If the subcooling degree SC is lower than the predetermined level E (step 302), i.e. the subcooling degree SC is with in a range 22a (Fig. 2), the controller 16 decides that the amount of the refrigerant circulating through the refrigeration cycle is insufficient (step 303). Thereafter, in step 304, the controller 16 outputs commands to the means 17 to hold the solenoid valves 10c and 10d associated with the inoperating units C and D in closed positions (as designated by 21a in Fig. 2) and to open the expansion valves 9c and 9d in the predetermined opening degree Hi for a period t1 (as designated by 20a in Fig. 2). Therefore, the refrigerant in the inoperating units C and D is extracted therefrom and after the lapse of time period t1 (step 305), the controller 16 outputs commands to the means 17 to close the expansion valves 9c and 9d (step 306). After the lapse of time period t2 (Fig. 2) (step 307), the controller 16 calculates the temperature difference (SC) again (step 301). If such difference is still with the range 22a, the above flow is repeated to extract the refrigerant from the inoperating units C and D.

To the contrary, if the subcooling degree SC is higher than the predetermined level F (step 302), i.e. the subcooling degree SC is with in a range 22b (Fig. 2), the controller 16 decides that the amount of the refrigerant circulating through the refrigeration cycle is excessive (step 308). Thereafter, in step 309, the controller 16 outputs commands to the means 17 to hold the expansion valves 9c and 9d associated with the inoperating units C and D in closed positions (as designated by 20a in Fig. 2) and to open the solenoid valves 10c and 10d for a period t3 (as designated by 21a in Fig. 2) by means of supplying a voltage HI (v) to the solenoid coil thereof. After the lapse of time period t3 (step 310), the controller 16 outputs commands to the means 17 to close the solenoid valves 10c and 10d (step 311). After the lapse of time period t4 (Fig. 2) (step 312), the controller 16 calculates the temperature difference (SC) again (step 301). If such difference is still with the range 22b, the above flow is repeated to introduce the refrigerant into the inoperating units C and D.

As the result of the above mentioned control, when the subcooling degree SC is within a range 22c (Fig. 2) (step 302) and the amount of the refrigerant circulating through the refrigeration cycle is proper (step 313), the solenoid valves 10c, 10d and the expansion valves 9c, 9d associated with the inoperating units C and D is held in closed positions (as designated by 21c and 20c in Fig. 2) so as to maintain the refrigerant within the inoperating indoor units C and D. After the lapse of sampling time period t5 (step 314), the process returns back to the step 301.

In the cooling operation mode, when only one indoor unit B is operated, the gaseous refrigerant is delivered from the compressor 1, via the four-way valve 2, to the heat exchanger 4 in which the gaseous refrigerant is heat-exchanged with the indoor air and radiates heat outsides to condense into condensate or liquid refrigerant. The liquid refrigerant is further delivered, through the receiver 5, the liquid side primary pipe 6, the liquid side branching pipe 7b, and the expansion valve 9b, to the heat exchanger 8b in which the liquid refrigerant is heat-exchanged with the indoor air and absorbs heat to evaporate into gaseous refrigerant. The gaseous refrigerant returns to the compressor 1 through the solenoid valve 10b, the gas side branching pipe 11b, the gas side primary pipe 12, the four-way valve 2 and the accumulator 3. In this case, the expansion valves 9c and 9d, and the solenoid valves 10c and 10d associated with the inoperating indoor units C and D are fully closed.

The controller 16 calculates a temperature difference between the refrigerant temperature detected by the sensor 18b and the refrigerant temperature detected by the sensor 19b, or the super heat degree SH of the refrigerant (step 315). If the super heat degree SH is higher than the predetermined level G (step 316), the controller 16 decides that the amount of the refrigerant circulating through the refrigeration cycle is insufficient (step 317). Proceeded are the same steps 318 to 321 as in case that the subcooling degree SC is lower than the predetermined level in heating operation mode. Therefore, the refrigerant in the inoperating units C and D is extracted therefrom. In this case, since the refrigeration cycle is reversed one, the expansion valves 9c, 9d and the solenoid valves 10c, 10d operate reversely to each other in step 318. To the contrary, if the super heat degree SH is lower than the predetermined level H (step 316), the controller 16 decides that the amount of the refrigerant circulating through the refrigeration cycle is excessive (step 322). Proceeded are the same steps 323 to 326 as in case that the subcooling degree SC is higher than the predetermined level in heating operation mode. Therefore, the refrigerant is introduced into the inoperating units C and D. In this case, since the refrigeration cycle is reversed one, the expansion valves 9c, 9d and the solenoid valves 10c, 10d operate reversely to each other in step 323.

When the super heat degree SH is within a range 23c (Fig. 2) (step 316) and the amount of the refrigerant circulating through the refrigeration cycle is proper (step 327), as same as in the subcooling degree SC is within the range 22c in the heating operation mode, the refrigerant is maintained within the inoperating indoor unit. After the lapse of sampling time period t6 (step 328), the process returns back to the step 315.

Namely, in the above mentioned embodiment shown in Fig. 3, the subcooling degree of the refrigerant (in the heating operation mode) or the super heating degree thereof (in the cooling operation mode) is detected by the sensors. When the subcooling degree SC exceeds the predetermined range in the heating operation mode, or the super heating degree SH is kept under the predetermined range in the cooling operation mode, the controller decides that the refrigerant circulates through the refrigeration cycle in the amount greater than that for the proper operation of the cycle, and then outputs the commands to the command signal outputting means so that the expansion valves associated with the inoperating units are held in closed position and the solenoid valves associated with the inoperating units are switched over and held in open position for a predetermined period in the heating operation mode, and such expansion valves are switched over and held in open position and such solenoid valves are held in closed position in the cooling operation mode. Therefore, the refrigerant circulating through the refrigeration cycle is introduced into and maintained within the inoperating units to reduce the amount of the circulating refrigerant. After the lapse of the predetermined time period, the expansion valves and the solenoid valves are switched over into the open positions. The valves are held in the closed positions for the predetermined period of time so that the refrigeration cycle is subject to the above mentioned control and then the subcooling degree SC of the refrigerant and the super heating degree SH can change. Thereafter, if the subcooling degree SC and the super heating degree SH are not within the desired range, the above mentioned control is repeatedly conducted intermittently to reduce the excess refrigerant.

In the same manner, when the subcooling degree SC is kept under the predetermined range in the heating operation mode, or the super heating degree SH exceeds the predetermined range in the cooling operation mode, the controller decides that the refrigerant circulates through the refrigeration cycle in the amount less than that for the proper operation of the cycle, and then outputs the commands to the command signal outputting means so that the expansion valves associated with the inoperating units are switched over and held in open position and the solenoid valves associated with the inoperating units are held in closed position for a predetermined period in the heating operation mode, and such expansion valves are held in closed position and such solenoid valves are switched over and held in open position in the cooling operation mode. Therefore, the refrigerant maintained within the inoperating units is discharged into the refrigeration cycle to increase the amount of the circulating refrigerant. In this case, the control is conducted intermittently.

Such control changes the amount of the circulating refrigerant and makes any effects on the controlled variables except such amount, e.g. the super heating degree of the refrigerant from the compressor. However, if the steps 329 to 332 (Fig. 4) are added to the control flow in Fig. 3, it becomes possible to eliminate such effects.

Accordingly, with reference to the control for distribution of refrigerant, which is important for the multiple room type air conditioning system, when the detected values, e.g. the super heating degree of the refrigerant from the compressor satisfy the conditions by which the distribution control is adversely effected, the expansion valves and the solenoid valves associated with the inoperating units are operated to interrupt the refrigerant flow from the inoperating units into the refrigeration cycle regardless of the values of the detected controlled variables in the excess refrigerant control, e.g. the subcooling degree SC and the super heating degree SH.

With regard to the above mentioned distribution control, the detailed explanation will be made hereinunder with referring to Figs. 1, 2 and 4 and Fig. 5 which shows the process in the steps 330 and 332 in Fig. 4.

In the excess refrigerant control, since the refrigerant is discharged from the inoperating units into the operating cycle, the super heating degree of the refrigerant from the compressor is decreased, so that the distribution control is adversely effected and the stability of the cycle becomes worse. Accordingly, in this embodiment, in order to prevent such stability from becoming worse, the controller 16 calculates a temperature difference between the temperature of the gaseous refrigerant from the compressor detected by the sensor 14 and the condensing temperature of the refrigerant detected by the sensor 13, or the super heating degree TdSH of the refrigerant from the compressor. The controller 16 interrupts the excess refrigerant control when the following conditions, or the process K (steps 330 and 332 in Fig. 4) are satisfied. Namely, the excess refrigerant control is temporary interrupted when the super heating degree TdSH of the refrigerant from the compressor becomes lower than the pre-set value SHset which makes the refrigerant distribution control proper, i.e. TdSH-SHSet < 0 (Figs. 5 and 6). To the contrary, even if the super heating degree TdSH is higher than the pre-set value SHset, in a J zone between the pre-set value SHset and a pre-set value J°C which is close to the pre-set value SHset, in case that the super heating degree TdSH has an intention of fallin down, i.e. the super heating degree TdSH at the sampling point 2 becomes lower than the super heating degree TdSH' at the preceding sampling point 1 and closer to the pre-set value SHset, it is interrupted to discharge the refrigerant from the inoperating indoor units into the operating cycle by means of the steps 329, 330 or 331, 332, regardless of the subcooling degree or the super heating degree. However, in case that the super heating degree TdSH has an intention of increasing as designated by the dotted line in Fig. 6, it is continued to discharge the refrigerant from the inoperating indoor units into the operating cycle, even though the super heating degree TdSH is within the J zone. Accordingly, in this embodiment, it becomes possible to eliminate the interference between the excess refrigerant control and the refrigerant distribution control both of which are important for the multiple room type air conditioning system.

Incidentally, the present invention is not limited to the above embodiments, but the following modifications may be possible. For example, with regard to the objections to be detected by the sensors, if the sensors are disposed in other positions, they can detect any other objects which correspond to such objections. Further, even though the sensors 18b, 18c and 18d are dispensed with, it is possible to calculate the saturation temperatures which should be detected by the sensors 18b, 18c and 18d by means of compensating for the detected values by the sensors 13, 15b, 15c and 15d with compensation coefficients such as indoor unit capacities. Thus, various modifications are possible within a scope of the present invention. In particular, although in the above embodiment the process K is provided in not only in the heating operation mode but also in the cooling operation mode (Fig. 4), it is practically sufficient to provide the process K only for the heating operation mode as shown in Fig. 7. The control flow shown in Fig. 7 is substantially identical to that in Fig. 4. Therefore, the explanation therefor is omitted. The control circuit for the embodiment shown in Fig. 7 is more simplified than that shown in Fig. 4.

In accordance with the above mentioned controls, the amount of the refrigerant circulating through the cycle is always kept proper correspondence with the air conditioning conditions. Therefore, it is possible to prevent the increase in the pressure and the temperature of the refrigerant from the compressor, which increase is caused by the increase of the amount of the refrigerant circulating through the cycle. The inoperation of the compressor which is caused by the operation of the protection means therefor due to such increase in the pressure and the temperature is also prevented. Further, it is possible to prevent the increase of the compressor temperature which is caused by decrease of the refrigerant circulating through the cycle and to prevent the generation of flash gas. Accordingly, the refrigeration cycle is kept in steady and proper, whereby a comfortable air conditioned circumstance is obtained.

According to the present invention, even though one or some indoor units of the multiple room type air conditioning system become inoperating conditions, it is possible to make the refrigerant in the proper amount circulate through the refrigeration cycle correspondence with the number of the operating indoor units, so that the meritorious advantages that a comfortable air conditioned circumstance is obtained is given.

Claims

1. In a heat pump type multiple room air conditioning system comprising a single outdoor unit (A) including a compressor (1) and an outdoor heat exchanger (4), a plurality of indoor units (B, C, D) each including an indoor heat exchanger (8b, 8c, 8d), a plurality of electric reverse expansion valves (9b, 9c, 9d) each provided for flowing a refrigerant in opposite directions in the respective branching pipes (7b, 7c, 7d) into which a liquid side primary pipe (6) connected to said outdoor unit branches out, and a plurality of solenoid valves (10b, 10c, 10d) each provided in the respective branching pipes (11b, 11c, 11d) into which a gas side primary pipe (12) connected to said outdoor unit branches out, the expansion valves associated with the inoperating indoor units of said indoor units, or said expansion valves and the solenoid valves associated with the inoperating indoor units of said indoor units, in operation of said system, being opened or closed to change the amount of refrigerant stored within said inoperating indoor units whereby making the amount of refrigerant circulating through said cycle proper, characterized in that said system further comprises a controller (16) for sampling a subcooling degree (SC) of the refrigerant in refrigeration circuit in operating indoor units of said indoor units or a super heating degree (SH) thereof periodically and for calculating and comparing the sampling data with predetermined values, and control signal outputting means (17) for receiving signals from said controller and for outputting command signals to said expansion valves and said solenoid valves associated with said inoperating indoor units to intermittently close or open said expansion valves, or said expansion valves and said solenoid valves, whereby the amount of refrigerant stored within said inoperating indoor units are intermittently changed to control an amount of refrigerant circulating through the cycle and then said subcooling degree or said super heating degree in the indoor units to be controlled is kept within a predetermined range.

2. A heat pump type multiple room air conditioning system according to Claim 1, wherein said system further comprises a control means for detecting a super heating degree of refrigerant from said compressor in a refrigeration cycle and for operate said expansion valves associated with the inoperating indoor units of said indoor units, or said expansion valves and said solenoid valves associated with the inoperating indoor units of said indoor units to interrupt a refrigerant flow from said inoperating indoor units into said refrigeration cycle.

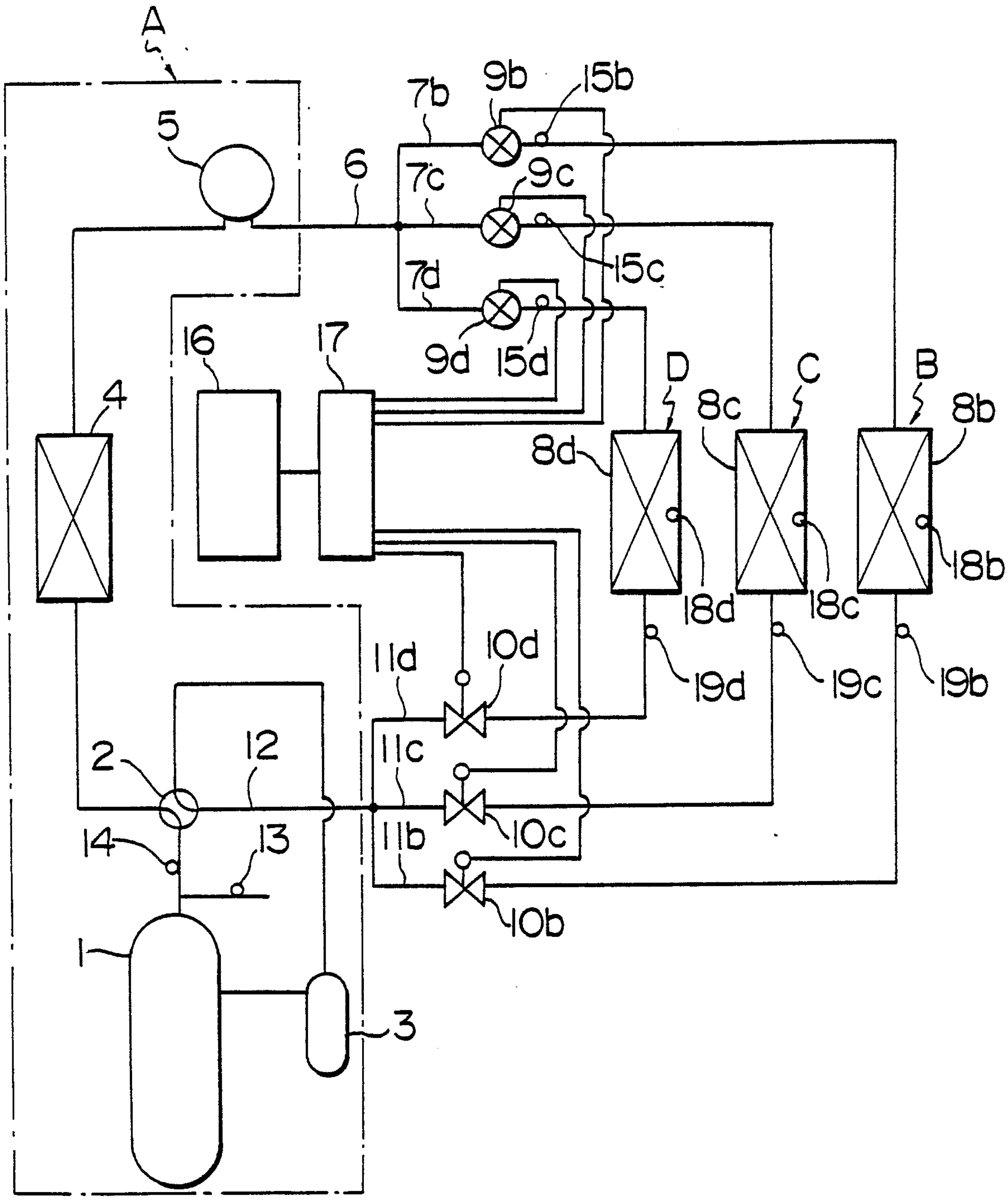
3. A heat pump type multiple room air conditioning system according to Claim 2, wherein said control means is provided only in a heating operation control circuit.

4. A method for operating an air conditioning system comprising a refrigeration cycle including an outdoor unit (A) having a compressor (1), an outdoor heat exchanger (4) and a four-way valve (2), a plurality of indoor units (B, C, D) each having an indoor heat exchanger (8b, 8c, 8d), a plurality of electric reverse expansion valves (9b, 9c, 9d) each provided for flowing a liquid refrigerant in opposite

directions in the respective branching pipes (7b, 7c, 7d) into which a liquid side primary pipe (6) connected to said outdoor unit branches out, and a plurality of solenoid valves (10b, 10c, 10d) each provided in the respective branching pipes (11b, 11c, 11d) into which a gas side primary pipe (12) connected to said outdoor unit branches out, said method comprising a step for opening or closing the expansion valves associated with the inoperating indoor units of said indoor units, or not only said expansion valves but also the solenoid valves associated with the inoperating indoor units of said indoor units, in operation of said system, to change the amount of refrigerant stored within said inoperating indoor units whereby making the amount of refrigerant circulating said cycle proper, characterized in that said method further comprises the following steps: of determining, in heating operation mode, that the amount of refrigerant circulating through the operating indoor units of said indoor units is excess, in case that the subcooling degree (SC) is greater than the predetermined value (F), and that the amount of refrigerant circulating through the operating indoor units of said indoor units is insufficient, in case that the subcooling degree (SC) is lower than the predetermined value (E); of determining, in cooling operation mode, that the amount of refrigerant circulating through the operating indoor units of said indoor units is insufficient, in case that the super heating degree (SH) is greater than the predetermined value (G), and that the amount of refrigerant circulating through the operating indoor units of said indoor units is excess, in case that the super heating degree (SH) is lower than the predetermined value (H); of introducing a part of the circulating refrigerant into said inoperating indoor units in case of the amount of refrigerant is excess; and of discharging the refrigerant stored within said inoperating units into the operating cycle.

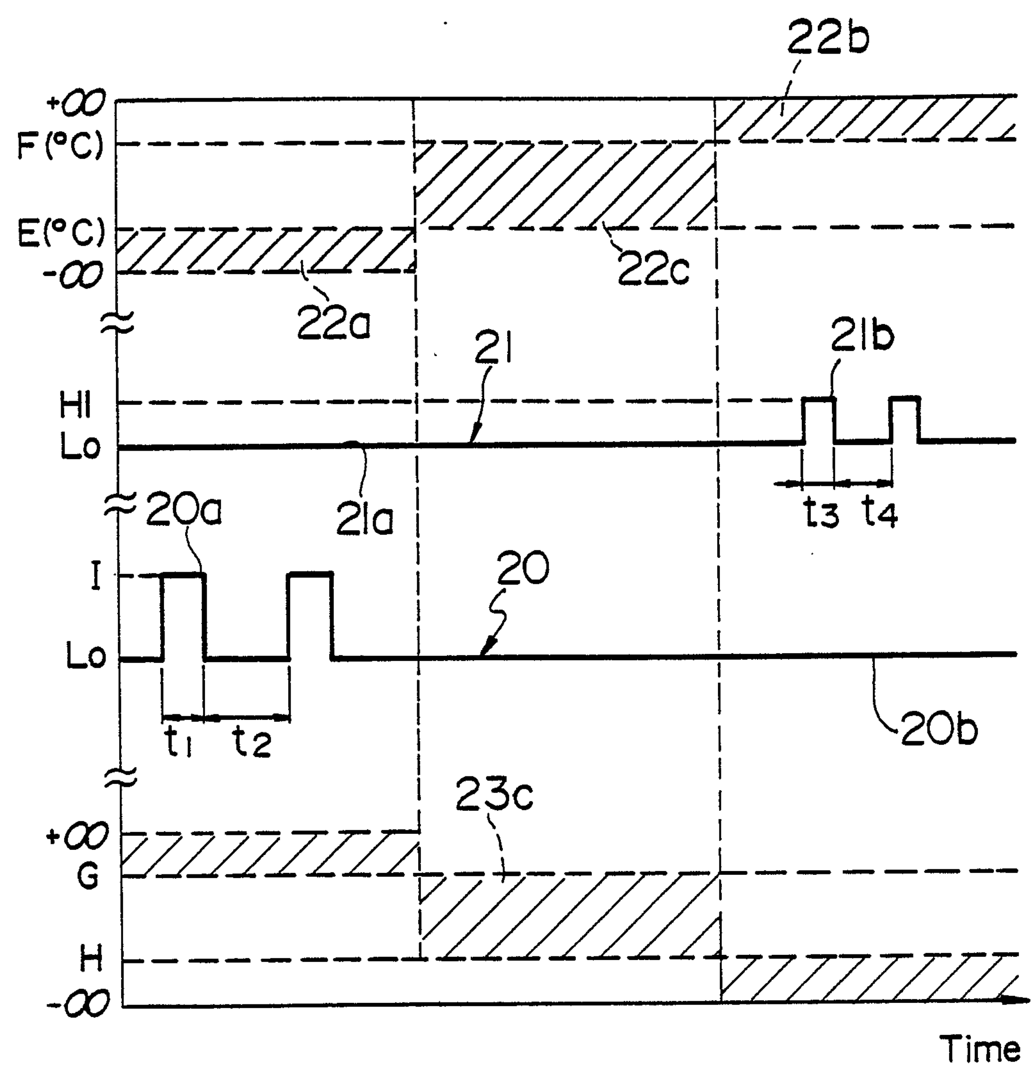
EPAB-36175.1

FIG. 1



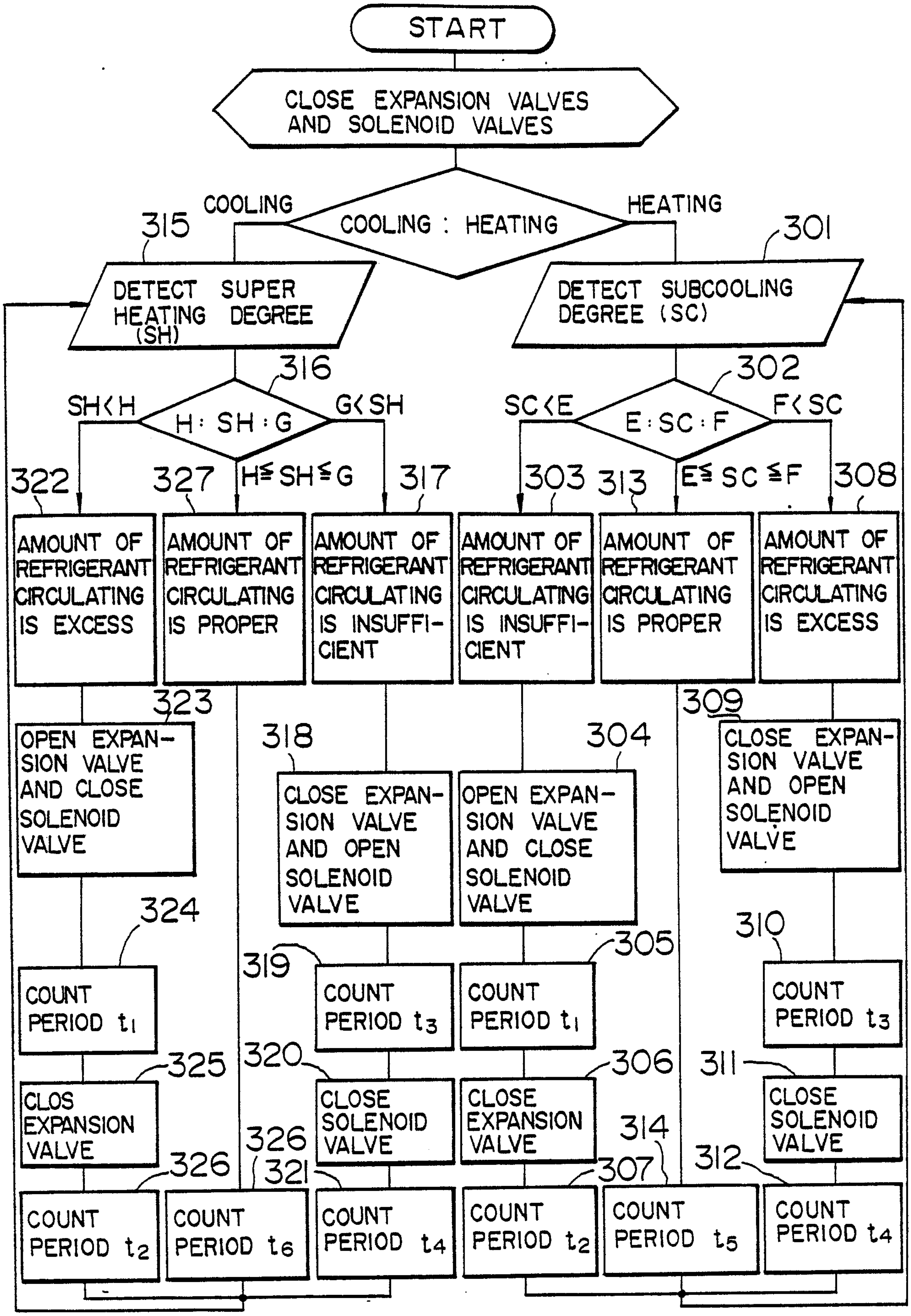
EPAB-36175.1

FIG. 2



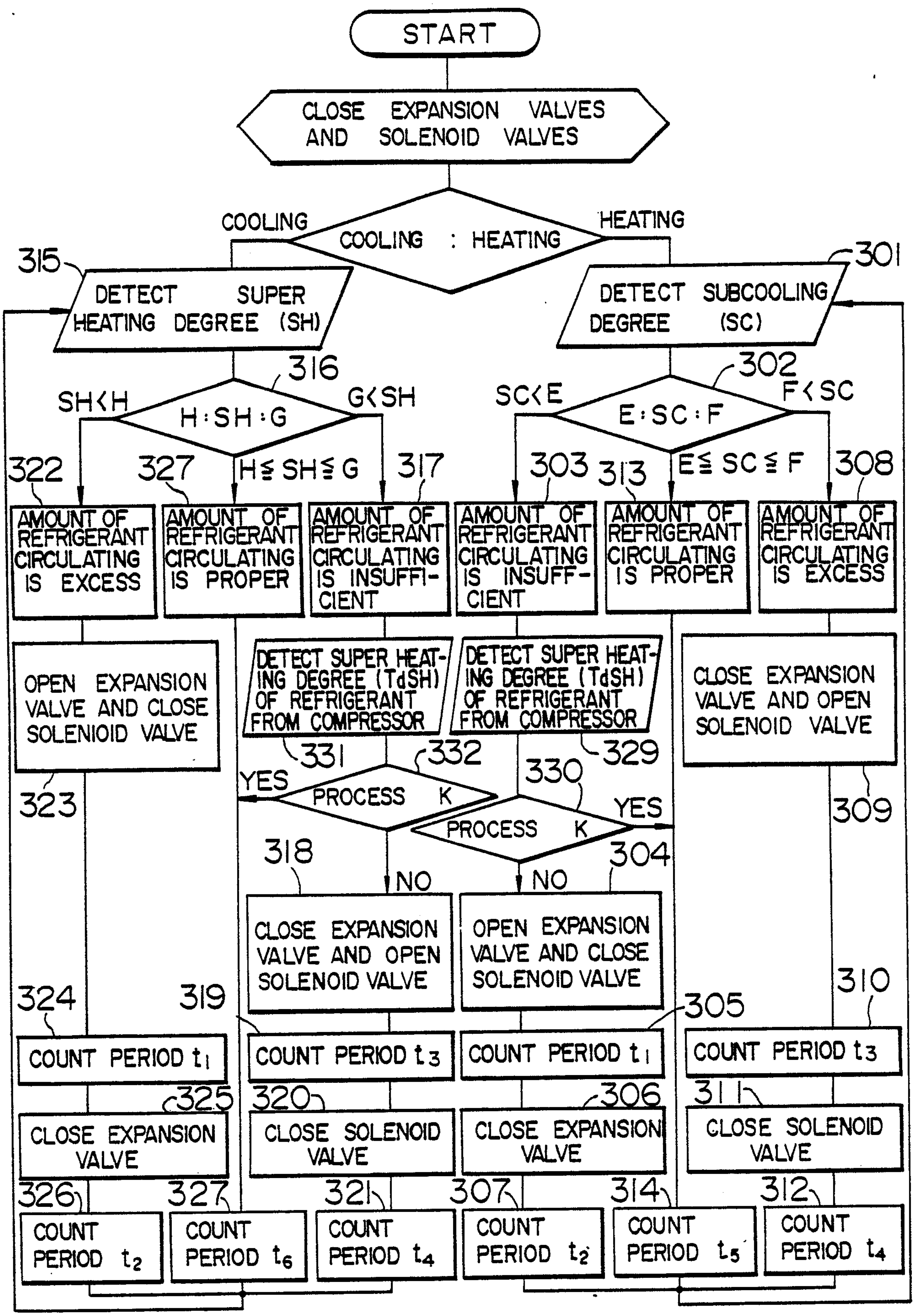
EPAB-36175.1

FIG. 3



EPAB-36175.1

FIG. 4



EPAB-36175.1

FIG. 5

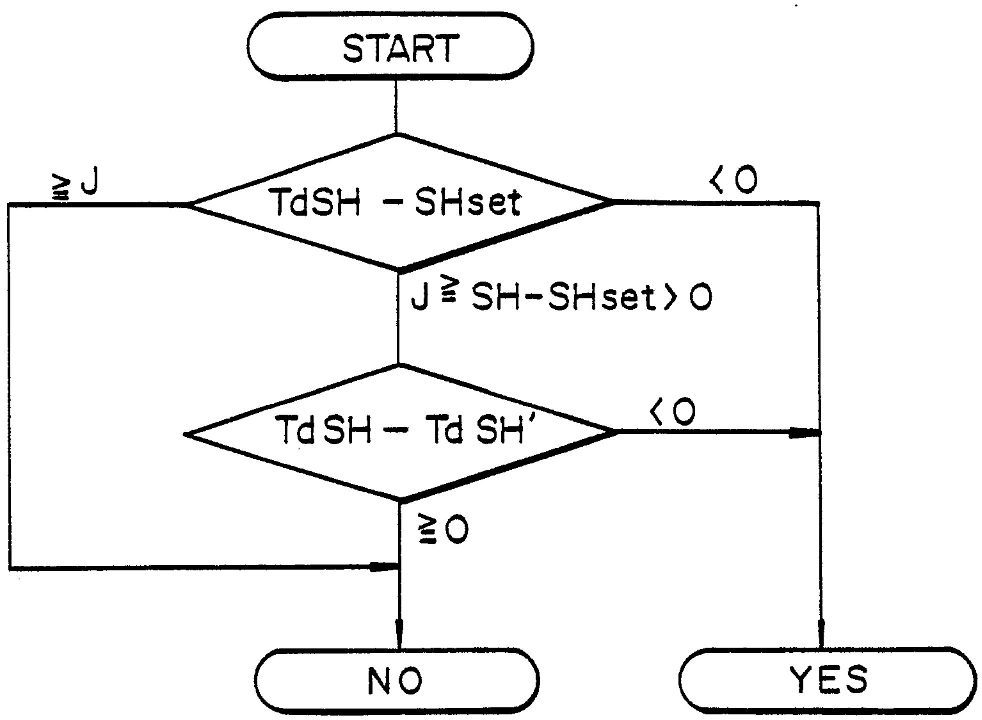
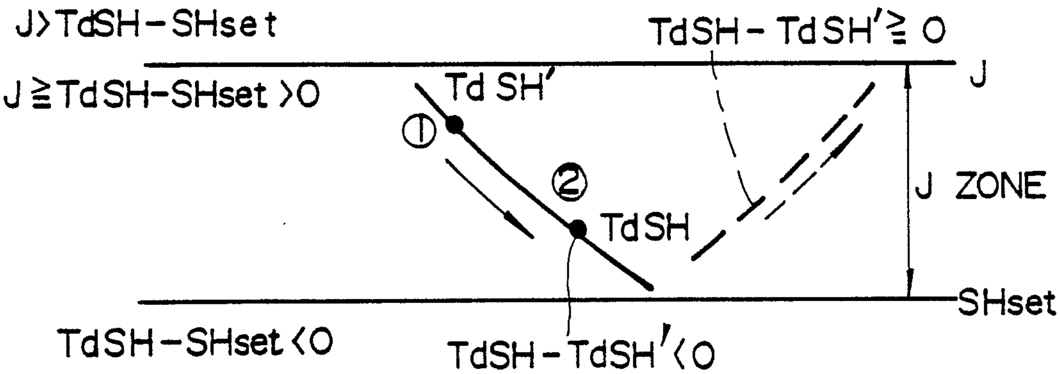


FIG. 6



EPAB-36175.1

FIG. 7