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(54) AIR CONDITIONER SYSTEM

KLIMAANLAGENSYSTEM

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Description

FIELD OF THE INVENTION

[0001] The present invention belongs to the technical field of air conditioners, and particularly relates to an air conditioner system.

BACKGROUND OF THE INVENTION

[0002] An existing air conditioner system usually consists of a condenser, a throttling device, an evaporator, and a compressor to form a cooling/heating circulating loop. A high-temperature and high-pressure gaseous refrigerant discharged from the compressor is condensed into low-temperature and high-pressure liquid in the condenser, and is throttled into low-temperature and low-pressure liquid through the throttling device. Then, the liquid enters the evaporator to absorb heat and be evaporated, thus completing one cooling/heating cycle.

[0003] Prior art document CN 106796045 (A) discloses an air conditioning system (100) according to the preamble of claim 1, with an internal heat exchanger (20) for exchanging heat between a refrigerant flowing through refrigerant piping between an outdoor heat exchanger (3) and an expansion device (4), and a refrigerant flowing through refrigerant piping between the expansion device (4) and an indoor heat exchanger (5), a pressure detection device (31), a first temperature detection device (32) for detecting the temperature of a refrigerant flowing into the expansion device (4) during cooling operation, and a control unit (51) configured so that, during cooling operation, the control unit (51) controls the degree of opening of the expansion device (4) on the basis of the results of detection by the pressure detection device (31) and the first temperature detection device (32).

[0004] When an air conditioner is in heating operation, the high-temperature and high-pressure gaseous refrigerant exchanges heat through the condenser to form a low-temperature and high-pressure liquid refrigerant, and then the low-temperature and high-pressure liquid refrigerant is throttled through the throttling device for pressure reduction to form a low-temperature and low-pressure gas-liquid two-phase region refrigerant which enters the evaporator to exchange heat. If the evaporation area is larger, the relative evaporation capacity is higher. The low-temperature and high-pressure liquid refrigerant will increase the degree of supercooling if it continues to release heat, thereby improving the cooling and heating capacities of the system cycle. During heat exchange of the refrigerant, more than 95% of the heat exchange amount is from the latent heat of vaporization in a two-phase region of the refrigerant, while the isobaric specific heat capacity of a one-way region (pure liquid, pure gas) is relatively small, and the heat exchange amount accounts for a small proportion of the total system cycle. In addition, a large pressure drop of the gaseous refrigerant in a pipeline is a main cause of pressure loss in the system cycle, which will increase the work amount in the cycle, i.e., increase the energy consumption of the system cycle.

[0005] In addition, referring to FIG. 3, FIG. 3 is a schematic diagram of a cycle during heating operation of a traditional air conditioner. As shown in FIG. 3, an actual operation temperature point of the air conditioner for the heating operation is generally that: at point A, a high-temperature (70°C) gaseous refrigerant enters an indoor heat exchanger and an indoor environment being 20°C for heat exchange. After the temperature is reduced to 30°C, the high-temperature gaseous refrigerant flows through an online pipe, and then enters the throttling device. The temperature (about 30°C) between point B and the throttling device is much higher than the temperature (7°C) of an outdoor environment, so after heat is wasted. If the after heat is absorbed and used, the degree of supercooling of the system cycle would be increased.

[0006] Based on this, the present invention is proposed.

BRIEF DESCRIPTION OF THE INVENTION

[0007] In order to solve the above problem in the prior art, i.e., in order to enhance the heating cycle effect of an air conditioner, an air conditioner system according to the present invention comprises the features of claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a schematic structure diagram of embodiment I of an air conditioner system not according to the present invention.

FIG. 2 is a schematic structure diagram of embodiment II of an air conditioner system of the present invention.

FIG. 3 is a schematic diagram of a cycle during heating operation of a traditional air conditioner.

DETAILED DESCRIPTION

[0009] In order to make the embodiments, technical solutions and advantages of the present invention clearer, the technical solution of the present invention will be described clearly and completely below in combination with the drawings. However, the claimed subject-matter is defined by the independent claim 1 only. Preferred embodiments are defined by the dependent claims 1 and 2.

[0010] Firstly, referring to FIG. 1, FIG. 1 is a schematic structure diagram of embodiment I of an air conditioner system not according to the present invention. As shown in FIG. 1, the air conditioner system includes a compressor 1, an indoor heat exchanger 2, a first throttling device 3, and an outdoor heat exchanger 4 which are connected in series in a main loop. A heat exchanger 5 is further

disposed in the main loop. For the sake of illustration, a pipeline between the first throttling device 3 and the indoor heat exchanger 2 is used as a first pipeline M, and a pipeline between the first throttling device 3 and the outdoor heat exchanger 4 is used as a second pipeline N. One side of the heat exchanger 5 is connected with the first pipeline M, and the other side of the heat exchanger 5 is connected with the second pipeline N. A connection mode as shown in FIG. 1 is that: the first pipeline M passes through one side of the heat exchanger 5, and the second pipeline N passes through the other side of the heat exchanger N. Furthermore, a refrigerant passing through the first pipeline M and a refrigerant passing through the second pipeline N may exchange heat in the heat exchanger 5. In addition, in the air conditioner system of the present invention, a bypass defrosting loop P is further disposed between the compressor 1 and the outdoor heat exchanger 4. The bypass defrosting loop P is used for defrosting the outdoor heat exchanger 4 in a heating cycle process of an air conditioner.

[0011] As shown in FIG. 1, a throttling valve 7 is disposed on the bypass defrosting loop P. When the outdoor heat exchanger 4 needs to be defrosted, the throttling valve 7 is opened to enable the refrigerant to defrost the outdoor heat exchanger 4 through the bypass defrosting loop P. When the outdoor heat exchanger 4 does not need to be defrosted, the throttling valve 7 is closed. By adding the bypass defrosting loop P, in the defrosting process of the air conditioner, the refrigerant would continue to enter the indoor heat exchanger 2 for heating, i.e., the refrigerant may enable the air conditioner to be still maintained in a heating working condition, thus achieving the objective of non-stop defrosting of the air conditioner.

[0012] In the heating cycle process of the air conditioner, a high-temperature and high-pressure gaseous refrigerant discharged from the compressor 1 flows to the indoor heat exchanger 2 to exchange heat in the indoor heat exchanger 2, and then becomes a low-temperature and high-pressure liquid refrigerant. The refrigerant reaches a point C along the first pipeline M. At this time, the temperature of the refrigerant is about 20°C (the heat here is after heat which is not fully used). Then, the refrigerant enters the second pipeline N after being throttled by the first throttling device 3. At this time, the temperature of the refrigerant at a point D (the throttled refrigerant) is about 5°C. Since the refrigerant in the first pipeline M and the refrigerant in the second pipeline N have a temperature difference, and the two refrigerants both pass through the heat exchanger 5. In this way, the refrigerant in the first pipeline M and the refrigerant in the second pipeline N exchange heat in the heat exchanger 5, thereby not only effectively increasing the degree of supercooling of the refrigerant in the first pipeline M (i.e., the refrigerant from the point C to the first throttling device 3 continues to release heat for cooling), but also promoting the evaporation of the refrigerant in the second pipeline N (i.e., the low-temperature refrigerant at the point D may be evaporated to absorb the after heat at the point C, and this is equivalent to enlarging the evaporation area, which effectively improves the heat exchange capacity), thus improving the heating capacity of the system.

[0013] In the heating operation process of the air conditioner, the refrigerant in the first pipeline M exchanges heat in the heat exchanger 5, then enters the first throttling device 3, so as to form a low-temperature and low-pressure gas-liquid two-phase region at the point D, and flows back to the compressor 1 through the outdoor heat exchanger 4. Through the above design, in the heating operation process of the air conditioner, the after heat may be reused to improve the heating capacity of the whole system.

[0014] It should be noted that the heat exchanger 5 above may be a water tank with water, or may be in any other suitable forms, as long as the refrigerants at the upper reach and the lower reach of the first throttling device 3 may exchange heat. In addition, the foregoing design may effectively improve the heating capacity for a heating cycle, and may lower the cooling capacity for a cooling cycle.

[0015] The mode switching device is used for switching the air conditioner system between a cooling mode and a heating mode.

[0016] As an example, referring to FIG. 2, FIG. 2 is a schematic structure diagram of embodiment II of an air conditioner system of the present invention. As shown in FIG. 2, a second throttling device 6 is further disposed in the main loop of the air conditioner system of the present invention, and is located in a zone of the first pipeline M between the heat exchanger 5 and the indoor heat exchanger 2. When the air conditioner is in heating operation, the second throttling device 6 is in a full open state, and the first throttling device 3 is used for throttling the refrigerant. At this time, the principle is the same as the principle of the air conditioner system in embodiment I. When the air conditioner system is switched into cooling operation through the four-way valve Q, the first throttling device 3 is in a full open state, and the second throttling device 6 is used for throttling the refrigerant. At this time, the refrigerants on two sides of the heat exchanger 5 nearly have no temperature difference. That is, the heat exchanger 5 does not exert the effect in the cooling cycle process. The whole cooling cycle is a conventional cooling cycle, thereby avoiding the lowering of the cooling capacity during the cooling operation.

[0017] Preferably, referring to FIG. 2, the compressor 1 is provided with a gas-liquid separator 11. A gaseous refrigerant entering the compressor 1 firstly passes through the gas-liquid separator 11, and then is absorbed by the compressor, so as to start the next cycle.

[0018] Based on the above, the heat exchanger is added in the air conditioner system of the present invention, and the two sides of the heat exchanger are connected with the first pipeline and the second pipeline. In this way, the refrigerant in the first pipeline and the refrigerant in the second pipeline may exchange heat in the heat ex-

changer, thereby effectively increasing the degree of supercooling of the refrigerant in the first pipeline and promoting the evaporation of the refrigerant in the second pipeline, thus improving the heating capacity of the system. The bypass defrosting loop is further added in the present invention. In the defrosting process of the air conditioner, the refrigerant would continue to enter the indoor heat exchanger for heating, i.e., the refrigerant may enable the air conditioner to be still maintained in a heating working condition, thus achieving the objective of non-stop defrosting of the air conditioner. In addition, by means of arranging the second throttling device in the present invention, when the air conditioner is switched into the cooling mode, the second throttling device is used to replace the first throttling device (at this time, the first throttling device is in the full open state) to throttle the refrigerant, thereby avoiding the phenomenon of the lowering of the cooling capacity in the cooling cycle.

Claims

1. An air conditioner system, comprising a compressor (1), an indoor heat exchanger (2), a first throttling device (3), and an outdoor heat exchanger (4) connected in series in a main loop,

   wherein a heat exchanger (5) is further disposed in the main loop, one side of the heat exchanger (5) being connected with a first pipeline (M) between the first throttling device (3) and the indoor heat exchanger (2), and an other side of the heat exchanger (5) being connected with a second pipeline (N) between the first throttling device (3) and the outdoor heat exchanger (4), so that a refrigerant passing through the first pipeline and a refrigerant passing through the second pipeline exchange heat in the heat exchanger,
   wherein the first pipeline (M) passes through one side of the heat exchanger, and
   the second pipeline (N) passes through the other side of the heat exchanger (5),
   wherein the air conditioner system further comprises a mode switching device being a four-way valve (Q), **characterized in that**
   a bypass defrosting loop (P) is disposed between the compressor and the outdoor heat exchanger, being configured to defrost the outdoor heat exchanger in a heating process of the air conditioner system,
   wherein a second throttling device (6) is further disposed in the main loop, and is located in a zone of the first pipeline between the heat exchanger and the indoor heat exchanger, and
   the mode switching device is configured to switch the air conditioner system between a cooling mode where the first throttling device (3) is in a full open state and the second throttling device (6) is configured to throttle the refrigerant, and a heating mode where the second throttling device (6) is in a full open state and the first throttling device (3) is configured to throttle the refrigerant.

2. The air conditioner system according to claim 1, wherein a throttling valve (7) is disposed in the bypass defrosting loop, and is configured such that:

   when the outdoor heat exchanger needs to be defrosted, the throttling valve is opened to enable the refrigerant flowing out of the compressor to defrost the outdoor heat exchanger through the bypass defrosting loop; and
   when the outdoor heat exchanger does not need to be defrosted, the throttling valve is closed.

3. The air conditioner system according to any one of claims 1 to 2, wherein the compressor is provided with a gas-liquid separator (11), and the refrigerant flows back into the compressor after passing through the gas-liquid separator.

Patentansprüche

1. Klimaanlagensystem, umfassend einen Kompressor (1), einen Innenraum-Wärmetauscher (2), eine erste Drosseleinrichtung (3) und einen Außenraum-Wärmetauscher (4), die in einer Hauptschleife in Reihe geschaltet sind,

   wobei ferner ein Wärmetauscher (5) in der Hauptschleife angeordnet ist, wobei eine Seite des Wärmetauschers (5) mit einer ersten Leitung (M) zwischen der ersten Drosseleinrichtung (3) und dem Innenraum-Wärmetauscher (2) verbunden ist und eine andere Seite des Wärmetauschers (5) mit einer zweiten Leitung (N) zwischen der ersten Drosseleinrichtung (3) und dem Außenraum-Wärmetauscher (4) verbunden ist, sodass ein Kältemittel, das durch die erste Leitung fließt, und ein Kältemittel, das durch die zweite Leitung fließt, im Wärmetauscher Wärme austauschen,
   wobei die erste Leitung (M) eine Seite des Wärmetauschers durchläuft und die zweite Leitung (N) die andere Seite des Wärmetauschers (5) durchläuft,
   wobei das Klimaanlagensystem ferner eine Moduswechseleinrichtung umfasst, die ein Vierwegeventil (Q) ist, **dadurch gekennzeichnet, dass** eine Umgehungs-Abtauschleife (P) zwischen dem Kompressor und dem Außenraum-Wärmetauscher angeordnet ist, die dazu eingerichtet ist, den Außenraum-Wärmetauscher in einem Heizvorgang des Klimaanlagensystems

abzutauen,
wobei ferner eine zweite Drosseleinrichtung (6) in der Hauptschleife angeordnet ist und sich in einem Bereich der ersten Leitung zwischen dem Wärmetauscher und dem Innenraum-Wärmetauscher befindet und
die Moduswechseleinrichtung dazu eingerichtet ist, das Klimaanlagensystem zwischen einem Kühlmodus, in dem die erste Drosseleinrichtung (3) in einem vollständig geöffneten Zustand ist und die zweite Drosseleinrichtung (6) dazu eingerichtet ist, das Kältemittel zu drosseln, und einem Heizmodus, in dem die zweite Drosseleinrichtung (6) in einem vollständig geöffneten Zustand ist und die erste Drosseleinrichtung (3) dazu eingerichtet ist, das Kältemittel zu drosseln.

2. Klimaanlagensystem nach Anspruch 1, wobei ein Drosselventil (7) in der Umgehungs-Abtauschleife angeordnet ist und derart eingerichtet ist, dass:

wenn ein Abtauen des Außenraum-Wärmetauschers nötig ist, das Drosselventil geöffnet wird, um dem Kältemittel, das aus dem Kompressor fließt, zu ermöglichen, den Außenraum-Wärmetauscher durch die Umgehungs-Abtauschleife abzutauen; und,
wenn kein Abtauen des Außenraum-Wärmetauschers nötig ist, das Drosselventil geschlossen ist.

3. Klimaanlagensystem nach einem der Ansprüche 1 bis 2, wobei der Kompressor mit einem Gas-Flüssigkeit-Trenner (11) versehen ist und das Kältemittel nach dem Durchlaufen des Gas-Flüssigkeit-Trenners zurück in den Kompressor fließt.

Revendications

1. Un système de climatiseur, comprenant un compresseur (1), un échangeur de chaleur intérieur (2), un premier dispositif d'étranglement (3), et un échangeur de chaleur extérieur (4) reliés en série dans une boucle principale,

dans lequel un échangeur de chaleur (5) est en outre disposé dans la boucle principale, un côté de l'échangeur de chaleur (5) étant relié à une première conduite (M) entre un premier dispositif d'étranglement (3) et l'échangeur de chaleur intérieur (2), et un autre côté de l'échangeur de chaleur (5) étant relié à une deuxième conduite (N) entre le premier dispositif d'étranglement (3) et l'échangeur de chaleur extérieur (4), de telle sorte qu'un fluide frigorigène passant par la première conduite et un fluide frigorigène passant par la deuxième conduite échangent de la chaleur dans l'échangeur de chaleur,
dans lequel la première conduite (M) traverse un côté de l'échangeur de chaleur, et la deuxième conduite (N) traverse l'autre côté de l'échangeur de chaleur (5),
dans lequel le système de climatiseur comprend en outre un dispositif de commutation de mode étant une vanne à quatre voies (Q), **caractérisé en ce que**
une boucle de dégivrage de dérivation (P) est disposée entre le compresseur et l'échangeur de chaleur extérieure, étant conçue pour dégivrer l'échangeur de chaleur extérieur dans un processus de chauffage du système de climatiseur,
dans lequel un deuxième dispositif d'étranglement (6) est en outre disposé dans la boucle principale, et est situé dans une zone de la première conduite entre l'échangeur de chaleur et l'échangeur de chaleur intérieur, et
le dispositif de commutation de mode est conçu pour basculer le système de climatiseur entre un mode de refroidissement où le premier dispositif d'étranglement (3)

est dans un état complètement ouvert et le deuxième dispositif d'étranglement (6) est configuré de manière à réguler le fluide frigorigène, et un mode de chauffage où le deuxième dispositif d'étranglement (6) est dans un état complètement ouvert et le premier
dispositif d'étranglement (3) est configuré de manière à réguler le fluide frigorigène.

2. Le système de climatiseur selon la revendication 1, dans lequel une vanne d'étranglement (7) est disposée dans la boucle de dégivrage de dérivation, et est conçue de sorte que :

lorsque l'échangeur de chaleur extérieur doit être dégivré, la vanne d'étranglement est ouverte pour permettre au fluide frigorigène sortant du compresseur de dégivrer l'échangeur de chaleur extérieur par la boucle de dégivrage de dérivation; et
lorsque l'échangeur de chaleur extérieur n'a pas besoin d'être dégivré, la vanne d'étranglement est fermée.

3. Le système de climatiseur selon l'une quelconque des revendications 1 à 2, dans lequel le compresseur est pourvu d'un séparateur gaz-liquide (11), et le fluide frigorigène retourne dans le compresseur après avoir traversé le séparateur gaz-liquide.

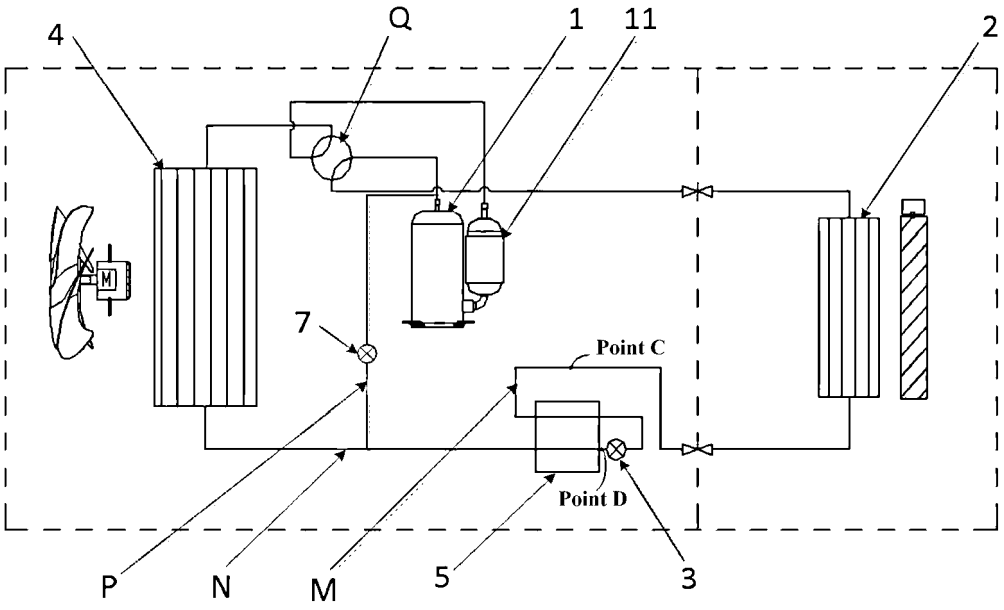


Fig. 1

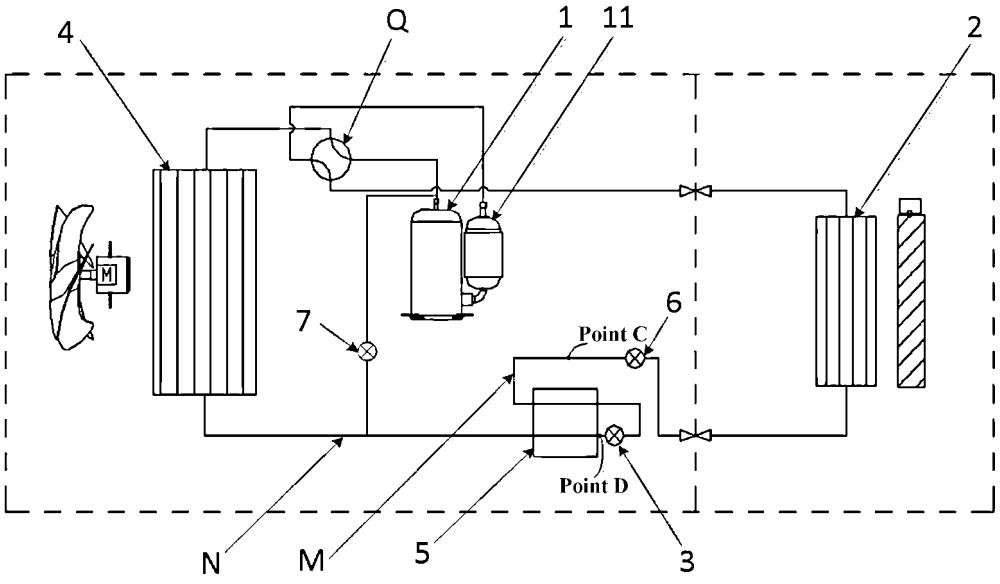


Fig. 2

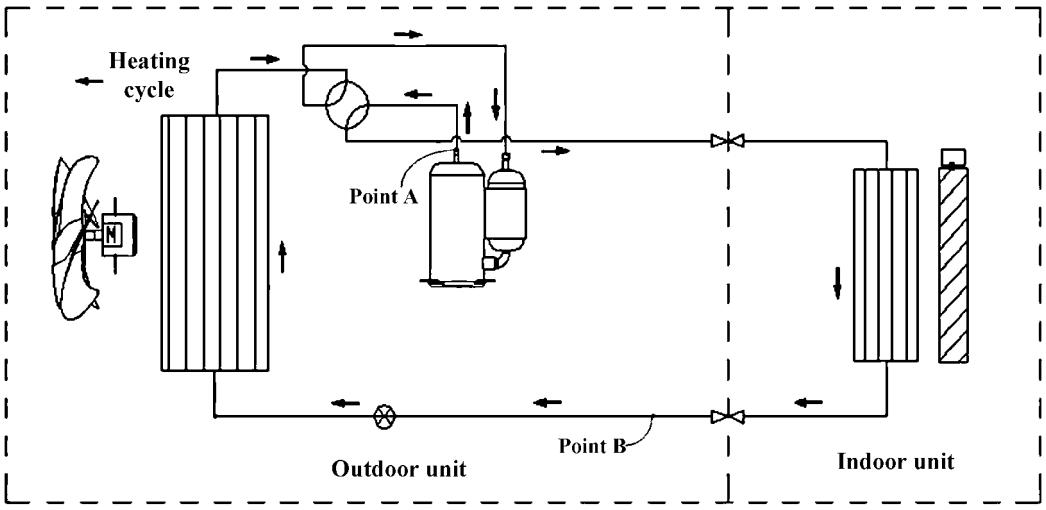


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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