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(73) Proprietor: **SANYO ELECTRIC CO., LTD.**
Moriguchi-shi, Osaka (JP)

(72) Inventors:
• **Akatsuka, Kei**
Ora-gun,
Gunma 370-0514 (JP)

• **Hirata, Ryota**
Ora-gun,
Gunma 370-0532 (JP)

(74) Representative: **Glawe, Delfs, Moll**
Patentanwälte
Postfach 26 01 62
80058 München (DE)

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Description

1. Field of the Invention

[0001] The present invention relates to a gas heat pump type air conditioner in which a compressor is driven by a gas engine, and particularly to a technique for keeping the water temperature of cooling water for cooling the gas engine.

2. Description of the Related Art

[0002] There has been known a gas heat pump type air conditioner equipped with a refrigerant circuit including a compressor driven by a gas engine serving as an internal combustion engine, a four-way valve, an outdoor heat exchanger and an indoor heat exchanger which are connected to one another through a refrigerant pipe, and a cooling water circuit for feeding cooling water to the gas engine by a cooling water pump to cool the gas engine (for example, see JP-A-2003-232582).

[0003] Furthermore, in the air conditioner described above, when the temperature of the cooling water is reduced to a predetermined temperature or less, the exit side of the engine for the cooling water and the suction side of the cooling water pump for the cooling water are short-circuited to each other to increase the temperature of the cooling water, and a wax three-way valve (automatic temperature adjusting valve) for preventing the cooling water from passing through the outdoor heat exchanger is provided at the exit side of the engine, thereby controlling the temperature of the cooling water.

[0004] However, the conventional technique described above has a problem that the cost is increased because it uses a wax three-way valve for the temperature control of the cooling water. Furthermore, it has also a problem that it is impossible to sufficiently control the temperature of the cooling water through the temperature control of the cooling water based on the wax three-way valve.

[0005] EP 1 275 913 A2 discloses an air conditioner according to the preamble of claim 1.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide an air conditioner that can control the temperature of cooling water without using any wax three-way valve.

[0007] This object is solved by the features of the main claim.

[0008] Advantageous embodiments are mentioned in the sub-claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a diagram showing the construction of an

air conditioner according to an embodiment of the present invention;

Fig. 2 is a diagram showing cooling water temperature keeping control; and

Fig. 3 is a diagram showing the cooling water temperature keeping control.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] A preferred embodiment according to the present invention will be described hereunder with reference to the accompanying drawings.

[0011] Fig. 1 is a diagram showing the construction of a gas heat pump type air conditioner 100. In Fig. 1, a refrigerant circuit is indicated by one-dotted chain lines and a cooling water circuit is indicated by heavy solid lines. The air conditioner 100 has an indoor unit 1 and an outdoor unit 3, and an indoor heat exchanger 7 having a flow divider 5 appended thereto, a fan 9, etc. are disposed in the indoor unit 1. Furthermore, at the outdoor unit 3 side are disposed a compressor 11, an electromagnetic type four-way valve 13, an auxiliary evaporator (sub evaporator) 15, an outdoor heat exchanger 19 appended with a flow divider 17, a fan 21, an expansion valve 72, etc. as element parts of the refrigerant circuit at the outdoor unit 3 side, and also disposed an engine 31, an exhaust heat exchanger 33, an electrically-operated three-way valve 37, a cooling water pump 39 which is an electrically-operated type AC pump, a radiator (air heat exchanger) 20, etc. as element parts of the cooling water circuit. In Fig. 1, reference numeral 43 represents an exhaust pipe connected to the inside of the exhaust heat exchanger 33, reference numeral 45 represents an inverter used to control the rotational number of the cooling water pump 39, reference numeral 47 represents a fan motor for driving the fan 21, and reference numeral 49 represents a flexible coupling for coupling the engine 31 and the compressor 11 to each other. The expansion valve 72 serves to adjust the flow amount of refrigerant flowing from the indoor heat exchanger 7 to the outdoor heat exchanger 19, and the radiator 20 serves to radiate the heat of the cooling water. The radiator 20 is disposed at the downstream side of the fan 21 with respect to the outdoor heat exchanger 19 so as to suppress the thermal effect of the radiator 20 on the outdoor heat exchanger 19.

[0012] A control unit 61 for controlling the driving of the four-way valve 13, the electrically-operated three-way valve 37, the inverter 45, the fan motor 47, etc. is disposed in the outdoor unit 3. The control unit 61 comprises CPU, an input/output interface, ROM, RAM, a timer counter, etc., and the input interface thereof is connected to a water temperature sensor 63 provided to a cooling water pipe 87 at the exit side of the engine 31, a heat exchange temperature sensor 65 secured to the outdoor heat exchanger 19, an exhaust temperature sensor 67 provided to an exhaust pipe 43, an outside air temperature sensor

69 secured to the outer wall surface, etc. Furthermore, the control unit 61 is connected to a control unit (not shown) at the indoor unit 1 side, and these control units mutually transmit/receive signals therebetween.

[0013] Next, the flow of the refrigerant will be operation described. Under heating operation, liquid refrigerant flows from the refrigerant pipe 71 to the outdoor unit 3 side, and then passes through the expansion valve 72, the flow divider 17, the outer heat exchanger 19, the refrigerant pipe 75, the four-way valve 13 and the refrigerant pipe 77 into the auxiliary evaporator 15. At this time, the refrigerant is heated when passing through the heat exchanger 19 and the auxiliary evaporator 15. A double-pipe type heat exchanger in which cooling water passes around the refrigerant pipe is adopted as the auxiliary evaporator 15, and a plate fin type heat exchanger in which the refrigerant pipe and the cooling water pipe are connected to each other through a plate fin is adopted as the outdoor heat exchanger 19 (see the outdoor heat exchanger 19 and the radiator 20 in Fig. 1). Gas refrigerant heated in both the heat exchangers 19, 15 passes through the refrigerant pipe 78 and flows into the compressor 11 to be compressed, so that the refrigerant is heated. High-temperature gas refrigerant discharged from the compressor 11 passes through a refrigerant pipe 79, the four-way valve 13 and a refrigerant pipe 81 and flows into the indoor heat exchanger 7 at the indoor unit 1 side. At this time, the refrigerant discharges heat energy to indoor air blow out from the fan 9 to be liquefied, and then the liquid refrigerant flows from the refrigerant pipe 71 to the outdoor unit 3 side again.

[0014] As described above, the auxiliary evaporator 15 for utilizing the heat of the cooling water of the engine 31 during heating operation and the exhaust heat exchanger 33 for utilizing the heat of the exhaust gas of the engine 31 for heating operation are provided in the outdoor unit 3, and thus even when the outside air temperature is lowered during heating operation, sufficient heating can be performed.

[0015] On the other hand, during cooling operation, the four-way valve 6 is switched. That is, high-temperature gas refrigerant discharged from the compressor 11 passes through the refrigerant pipe 79, the four-way valve 13 and the refrigerant pipe 75, and then flows into the outdoor heat exchanger 19. At this time, the refrigerant is cooled and liquefied by low-temperature outside air in the outdoor heat exchanger 19. The refrigerant thus liquefied passes through the refrigerant pipe 71, and flows into the indoor heat exchanger 7 at the indoor unit 1 side. The refrigerant absorbs heat from the indoor air and it is evaporated. The refrigerant thus evaporated passes through the refrigerant pipe 81, flows to the outdoor unit 3 side again and then flows through the four-way valve 13, the refrigerant pipe 77, the auxiliary evaporator 15 and the refrigerant pipe 78 into the compressor 78 again. Here, during cooling operation, the circulation of the cooling water into the auxiliary evaporator 15 is stopped and thus the refrigerant is not heated in the aux-

iliary evaporator 15 except for a case where heating operation is carried out or a case where the temperature of the cooling water is lowered.

[0016] Next, the construction of the cooling water circuit will be described in detail.

[0017] As shown in Fig. 1, the cooling water circuit has a main cooling path in which the cooling water discharged from the cooling water pump 39 is passed through the exhaust heat exchanger 33, the engine 31, the electrically-operated three-way valve 37 and the radiator 20 in this order and then flows back to the cooling water pump 39, and an auxiliary cooling path in which the cooling water discharged from the engine 31 is passed through the electrically-operated three-way valve 37 and the auxiliary evaporator 15 and then flows back to the cooling water pump 39.

[0018] The flow of the cooling water under heating operation will be described. The cooling water discharged from the cooling water pump 39 passes through the cooling water pipe 85 and then flows into the exhaust heat exchanger 33 to be heated by the exhaust gas. Thereafter, the cooling water thus heated flows into the engine 31. After the cooling water cools the engine 31, the high-temperature cooling water passes through the cooling water pipe 87, the electrically-operated three-way valve 37 and the cooling water pipe 89, and flows into the radiator 20 to radiate the heat energy thereof. The cooling water which radiates the heat energy in the radiator 20 is passed through the cooling water pipe 91, and flows back to the cooling water pump 39 again.

[0019] Here, under heating operation, the high-temperature cooling water may pass through not only the radiator 20, but also the auxiliary evaporator 15 as described later, whereby it subsidiarily heats the refrigerant. Furthermore, under cooling operation, the high-temperature cooling water passes through only the radiator 20, and radiates the heat energy.

[0020] The outdoor heat exchanger 19 and the radiator 20 may be integrally assembled with each other, so that these heat exchangers can be regarded as a single outdoor heat exchanger functioning as both a condenser for refrigerant and a radiator.

[0021] In the auxiliary cooling path, the cooling water discharged from the cooling water pump 39 passes through the cooling water pipe 85, and flows into the exhaust heat exchanger 33. The refrigerant is heated by exhaust gas, and then flows into the engine 31. During heating operation, the cooling water which cools the engine 31 and thus is increased in temperature passes through the cooling water pipe 87, the electrically-operated three-way valve 37 and the cooling water pipe 95 and then flows into the auxiliary evaporator 15 to heat the refrigerant and thus radiate the heat energy thereof. The cooling water which radiates the heat energy in the auxiliary evaporator 15 is passed through the cooling water pipes 97, 91 and confluent into the cooling water pipe 91. Then, the cooling water passes through the cooling water pipe 91 and then flows back to the cooling water

pump 39.

[0022] With respect to the gas heat pump type air conditioner, when the air conditioner is started after it has been stopped for a long time, the cooling water temperature is lowered and thus the heat exchange between the cooling water and the refrigerant in the auxiliary evaporator is hardly carried out. Therefore, it takes a long time to complete a warm-up operation. Particularly in the mid-winter or the like, start of the heating operation is delayed.

[0023] Therefore, in this embodiment, when the cooling water temperature is low, the cooling water is circulated through only the auxiliary cooling water, whereby the cooling water temperature is quickly increased.

[0024] More specifically, when the cooling water temperature at the exit of the engine 31 is lower than a target temperature (70°C in this embodiment), for example when the engine 31 is started after it is stopped for a long time or the like, the control unit 61 closes the port at the radiator 20 side of the electrically-operated three-way valve 37 while opening the port at the auxiliary evaporator 15 side of the electrically-operated three-way valve 37, whereby the entire amount of the cooling water is circulated to the auxiliary cooling path. That is, the heat radiation amount of the cooling water in the auxiliary evaporator 15 is smaller than that in the radiator 20 provided to the main cooling path, and thus the reduction level of the cooling water temperature when the cooling water is circulated through the auxiliary cooling path is smaller than that of the cooling water temperature when the cooling water is circulated through the main cooling path. Therefore, the cooling water temperature is higher in this case.

[0025] Here, by using the auxiliary evaporator 15 having a smaller heat radiation amount than the radiator 20, the heat radiation amount of the cooling water when the cooling water is circulated through the auxiliary cooling path is reduced to a smaller value, and the cooling water temperature can be more increased. However, if the heat radiation amount of the auxiliary evaporator 15 is excessively small, the pressure loss of the refrigerant is increased in accordance with the type of the outdoor heat exchanger 19, which contributes to reduction in power of the refrigerant circuit.

[0026] Therefore, according to this embodiment, a bypass pipe 99 is provided as shown in Fig. 1 so that the cooling water is split at the entrance side of the auxiliary evaporator 15 and a part of the cooling water bypasses the auxiliary evaporator 15. Accordingly, the heat radiation amount of the cooling water in the auxiliary cooling path can be suppressed to a lower level without increasing the pressure loss of the refrigerant, and the cooling water temperature can be quickly increased. Furthermore, in the construction that the bypass pipe 99 is provided as described above, the diameter of the bypass pipe 99 may be properly changed so that the ratio of the flow amounts of the cooling water flowing in the auxiliary evaporator 15 and the bypass pipe 99 is varied, and thus the heat radiation amount in the auxiliary cooling path

can be simply adjusted. In spite of the variation of the diameter of the bypass pipe, a valve (not shown) whose opening degree is freely adjustable may be provided to the bypass pipe. In this case, the flow amount of the cooling water distributed to the bypass pipe 99 can be freely varied by adjusting the opening degree of the valve, thereby adjusting the ratio of the flow amounts of the cooling water to be distributed to both the auxiliary evaporator 15 and the bypass pipe 99.

[0027] As described above, when the cooling water temperature is lower than the target temperature, the electrically-operated three-way valve 37 is controlled so that the entire amount of the cooling water is circulated through the auxiliary cooling path having a smaller heat radiation amount than the main cooling path, whereby the cooling water temperature is increased to quickly reach the target temperature.

[0028] Furthermore, according to this embodiment, when the cooling water temperature is lower than the target temperature, in addition to the switching control of the cooling path, the cooling water pump 39 may be rotated at the lowest rotational number than the rotational number of the pump under normal operation so that the trap time of the cooling water in the engine 31 is lengthened and the increase of the cooling water temperature is promoted. Accordingly, the cooling water temperature can be made to reach the target temperature more early.

[0029] After the cooling water temperature reaches the target water temperature, the control unit 61 gradually opens the port at the radiator 20 side of the electrically-operated three-way valve 37, so that the relatively high-temperature cooling water flows into the radiator 20. As described above, according to this embodiment, the cooling water temperature can be quickly increased up to the target temperature just after the start of the engine, and thus the warm-up operation can be quickly completed. Furthermore, even in the midwinter under which the outside air temperature is remarkably low, waste heat can be withdrawn in the auxiliary evaporator even when the cooling water temperature is being increased in the warm-up operation, and thus the rise-up characteristic of the heating operation can be enhanced.

[0030] Furthermore, in this embodiment, even after the cooling water temperature reaches the target temperature, that is, even after the warm-up operation is completed, the rotational number of the cooling water pump 39 is controlled on the basis of the outside air temperature and the cooling water temperature to adjust the cooling water flow amount and keep the cooling water temperature to the target temperature so that water contained in the exhaust gas of the engine 31 is prevented from being condensed in the exhaust path or at the head portion of the engine 31 (the place at which the exhaust gas is discharged from the engine 31) and mixed with engine oil to generate sludge.

[0031] Specifically, according to this embodiment, five judgment temperature levels A to E for providing the temperature ranges of the cooling water temperature are set

and the rotational number of the cooling water pump 39 is controlled in accordance with which one of the judgment temperature levels A to E the present cooling water temperature belongs to as shown in Fig. 2. The judgment temperature levels A to E will be described in more detail.

[0032] A case where the present cooling water temperature is equal to about the target temperature, that is, it is unnecessary to carry out temperature control of the cooling water temperature, is set as a judgment temperature level C, a case where the present cooling water temperature is lower than the target temperature by a predetermined temperature is set as a judgment temperature level B, a case where the present cooling water temperature is further lower than that in the judgment temperature level B by a predetermined temperature is set as a judgment temperature level A, a case where the present cooling water temperature is higher than the target temperature by a predetermined temperature is set as a judgment temperature level D, and a case where the present cooling water temperature is further higher than that in the judgment temperature level D by a predetermined temperature is set as a judgment temperature level E.

[0033] Furthermore, the water temperature condition required to the cooling water as to whether the cooling water is used to heat the refrigerant is different between cooling operation and heating operation, and thus different temperature ranges are set to each of the judgment temperature levels A to E between cooling operation and heating operation. Furthermore, even under heating operation, different temperature ranges are set in accordance with the outside air temperature.

[0034] Specifically, during cooling operation, or during heating operation and when the outside air temperature is higher than 5°C, a case where the cooling water temperature is equal to the target temperature is set as the judgment temperature level C, a case where the cooling water temperature is lower than the target temperature by 2°C is set as the judgment temperature level B, and a case where the cooling water temperature is lower than the target temperature by 10°C is set as the judgment temperature level A. Furthermore, a case where the cooling water temperature is higher than the target temperature by 10°C is set as the judgment temperature level D, and a case where the cooling water temperature is higher than the target temperature by 20°C is set as the judgment temperature level E. On the other hand, during heating operation and when the outside air temperature is not higher than 5°C, a case where the cooling water temperature is lower than the target temperature by 2°C is set as the judgment temperature level C, a case where the cooling water temperature is lower than the target temperature by 5°C is set as the judgment temperature level B, a case where the cooling water temperature is lower than the target temperature by 10°C is set as the judgment temperature level A, a case where the cooling water temperature is equal to the target temperature is set as the judgment temperature level D, and a case

where the cooling water temperature is higher than the target temperature by 10°C is set as the judgment temperature level E.

[0035] As described above, when the cooling water temperature is in the judgment temperature level B or A, in order to indicate that the cooling water temperature is lower than the target temperature, the rotational number of the cooling water pump 39 is gradually lowered to increase the cooling water temperature. For example, when the present cooling water temperature is located between the judgment temperature levels B and C, the rotational number of the cooling water pump 39 is reduced every 100rpm every time 200 seconds elapse until the cooling water temperature is equal to the judgment temperature level C or more. Furthermore, when the cooling water temperature is located between the judgment temperature levels A and B, the rotational number of the cooling water pump 39 is further reduced by only 100rpm. On the other hand, when the cooling water temperature is equal to the judgment temperature level A or less, the rotational number of the cooling water pump 39 is reduced by only 200rpm. As a result, as the cooling water temperature is lower than the target temperature, the rotational number of the cooling water pump 39 is reduced, and a higher speed is achieved for the increasing of the cooling water temperature, and thus the cooling water temperature can be quickly approached to the target temperature.

[0036] On the other hand, when the cooling temperature is in the judgment temperature level D or E, in order to indicate that the cooling water temperature is higher than the target temperature, the rotational number of the cooling water pump 39 is gradually increased to suppress the increase of the cooling water temperature. For example, when the present cooling water temperature is located between the judgment temperature levels D and E, the rotational number of the cooling water pump 39 is increased every 100rpm every time 200 seconds elapses until the cooling water temperature is equal to the judgment temperature level D or less. Furthermore, when the cooling water temperature is equal to the judgment temperature level E or more, the rotational number of the cooling water pump 39 is further increased by only 100rpm. As a result, as the cooling water temperature is higher than the target temperature, the rotational number of the cooling water pump 39 is increased, and the increase of the cooling water temperature is suppressed, so that the cooling water temperature can be quickly reduced to the target temperature.

[0037] The setting of the judgment temperature levels A to E shown in Fig. 2 and the increase amount (decrease amount) of the cooling water pump 39 shown in Fig. 3 are examples, and they can be properly changed in accordance with the performance of the air conditioner 100 or the type of the cooling water pump 39. Furthermore, during cooling operation, the cooling water is circulated through only the radiator 20 on the main cooling path without being circulated through the auxiliary cooling

path, and the rotational number of the cooling water pump 39 is preferentially controlled to thereby carry out the control of keeping the cooling water temperature. At this time, only when the cooling water temperature is not increased even by the rotational number control of the cooling water pump 39, the cooling water is split to the auxiliary cooling path to promote the increase of the cooling water temperature.

[0038] As described above, according to this embodiment, the refrigerant circuit is provided with the auxiliary evaporator 15 in which the cooling water of the engine 31 is circulated, and also the cooling refrigerant circuit is provided with the main cooling path in which the cooling water passing through the engine 31 flows through the radiator 20 to the cooling water pump 39, the auxiliary cooling path in which the cooling water passing through the engine 31 passes through the auxiliary evaporator 15 and flows to the cooling water pump 39, and the electrically-operated three-way valve 39 for distributing the cooling water to the main cooling path and the auxiliary cooling path. When the cooling water temperature is lower than the target temperature, the electrically-operated three-way valve 37 is controlled on the basis of the temperature difference between the cooling water temperature and the target temperature, so that the cooling water are distributed to both the main cooling path and the auxiliary cooling path, or the overall amount of the cooling water is distributed to the auxiliary cooling path and the rotational number of the cooling water pump 39 is lowered. Therefore, the following effects can be achieved.

[0039] That is, the cooling water is distributed to the auxiliary cooling path having a smaller heat radiation amount than that of the main cooling path, and further the rotational number of the cooling pump 39 is reduced so that the flow amount of the cooling water is reduced. Therefore, the heat radiation amount in the radiator 20 is suppressed, and also the trap time of the cooling water in the engine 31 is lengthened, so that the heat withdrawing amount from the engine 31 is also increased. Therefore, the reduction of the heat radiation amount of the cooling water and the increase of the heating amount of the cooling water are promoted, so that the cooling water temperature can be quickly increased.

[0040] Particularly under warm-up operation or the like, the entire amount of the cooling water is distributed to the auxiliary cooling path to minimize the heat radiation of the cooling water, so that the cooling water temperature can be made to quickly reach the predetermined target temperature, and thus the time required until the warm-up operation is completed can be shortened.

[0041] Furthermore, after the warm-up operation is completed, even when the cooling water temperature is lowered by reducing the rotational number of the engine 31 or the like, the increase of the cooling water temperature can be promoted by reducing the rotational number of the cooling water pump 39. At this time, under heating operation, on the basis of the temperature difference between the cooling water temperature and the target tem-

perature, the cooling water is distributed to both the main cooling path and the auxiliary cooling path, or the entire amount of the cooling water is distributed to the auxiliary cooling path, whereby the heat radiation amount of the cooling water can be adjusted and the coolingwater temperature can be accurately controlled.

[0042] On the other hand, during cooling operation, in order to prevent the cooling power from being disturbed, the rotational number of the cooling water pump 39 is lowered while the entire amount of the cooling water is circulated through the radiator 20 of the main cooling path when the cooling water temperature is lowered, thereby promoting increase of the cooling water temperature. When the cooling water temperature is not promoted to increase, the coolingwater is also distributed to the auxiliary cooling passage to suppress the heat radiation amount of the cooling water, thereby promoting increase of the cooling water temperature.

[0043] As described above, according to this embodiment, the cooling water temperature can be controlled by both the distribution of the cooling water to the main cooling path and the auxiliary cooling path and the control of the rotational number of the cooling water pump 39, and no wax three-way value is not needed unlike the prior art, so that the cost can be suppressed.

[0044] Furthermore, according to this embodiment, when the water temperature of the cooling water is higher than the target temperature, the rotational number of the cooling water pump 39 is increased on the basis of the temperature difference between the cooling water temperature and the target temperature. Therefore, in addition to the increase of the temperature of the cooling water temperature, it is possible to suppress the increase of the temperature. Accordingly, the cooling water temperature can be kept to the target temperature.

[0045] According to this embodiment, the cooling water flowing through the auxiliary cooling path is split to the auxiliary cooling path, and the bypass 99 for making the cooling water bypass the auxiliary evaporator 15 is provided. Therefore, the heat radiation amount of the cooling water in the cooling path can be suppressed to the low level without increasing the pressure loss of the refrigerant, and the cooling water temperature can be quickly increased.

[0046] The present invention is not limited to the embodiment described above, and any modification may be made to the embodiment without departing from the subject matter of the present invention. For example, in the above embodiment, by providing the bypass pipe 99 to the auxiliary cooling path, the heat radiation amount of the cooling water in the auxiliary evaporator 15 is lowered. However, the present invention is not limited to this mode. For example, when the cooling water temperature is lower than the target temperature, the flow amount of the refrigerant flowing into the auxiliary evaporator 15 may be reduced by narrowing down the expansion valve 72, whereby the heat radiation amount of the cooling water in the auxiliary evaporator 15 is suppressed. Further-

more, the opening degree of the expansion valve 72 may be controlled in combination with the construction that the bypass pipe 99 is provided.

[0047] Furthermore, in the above-described embodiment, the AC pump is used as the cooling water pump 39 and the rotational amount of the cooling water pump 39 is controlled by the inverter 45. However, the present invention is not limited to this mode, and it may be modified so that a DC pump is used as the cooling water pump 39 and the rotational number is controlled by using no inverter 45.

[0048] Still furthermore, a plate type heat exchanger may be used as the auxiliary heat exchanger 15.

Claims

1. An air conditioner equipped with a refrigerant circuit including a compressor (11) driven by an engine (31), a four-way valve (13), an outdoor heat exchanger (19) and an indoor heat exchanger (7) which are connected to one another through a refrigerant pipe, and a cooling water circuit for feeding cooling water to the engine (31) through a cooling water pump (39) to cool the engine (31), wherein the refrigerant circuit is further equipped with an auxiliary evaporator (15) in which the cooling water for the engine (31) is circulated; the cooling water circuit is further equipped with a main cooling path through which the cooling water passing through the engine (31) flows back through the outdoor heat exchanger (19) to the cooling water pump (39), an auxiliary cooling path through which the cooling water passing through the engine (31) flows back through the auxiliary evaporator (15) to the cooling water pump (39), and an electrically-operated three-way valve (37) for distributing the cooling water to the main cooling path and the auxiliary cooling path; and there is provided a controller (61) for controlling the electrically-operated three-way valve (37) on the basis of the temperature difference between the water temperature of the cooling water and a target temperature so that the cooling water is distributed to both the main cooling path and the auxiliary cooling path or to only the auxiliary cooling path,
characterized in that
when the water temperature of the cooling water is lower than the target temperature, the controller (61) controls the electrically-operated three-way valve (37) so that the cooling water is distributed to only the auxiliary cooling path (95), and reduces the rotational number of the cooling water pump (39).
2. The air conditioner according to claim 1, wherein when the water temperature of the cooling water is higher than the target temperature, the controller increases the rotational number of the cooling water pump on the basis of the temperature difference be-

tween the temperature of the cooling water and the target temperature.

3. The air conditioner according to claim 1, wherein the auxiliary cooling path is further equipped with a bypass path (99) through which the cooling water flowing in the auxiliary cooling path is split so that the cooling water bypasses the auxiliary evaporator (15).
4. The air conditioner according to claim 1, wherein the refrigerant circuit is further equipped with an expansion valve (72) for varying the flow amount of refrigerant passing through the outdoor heat exchanger (19) and flowing into the auxiliary evaporator (15), and when the water temperature of the cooling water is lower than the target temperature, the controller (61) reduces the opening degree of the expansion valve (72) so that the flow amount of the refrigerant flowing into the auxiliary evaporator (15) is reduced.

Patentansprüche

1. Klimaanlage ausgerüstet mit einem Kältemittelkreislauf mit einem durch einen Motor (31) angetriebenen Verdichter (11), einem Vier-Wege-Ventil (13), einem Außenwärmetauscher (19) und einem Innenwärmetauscher (7), die durch eine Kältemittelleitung miteinander verbunden sind, und einem Kühlwasserkreislauf, um Kühlwasser durch eine Kühlwasserpumpe (39) zum Motor (31) zu leiten, um den Motor (31) zu kühlen, wobei der Kältemittelkreislauf weiterhin mit einem Hilfsverdampfer (15) ausgerüstet ist, in welchem das Kühlwasser für den Motor (31) umgewälzt wird; der Kühlwasserkreislauf weiterhin ausgerüstet ist mit einem Hauptkühlweg, durch welchen das durch den Motor (31) fließende Kühlwasser durch den Außenwärmetauscher (19) zur Kühlwasserpumpe (39) zurückfließt, einem Hilfskühlweg, durch welchen das durch den Motor (31) hindurchgehende Kühlwasser durch den Hilfsverdampfer (15) zur Kühlwasserpumpe (39) zurückfließt, und einem elektrisch betätigten Drei-Wege-Ventil (37) zum Verteilen des Kühlwassers auf den Hauptkühlweg und den Hilfskühlweg; und wobei eine Steuerung (31) zum Steuern des elektrisch betätigten Drei-Wege-Ventils (37) auf der Grundlage der Temperaturdifferenz zwischen der Wassertemperatur des Kühlwassers und einer Zieltemperatur vorgesehen ist, so dass das Kühlwasser sowohl auf den Hauptkühlweg als auch den Hilfskühlweg oder nur auf den Hilfskühlweg verteilt wird,
dadurch gekennzeichnet, dass
wenn die Wassertemperatur des Kühlwassers niedriger als die Zieltemperatur ist, die Steuerung (61) das elektrisch betätigte Drei-Wege-Ventil (37) so steuert, dass das Kühlwasser nur auf den Hilfskühl-

weg (95) verteilt wird und die Umdrehungszahl der Kühlwasserpumpe (39) verringert wird.

2. Klimaanlage nach Anspruch 1, wobei, wenn die Wassertemperatur des Kühlwassers höher als die Zieltemperatur ist, die Steuerung die Umdrehungszahl der Kühlwasserpumpe auf der Grundlage der Temperaturdifferenz zwischen der Temperatur des Kühlwassers und der Zieltemperatur erhöht. 5
3. Klimaanlage nach Anspruch 1, wobei der Hilfskühlweg weiterhin mit einer Nebenschlussleitung (99) versehen ist, durch welche das in den Hilfskühlweg fließende Wasser so geteilt wird, dass das Kühlwasser den Hilfsverdampfer (15) überbrückt. 10
4. Klimaanlage nach Anspruch 1, wobei der Kältemittelschaltkreis weiterhin mit einem Expansionsventil (72) ausgerüstet ist, um die Strömungsmenge des durch den Außenwärmetauscher (19) hindurchgehenden Kältemittels zu variieren und in den Hilfsverdampfer (15) fließen zu lassen, und, wenn die Wassertemperatur des Kühlwassers niedriger als die Zieltemperatur ist, die Steuerung (61) den Öffnungsgrad des Expansionsventils (72) so reduziert, dass die Strömungsmenge des in den Hilfsverdampfer (15) fließenden Kältemittels reduziert wird. 15

Revendications

1. Climatiseur équipé d'un circuit de réfrigération comprenant un compresseur (11) entraîné par un moteur (31), une vanne à quatre voies (13), un échangeur de chaleur extérieur (19) et un échangeur de chaleur intérieur (7) qui sont reliés les uns aux autres par un conduit de fluide frigorigène, et d'un circuit d'eau de refroidissement pour amener de l'eau de refroidissement au moteur (31) au moyen d'une pompe d'eau de refroidissement (39) afin de refroidir le moteur (31), dans lequel le circuit de fluide frigorigène est en outre équipé d'un évaporateur auxiliaire (15) dans lequel on fait circuler l'eau de refroidissement pour le moteur (31) ; le circuit d'eau de refroidissement est en outre équipé d'un chemin de refroidissement principal par lequel l'eau de refroidissement qui traverse le moteur (31) revient par l'intermédiaire de l'échangeur de chaleur extérieur (19) à la pompe à eau de refroidissement (39), d'un chemin de refroidissement auxiliaire par lequel l'eau froide traversant le moteur (31) revient par l'intermédiaire de l'évaporateur auxiliaire (15) à la pompe d'eau de refroidissement (39), et d'une électrovanne à trois voies (37) pour aiguiller l'eau de refroidissement vers le chemin de refroidissement principal et le chemin de refroidissement auxiliaire ; et il est prévu une unité de commande (61) pour commander l'électrovanne à trois voies (37) sur la base de la différence de tem- 30

pérature entre la température d'eau de l'eau de refroidissement et une température de consigne de sorte que l'eau de refroidissement soit distribuée à la fois au chemin de refroidissement principal et au chemin de refroidissement auxiliaire ou seulement au chemin de refroidissement auxiliaire, **caractérisé en ce que**

lorsque la température d'eau de l'eau de refroidissement est inférieure à la température de consigne, l'unité de commande (62) commande l'électrovanne à trois voies (37) de sorte que l'eau de refroidissement soit distribuée seulement au chemin de refroidissement auxiliaire (95), et elle réduit la vitesse de rotation de la pompe d'eau de refroidissement (39).

2. Climatiseur selon la revendication 1, dans lequel, lorsque la température d'eau de l'eau de refroidissement est supérieure à la température de consigne, l'unité de commande augmente la vitesse de rotation de la pompe à eau de refroidissement sur la base de la différence de température entre la température de l'eau de refroidissement et la température de consigne. 20
3. Climatiseur selon la revendication 1, dans lequel le chemin de refroidissement auxiliaire est en outre équipé d'un chemin de contournement (99) par lequel l'eau de refroidissement circulant dans le chemin de refroidissement auxiliaire est divisée de sorte que l'eau de refroidissement contourne l'évaporateur auxiliaire (15) 25
4. Climatiseur selon la revendication 1, dans lequel le circuit de fluide frigorigène est en outre équipé d'une vanne de détente (72) pour modifier le débit de fluide frigorigène traversant l'échangeur de chaleur extérieur (19) et circulant dans l'évaporateur auxiliaire (15), et, lorsque la température d'eau de l'eau de refroidissement est inférieure à la température de consigne, l'unité de commande (61) réduit le degré d'ouverture de la vanne de détente (72) de sorte que le débit du fluide frigorigène circulant dans l'évaporateur auxiliaire (15) soit réduit. 30

FIG. 1

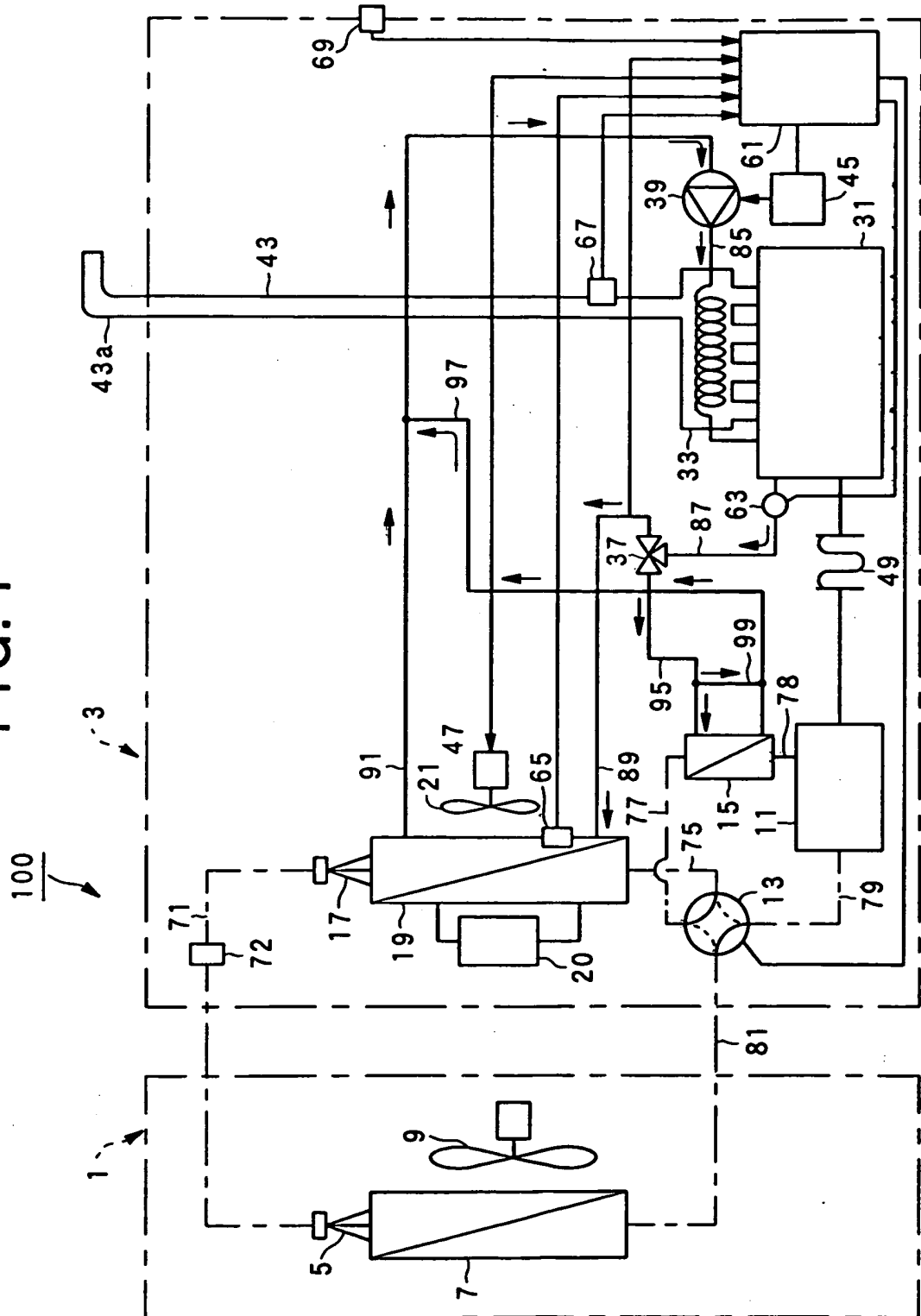
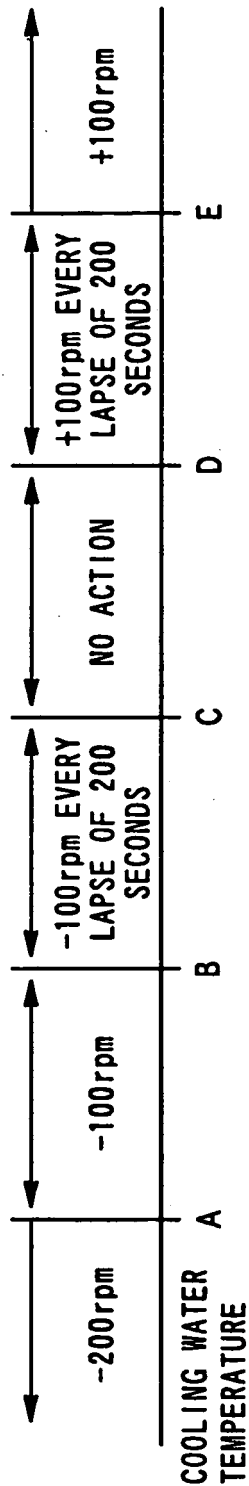


FIG. 2

JUDGMENT TEMPERATURE [°C]	A	B	C	D	E
COOLING	TARGET TEMP. -10	TARGET TEMP. -2	TARGET TEMP.	TARGET TEMP. +10	TARGET TEMP. +20
HEATING (OUTSIDE TEMP. >5°C)	TARGET TEMP. -10	TARGET TEMP. -2	TARGET TEMP.	TARGET TEMP. +10	TARGET TEMP. +20
HEATING (OTHER THAN DESCRIBED ABOVE)	TARGET TEMP. -10	TARGET TEMP. -5	TARGET TEMP. -2	TARGET TEMP.	TARGET TEMP. +10

FIG. 3



REFERENCES CITED IN THE DESCRIPTION

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