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(72) Inventors:
• **WANG, Fei**
Qingdao, Shandong 266101 (CN)
• **FU, Yu**
Qingdao, Shandong 266101 (CN)
• **LUO, Rongbang**
Qingdao, Shandong 266101 (CN)
• **XU, Wenming**
Qingdao, Shandong 266101 (CN)

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(71) Applicant: **Qingdao Haier Air Conditioner General Corp., Ltd.**
Qingdao, Shandong 266101 (CN)

(74) Representative: **Ziebig & Hengelhaupt Patent- und Rechtsanwaltskanzlei PartG mbB**
Leipziger Straße 49
10117 Berlin (DE)

(54) **AIR CONDITIONER SYSTEM**

(57) An air conditioner system, comprising: connected in series in a main loop, a compressor (1), an indoor heat exchanger (2), a first throttling device (3), and an outdoor heat exchanger (4). A heat exchanger (5) is further disposed in the main loop, and a bypass defrosting loop (P) is disposed between the compressor (1) and the outdoor heat exchanger (4). One side of the heat exchanger (5) is connected with a first pipeline (M) between the first throttling device (3) and the indoor heat exchanger (2); and the other side of the heat exchanger (5) is connected with a second pipeline (N) between the first

throttling device (3) and the outdoor heat exchanger (4). Heat exchange can be performed in the heat exchanger (5) by means of refrigerants in the first pipeline (M) and the second pipeline (N). The bypass defrosting loop (P) is used for defrosting the outdoor heat exchanger (4) in an air conditioner heating process. Therefore, the super-cooling degree of the refrigerants in the first pipeline (M) is effectively increased and the evaporation of the refrigerants in the second pipeline (N) can be promoted, thus increasing the produced heat amount of the system and realizing the purpose of non-stop defrosting.

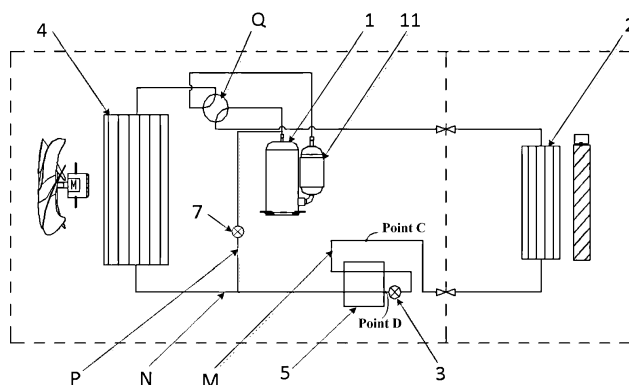


Fig. 1

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] 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.

[0004] 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.

[0005] Based on this, the present invention is proposed.

BRIEF DESCRIPTION OF THE INVENTION

[0006] 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 provided by the present invention includes a compressor, an indoor heat exchanger, a first throttling device, and an outdoor heat exchanger which are connected in series in a main loop. A heat exchanger is further disposed in the main loop, and a bypass defrosting loop is disposed between the compressor and the outdoor heat exchanger. One side of the heat exchanger is connected with a first pipeline between the first throttling device and the indoor heat exchanger, and the other side of the heat exchanger is connected with a second pipeline between the first throttling device and the outdoor heat exchanger. A refrigerant passing through the first pipeline and a refrigerant passing through the second pipeline may exchange heat in the heat exchanger. The bypass defrosting loop is used for defrosting the outdoor heat exchanger in a heating process of the air conditioner.

[0007] In an exemplary implementation mode of the above air conditioner system, the first pipeline passes through one side of the heat exchanger, and/or the second pipeline passes through the other side of the heat exchanger.

[0008] In an exemplary implementation mode of the above air conditioner system, a second throttling device 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.

[0009] In an exemplary implementation mode of the above air conditioner system, when the air conditioner system is in heating operation, the second throttling device is in a full open state, and the first throttling device is used for throttling the refrigerant.

[0010] In an exemplary implementation mode of the above air conditioner system, when the air conditioner system is in cooling operation, the first throttling device is in a full open state, and the second throttling device is used for throttling the refrigerant.

[0011] In an exemplary implementation mode of the above air conditioner system, a throttling valve is disposed in the bypass defrosting loop. 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. When the outdoor heat exchanger does not need to be defrosted, the throttling valve is closed.

[0012] In an exemplary implementation mode of the above air conditioner system, the compressor is provided with a gas-liquid separator, and the refrigerant flows back

into the compressor after passing through the gas-liquid separator.

[0013] In an exemplary implementation mode of the above air conditioner system, the air conditioner system further includes a mode switching device. The mode switching device is used for switching the air conditioner system between a cooling mode and a heating mode.

[0014] In an exemplary implementation mode of the above air conditioner system, the mode switching device is a four-way valve.

[0015] In the technical solution of the present invention, the heat exchanger is added in the air conditioner system, and 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 exchanger, 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. Furthermore, 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, according to the air conditioner of the present invention, by means of arranging the second throttling device, 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a schematic structure diagram of embodiment I of an air conditioner system of 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

[0017] 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. Obviously, the embodiments are parts of the embodiments of the present invention, not all the embodiments. Those skilled in the art should understand

that these implementation modes are only used to explain the technical principle of the present invention, and not intended to limit the protection scope of the present invention.

[0018] Firstly, referring to FIG. 1, FIG. 1 is a schematic structure diagram of embodiment I of an air conditioner system of the present invention. As shown in FIG. 1, the air conditioner system of the present invention 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.

[0019] As an example, 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] As an example, the air conditioner system of the present invention further includes a mode switching device (a four-way valve Q in FIG. 1). The mode switching device is used for switching the air conditioner system between a cooling mode and a heating mode.

[0024] 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 cool-

ing cycle, thereby avoiding the lowering of the cooling capacity during the cooling operation.

[0025] Preferably, referring to FIG. 1 and 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.

[0026] 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 exchanger, 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.

[0027] So far, the technical solution of the present invention has been described with reference to the exemplary implementation modes shown in the drawings. However, those skilled in the art can easily understand that the protection scope of the present invention is obviously not limited to these specific implementation modes. Those skilled in the art can make equivalent changes or replacements to related technical features without departing from the principle of the present invention, and these changed or replaced technical solutions will all fall within the protection scope of the present invention.

Claims

1. An air conditioner system, comprising a compressor, an indoor heat exchanger, a first throttling device, and an outdoor heat exchanger connected in series in a main loop, wherein a heat exchanger is further disposed in the main loop, and a bypass defrosting loop is disposed between the compressor and the outdoor heat exchanger; one side of the heat exchanger is connected with a first pipeline between the first throttling device and the indoor heat exchanger, and an other side of the

heat exchanger is connected with a second pipeline between the first throttling device and the outdoor heat exchanger, so that a refrigerant passing through the first pipeline and a refrigerant passing through the second pipeline may exchange heat in the heat exchanger; and
the bypass defrosting loop is configured to defrost the outdoor heat exchanger in a heating process of an air conditioner.

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2. The air conditioner system according to claim 1, wherein the first pipeline passes through one side of the heat exchanger, and/or the second pipeline passes through the other side of the heat exchanger.

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3. The air conditioner system according to claim 2, wherein a second throttling device 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.

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4. The air conditioner system according to claim 3, wherein when the air conditioner system is in heating operation, the second throttling device is in a full open state, and the first throttling device is configured to throttle the refrigerant.

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5. The air conditioner system according to claim 3, wherein when the air conditioner system is in cooling operation, the first throttling device is in a full open state, and the second throttling device is configured to throttle the refrigerant.

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

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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.

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7. The air conditioner system according to any one of claims 1 to 6, wherein the compressor is provided with a gas-liquid separator, and the refrigerant flows back into the compressor after passing through the gas-liquid separator.

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8. The air conditioner system according to any one of claims 1 to 6, wherein the air conditioner system further comprises a mode switching device; and the mode switching device is configured to switch the air conditioner system between a cooling mode and a heating mode.

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9. The air conditioner system according to claim 8, wherein the mode switching device is a four-way valve.

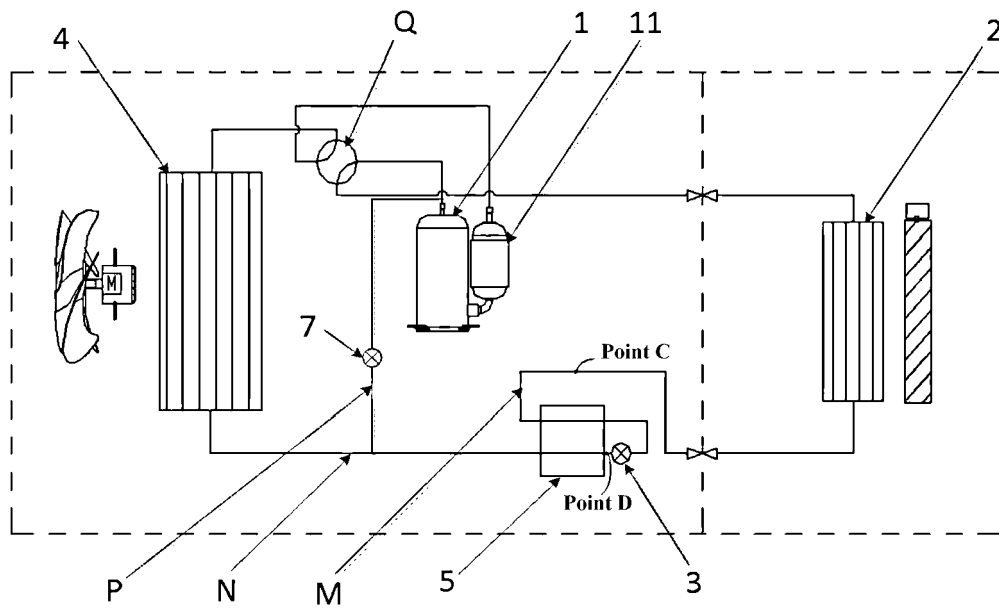


Fig. 1

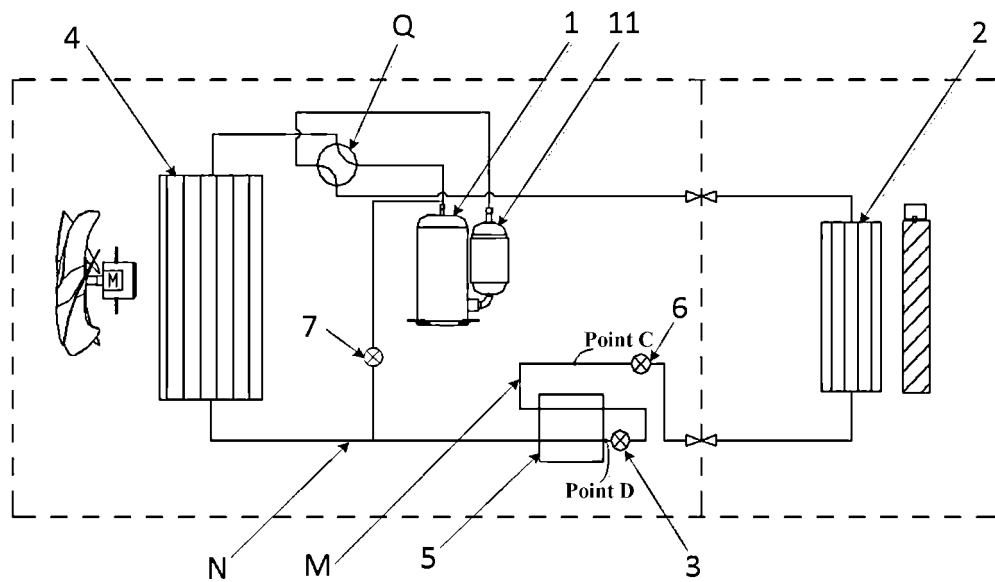


Fig. 2

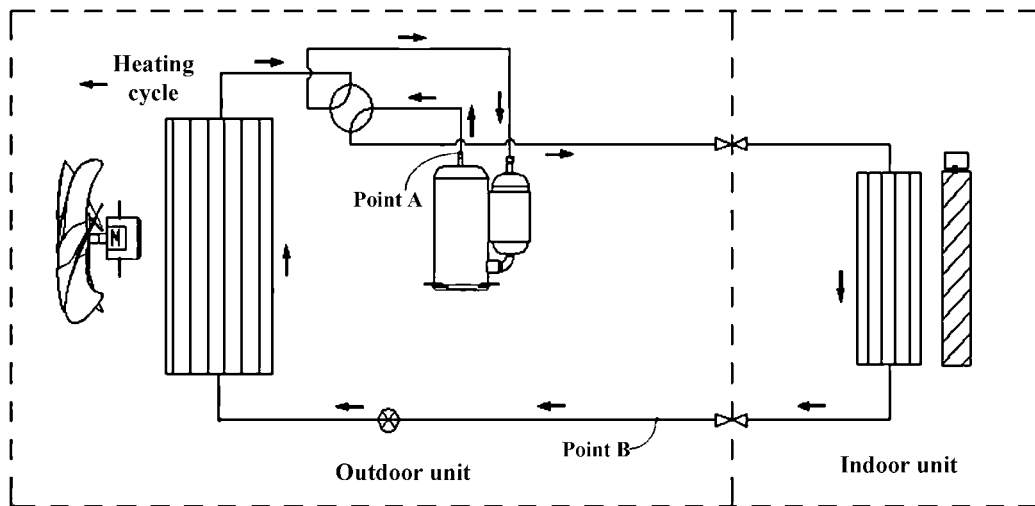


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/115749

A. CLASSIFICATION OF SUBJECT MATTER F25B 40/02(2006.01)i; F25B 47/02(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F25B 40; F25B 47 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNKI; VEN; CNABS; 换热, 热交换, 过冷, 压缩, 除霜, 旁通, heat exchanger, supercool+, overcool+, frost, bypass	
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Date of the actual completion of the international search 16 January 2019		Date of mailing of the international search report 30 January 2019
Name and mailing address of the ISA/CN National Intellectual Property Administration, PRC (ISA/CN) No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451		Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

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