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(54) HEAT EXCHANGE SYSTEM AND HEAT EXCHANGE METHOD

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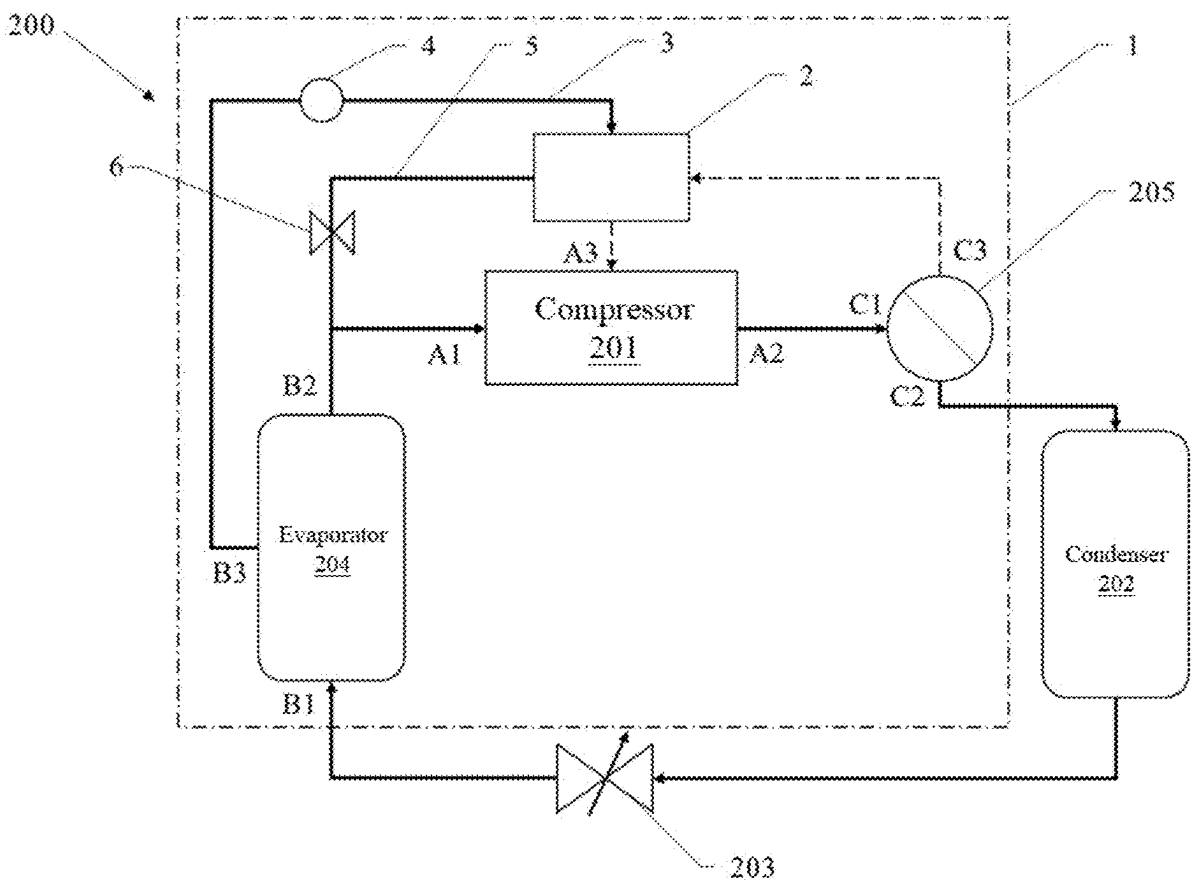
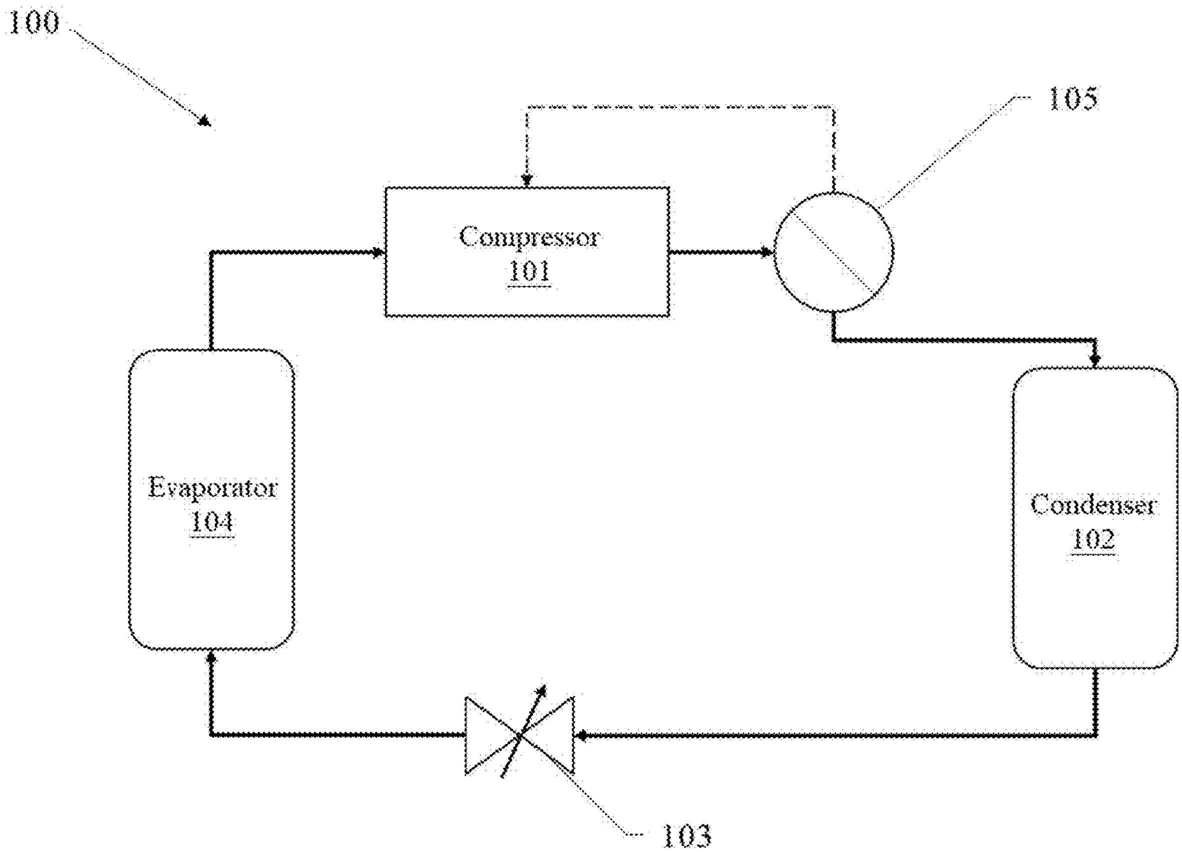
(57) **ABSTRACT**

The disclosure relates to the technical field of refrigeration, in particular to a heat exchange system and a heat exchange method. The heat exchange system can increase the suction/discharge superheat of a refrigerant and decrease the temperature of lubricating oil, thus improving the viscosity and lubrication performance of the lubricating oil; and the heat exchange system has a low cost, a simple structure and a small size and is suitable for different types of refrigeration systems. The heat exchange system comprises a compressor, an evaporator, a heat exchanger, an inlet line, a first regulating device and an outlet line. A heat exchange line is arranged in the heat exchanger, the inlet line is connected to the evaporator and the heat exchange line, the first regulating device is arranged on the inlet line and the outlet line is connected to a suction inlet of the compressor and the heat exchange line.





Prior Art

FIG. 1

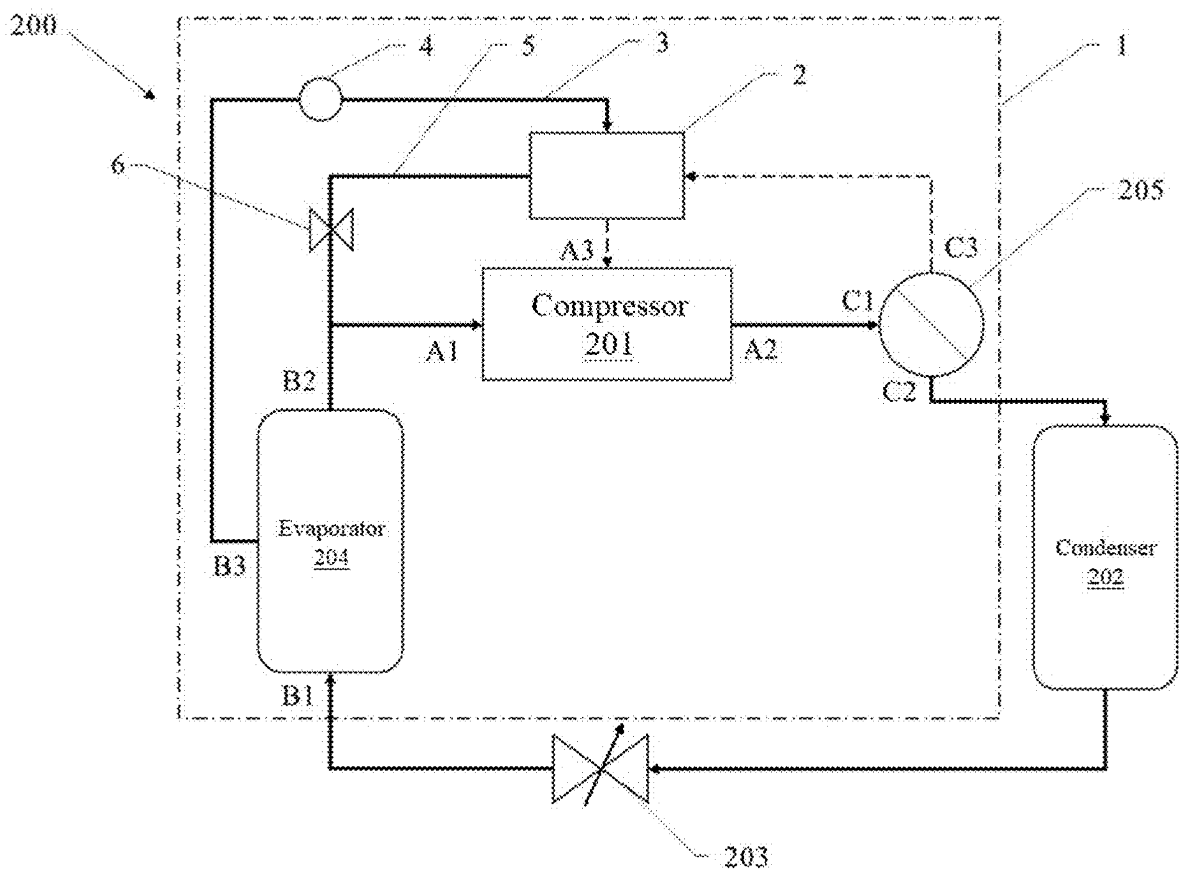

200
4
5
3
2
1
6
205
A3
C3
Compressor
201
C1
A1
A2
B2
C2
Evaporator
204
Condenser
202
B3
B1
203

FIG. 2

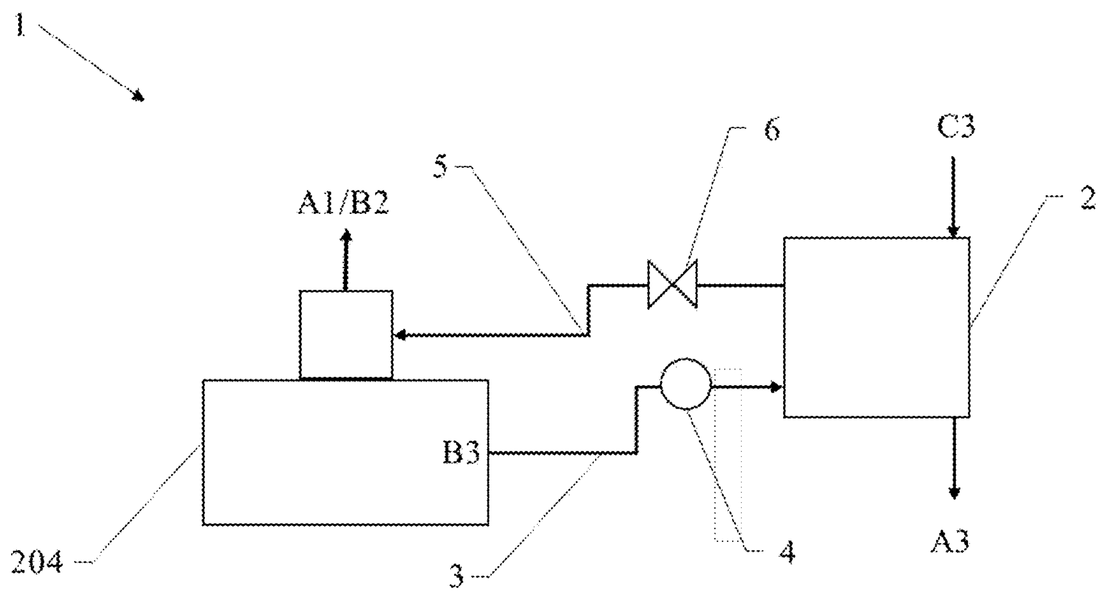

1
6
C3
5
2
A1/B2
B3
204
4
A3
3

FIG. 3

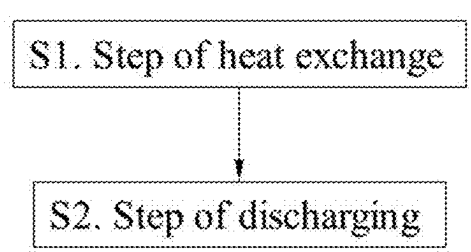

S1. Step of heat exchange
S2. Step of discharging

FIG. 4

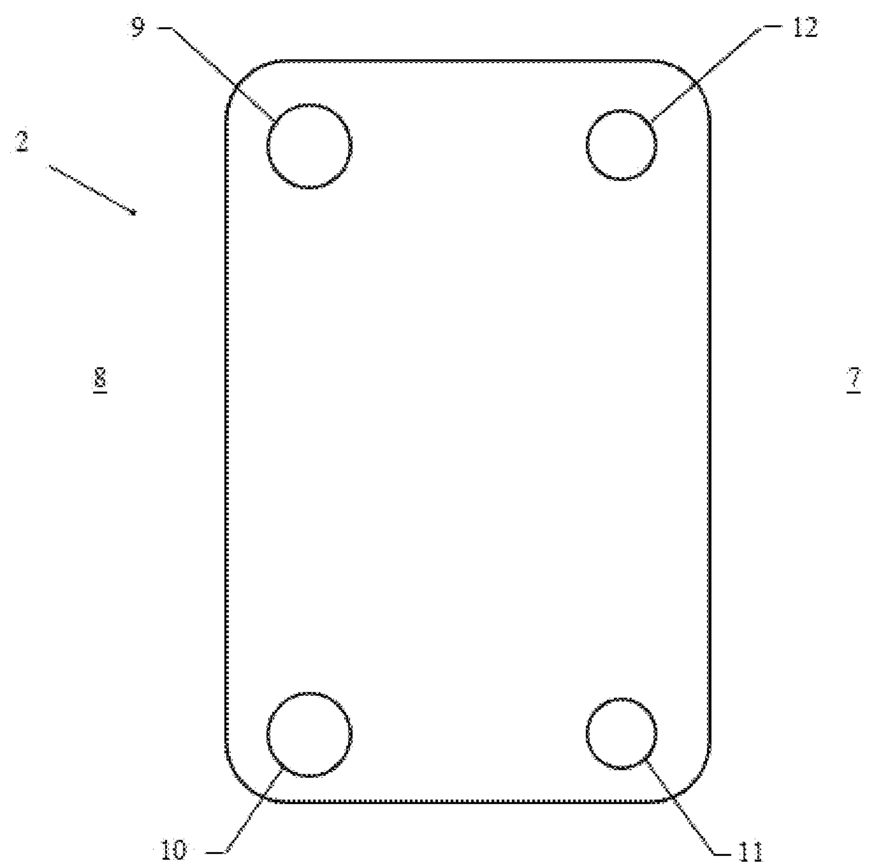


FIG. 5

HEAT EXCHANGE SYSTEM AND HEAT EXCHANGE METHOD

FOREIGN PRIORITY

[0001] This application claims the benefit of Chinese Patent Application No. 202410114501.6, filed Jan. 26, 2024, and all the benefits accruing therefrom under 35 U.S.C. § 119, the contents of which in its entirety are herein incorporated by reference.

TECHNICAL FIELD

[0002] The disclosure relates to the technical field of refrigeration, in particular to a heat exchange system and a heat exchange method for the heat exchange system.

BACKGROUND

[0003] In a refrigeration system, a refrigerant flows through a compressor, is compressed in the compressor to be in a high-temperature and high-pressure condition, and is then discharged out of the compressor at a high velocity and a high temperature, and under the action of a high temperature, lubricating oil in the compressor will be discharged in the form of oil vapor or particles mixed with a refrigerant gas. In the prior art, an oil separator was arranged on the outlet side of the compressor to separate lubricating oil from the refrigerant gas.

[0004] However, in the prior art, when the discharge superheat of the refrigerant is less than 4-5 K, the performance of the oil separator will become extremely poor, the separation effect will be affected, and a large quantity of the refrigerant will be dissolved in lubricating oil, reducing the viscosity of the lubricating oil. Moreover, in some refrigeration systems, the temperature of an outlet of the oil separator may reach 90° C. or over. Such a high temperature will reduce the viscosity of lubricating oil returning into the compressor, possibly aggravating abrasion of components in the compressor, shortening the service life of the compressor, and even causing damage to components in the compressor such as the bearing.

SUMMARY OF THE INVENTION

[0005] In view of the above problems, the disclosure provides a heat exchange system and a heat exchange method. The heat exchange system can increase suction superheat of a refrigerant and decrease the temperature of lubricating oil, thus improving the cooling effect on a bearing, improving the viscosity and lubrication performance of the lubricating oil, improving the performance of a compressor, and prolonging the service life of the compressor.

[0006] In one aspect, the technical solution of the disclosure provides a heat exchange system, comprising a compressor, an evaporator, a heat exchanger, an inlet line, a first regulating device and an outlet line. A refrigerant circulates in the evaporator, a heat exchange line is arranged in the heat exchanger, the inlet line is connected to the evaporator and the heat exchange line, the first regulating device is arranged on the inlet line and used for pumping the refrigerant from the evaporator into the heat exchange line, and the outlet line is connected to a suction inlet of the compressor and the heat exchange line.

[0007] Optionally, in the technical solution of the disclosure, the heat exchange system further comprises a second regulating device arranged on the outlet line.

[0008] Optionally, in the technical solution of the disclosure, the heat exchange line comprises a primary-side line and a secondary-side line, the heat exchange system further comprises an oil separator, and an oil and refrigerant mixture from the oil separator flows through the primary-side line; and the refrigerant from the inlet line flows through the secondary-side line.

[0009] Optionally, in the technical solution of the disclosure, a temperature difference between the refrigerant in the inlet line and the refrigerant in the outlet line is within 20-40° C., and a temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line is within 20-50° C.

[0010] Optionally, in the technical solution of the disclosure, the first regulating device and/or the second regulating device is configured as an air pump or a flow control valve.

[0011] In another aspect, the technical solution of the disclosure further provides a heat exchange method applied to the heat exchange system. The heat exchange method comprises: a step of heat exchange: pumping the refrigerant from the inlet line into the heat exchange line to exchange heat with the oil and refrigerant mixture in the heat exchange line; and a step of discharging: discharging the refrigerant subjected to heat exchange to the suction inlet of the compressor by means of the outlet line.

[0012] Optionally, in the technical solution of the disclosure, the heat exchange method further comprises a step of regulation: regulating a pressure of the refrigerant or a flow rate of the refrigerant in the inlet line and/or in the outlet line respectively by means of the first regulating device arranged on the inlet line and/or the second regulating device arranged on the outlet line.

[0013] Optionally, in the technical solution of the disclosure, a temperature of the refrigerant in the outlet line is increased by 20° C.-40° C., compared with a temperature of the refrigerant in the inlet line.

[0014] Optionally, in the technical solution of the disclosure, a temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line is within 20-50° C.

[0015] According to the technical solution of the disclosure, part of the refrigerant in the evaporator flows through the secondary-side line of the heat exchange line in the heat exchanger to be heated by heat exchange, and at the suction inlet of the compressor (the outlet of the evaporator), the refrigerator heated by heat exchange is mixed with the refrigerant discharged from the outlet of the evaporator, such that the temperature of the refrigerant flowing into the suction inlet of the compressor is increased, and the difference between the temperature of the refrigerant flowing into the suction inlet of the compressor and the evaporating temperature of the refrigerant is increased, that is, the superheat of the refrigerant is increased, thus avoiding liquid slugging caused by part of the refrigerant entering the compressor in a liquid state in case of insufficient superheat, improving the discharge superheat of the compressor, and improving the oil separation efficiency of the oil separator.

[0016] In addition, the high-temperature and high-pressure oil and refrigerant mixture from the oil-gas separator flows through the primary-side line of the heat exchange line in the heat exchanger and exchanges heat with the refrigerant in the secondary-side line of the heat exchange line in the heat exchanger, such that the temperature of lubricating oil is decreased. The viscosity of the lubricating oil is increased, thus decreasing the temperature of a bearing, effectively improving the lubricating effect, reducing abrasion of the compressor in operation, and prolonging the service life of the compressor.

[0017] The technical solution of the disclosure fulfills the above technical effects by means of a simple design only by arranging the heat exchanger and corresponding lines, without adding special equipment.

DESCRIPTIONS OF THE DRAWINGS

[0018] FIG. **1** is a schematic diagram of a refrigeration system in the prior art.

[0019] FIG. **2** is a schematic diagram of a refrigeration system according to one or more embodiments of the disclosure.

[0020] FIG. **3** is a schematic diagram of a heat exchange system according to one or more embodiments of the disclosure.

[0021] FIG. **4** is a flow diagram of a heat exchange method according to one or more embodiments of the disclosure.

[0022] FIG. **5** is a schematic diagram of a heat exchanger according to one or more embodiments of the disclosure.

LIST OF REFERENCE NUMERALS

[0023] **100**, refrigeration system; **101**, compressor; **102**, condenser; **103**, expansion valve; **104**, evaporator; **105**, oil separator; **200**, refrigeration system; **201**, compressor; **202**, condenser; **203**, expansion valve; **204**, evaporator; **205**, oil separator; **1**, heat exchange system; **2**, heat exchanger; **3**, inlet line; **4**, first regulating device; **5**, outlet line; **6**, second regulating device; **7**, primary-side of heat exchanger; **8**, secondary-side of heat exchanger; **9**, refrigerant inlet of heat exchanger; **10**, refrigerant inlet of heat exchanger; **11**, oil inlet of heat exchanger; **12**, oil outlet of heat exchanger; A**1**, suction inlet of compressor; A**2**, outlet of compressor; A**3**, lubricating oil inlet of compressor; B**1**, inlet of evaporator; B**2**, outlet of evaporator; B**3**, heat-exchange outlet of evaporator; C**1**, inlet of oil separator; C**2**, refrigerant outlet of oil separator; C**3**, mixture outlet of oil separator.

DETAILED DESCRIPTION

[0024] First, it should be noted that the components, operating principle, features, and advantages of a refrigeration system according to the disclosure will be described by way of examples. However, it should be understood that all descriptions are provided merely for illustration and thus should not be construed as limitations of the disclosure.

[0025] In addition, for any technical features described or implied in the embodiments mentioned here or any technical features shown or implied in the drawings, the application allows for any combination or deletion of these technical features (or their equivalents) without any technical obstacles, so as to obtain more other embodiments, that are not directly mentioned here, of the disclosure.

[0026] FIG. **1** is a schematic diagram of a refrigeration system in the prior art.

[0027] As shown in FIG. **1**, a refrigeration system **100** comprises a compressor **101**, a condenser **102**, an expansion valve **103** and an evaporator **104** which are connected in sequence.

[0028] In a refrigeration/heating cycle of the refrigeration system **100**, first, a step of compression is performed: the compressor **101** sucks a refrigerant gas from the evaporator **104** and compresses the refrigerant gas to increase the pressure of the refrigerant gas so as to obtain a high-temperature and high-pressure refrigerant gas.

[0029] Then, a step of condensation is performed: the high-temperature and high-pressure refrigerant gas discharged from the compressor **101** exchanges heat with cooling water in the condenser **102**, such that temperature of the cooling water in the condenser **102** is increased, and the refrigerant gas is condensed into a refrigerant liquid.

[0030] Next, a step of expansion is performed: the high-temperature and high-pressure refrigerant liquid from the condenser **102** flows through the expansion valve **103** for throttling expansion, such that the pressure and temperature of the refrigerant liquid are decreased to obtain a low-temperature and low-pressure refrigerant liquid.

[0031] Finally, a step of evaporation is performed: the low-temperature and low-pressure refrigerant liquid absorb heat from a heat exchange medium in the evaporator **104** to be evaporated into a gas, and the temperature of the heat exchange medium in the evaporator **104** is decreased at the same time. The refrigerant gas discharged from an outlet of the evaporator **104** is sucked again into the compressor **101** to be compressed, and the step of compression, the step of condensation, the step of throttling and the step of evaporation cycle are repeated.

[0032] In the evaporation process, when the gas evaporated from the refrigerant liquid is sucked again into compressor **101**, the suction temperature of the refrigerant should be slightly higher than the evaporating temperature. That is, certain suction superheat of the refrigerant should be maintained to ensure that the refrigerant sucked into the compressor **101** can be in a gaseous state to prevent liquid slugging, which may otherwise affect normal operation of the compressor **101**.

[0033] In addition, the compressor **101** in the refrigeration system **100** is configured as a screw compressor. When the screw compressor operates, lubricating oil needs to be sprayed between a screw and other components of the screw compressor, and an oil film is formed between rotors by the lubricating oil to fulfill sealing, lubricating and cooling effects. Referring to FIG. **1**, the oil separator **105** is arranged on an outlet side of compressor **101** and used for separating lubricating oil from the refrigerant gas. The refrigerant gas separated out by the oil separator **105** flows to the condenser **102**, the expansion valve **103** and the evaporator **104** to continue the refrigeration cycle of the refrigeration system **100**. The lubricating oil separated out by the oil separator **105** returns into the compressor **101** to be used for lubrication. In FIG. **1**, the flow path of the refrigerant is indicated by the solid line, and the flow path of an oil and refrigerant mixture/the lubricating oil is indicated by the dashed line.

[0034] However, in the above technical solution, the lubricating oil separated out by the oil separator **105** has a high temperature, the viscosity of the lubricating oil decreases with the increase of temperature, and an excessively low viscosity of the lubricating oil will lead to insufficient lubrication, aggravating the friction between the screw, the bearing and other components in the compressor **101** and affecting normal operation of the compressor **101**.

[0035] In view of the problems in the operating principle and refrigeration cycle of the refrigeration system **100**, one or more embodiments of the disclosure provides a refrigeration system **200**.

[0036] FIG. **2** is a schematic diagram of a refrigeration system according to one or more embodiments of the disclosure.

[0037] FIG. **3** is a schematic diagram of a heat exchange system according to one or more embodiments of the disclosure.

[0038] As shown in FIG. **2**, the refrigeration system **200** in some embodiments comprises a heat exchange system **1**, and a compressor **201**, an oil separator **205** and an evaporator **204** in the refrigeration system **200** belong to the heat exchange system **1**.

[0039] The compressor **201** is provided with a suction inlet A**1** and an outlet A**2**, the evaporator **204** is provided with an inlet B**1** and an outlet B**2**, and the oil separator **205** is provided with an inlet C**1**, a refrigerant outlet C**2** and a mixture outlet C**3**.

[0040] The suction inlet A**1** of compressor **201** is connected to outlet B**2** of evaporator **204**, and outlet A**2** of compressor **201** is connected to the inlet C**1** of oil separator **205**. The inlet B**1** of the evaporator **204** is indirectly connected to the refrigerant outlet C**2** of the oil separator **205**, and the outlet B**2** of the evaporator **204** is connected to the suction inlet A**1** of the compressor **101**.

[0041] The inlet C**1** of the oil separator **205** is connected to the outlet A**2** of the compressor **201**, and the oil separator **205** receives a high-temperature and high-pressure refrigerant gas mixed with lubricating oil from the compressor **201** and separates the high-temperature and high-pressure refrigerant gas from the lubricating oil. The refrigerant gas separated out by the oil separator **205** returns into a cycle of the refrigeration system **200** from the refrigerant outlet C**2** of the oil separator **205**, and sequentially flows through a condenser **202**, an expansion valve **203** and the evaporator **204**. The mixture outlet C**3** of the oil separator **205** is used for discharging an oil and refrigerant mixture obtained by separation.

[0042] As shown in FIGS. **3** and **5**, in some embodiments of the disclosure, the heat exchange system **1** further comprises a heat exchanger **2**, an inlet line **3**, a first regulating device **4** and an outlet line **5**.

[0043] A refrigerant circulates in the evaporator **204**. The refrigerant flows into the evaporator **204** via the inlet B**1** of the evaporator **204**, absorbs heat in the evaporator **204**, then flows out of the evaporator **204** via the outlet B**2** of the evaporator **204**, and finally flows to the inlet A**1** of the compressor **101**. The superheat of the refrigerant is a difference between the temperature of the refrigerant flowing into the suction inlet A**1** of compressor **101** and the evaporating temperature of the refrigerant.

[0044] The heat exchanger **2** comprises a primary-side **7** and a secondary-side **8**. A heat exchange line comprising a primary-side line between an oil inlet **11** and outlet **12** of the heat exchanger and a secondary-side line between a refrigerant inlet **9** and outlet **10** of the heat exchanger are arranged in the heat exchanger **2**, and the inlet line **3** is connected to a heat-exchange outlet B**3** of the evaporator **204** and the secondary-side line of the heat exchange line and is used for guiding part of the refrigerant into the secondary-side line of the heat exchange line in the heat exchanger **2** from the evaporator **204**. The first regulating device **4** is arranged on the inlet line **3** and used for increasing the pressure of the refrigerant from the evaporator **204** and pumping the refrigerant into the secondary-side line of the heat exchange line in the heat exchanger **2** for heat exchange. The outlet line **5** is connected to the suction inlet A**1** of the compressor **201** (the outlet B**2** of the evaporator **104**) and the secondary-side line of the heat exchange line in the heat exchanger **2** and used for returning the refrigerant, that is heated by heat exchange in the heat exchanger **2**, into the compressor **201**.

[0045] In some embodiments, the first regulating device **4** is configured as an air pump, preferably a low-lift pump. In addition, in actual use of the disclosure, the first regulating device **4** may be one or a combination of multiple of a gear pump, a centrifugal pump, a piston pump, a hydraulic plunger pump, a pneumatic diaphragm pump, a booster pump, a steam-jet pump. The disclosure has no limitation in this aspect as long as the first regulating device **4** can increase the pressure of the refrigerant from the outlet of the evaporator **204** to ensure that the refrigerant can overcome the resistance in the inlet line **3**, the heat exchanger **2** and the outlet line **5** to be pumped into the heat exchanger **2** for heat exchange and then flow to the suction inlet A**1** of the compressor **201**.

[0046] At the suction inlet A**1** of the compressor **201**, part of the refrigerant, that is heated by heat exchange in the heat exchanger **2**, is mixed with part of the refrigerant discharged from the outlet B**2** of the evaporator **204**, such that the temperature of the refrigerant flowing into the suction inlet A**1** of the compressor **201** is increased. The difference between the temperature of the refrigerant flowing into the suction inlet A**1** of the compressor **201** and the evaporating temperature of the refrigerant is increased, that is, the superheat of the refrigerant is increased, thus avoiding liquid slugging caused by the refrigerant entering the compressor **201** in a liquid state in case of insufficient superheat.

[0047] Moreover, in some embodiments of the disclosure, the high-temperature and high-pressure oil and refrigerant mixture from the oil separator **205** flows to the heat exchanger **2** via the mixture outlet C**3** of the oil separator **205**, wherein the oil and refrigerant mixture is lubricating oil containing a small quantity of refrigerant gas. The lubricating oil flows through the primary-side line of the heat exchange line in the heat exchanger **2**, and the temperature of the lubricating oil in the oil separator **205** is higher than the temperature of the refrigerant at the outlet of the evaporator **204**. In this way, in the heat exchanger **2**, the lubricating oil flowing through the primary-side line of the heat exchange line in the heat exchanger **2** exchanges heat with the refrigerant flowing through the secondary-side line of the heat exchange line in the heat exchanger **2**, such that the temperature of the refrigerant is increased, and the temperature of the high-temperature lubricating oil is decreased, thus increasing the viscosity of the lubricating oil. The high-viscosity lubricating oil returns into the compressor **201** via a lubricating oil inlet A**3** of the compressor **201** to be used for lubrication in the compression process, thus effectively improving the lubrication effect, reducing abrasion of the compressor **101** in operation, and prolonging the service life of the compressor **201**.

[0048] In some embodiments, the heat exchanger **2** is preferably a plate heat exchanger, rectangular thin channels (the primary-side line and the secondary-side line) are formed between multiple plates in the plate heat exchanger, high-temperature fluid flowing through the primary-side line is not in contact with low-temperature fluid flowing through the secondary-side line, and the high-temperature fluid exchanges heat with the low-temperature fluid by means of the plates. The plate heat exchanger has high heat-exchange efficiency and a compact structure and occupies a small space.

[0049] Optionally, in some embodiments of the disclosure, a temperature difference between the refrigerant in the inlet line **3** and the refrigerant in the outlet line **5** is within 20-40° C. If the temperature of the refrigerant at the outlet of the evaporator **204** is about 60° C., the temperature of the refrigerant in the outlet line **5** can be increased to, for example, about 90° C. (80° C.-100° C.) after heat exchange in the heat exchanger **2**. Further, the refrigerant (for example, at a temperature of 90° C.) in the outlet line **5** and the refrigerant (for example, at a temperature of 60° C.) discharged from the outlet B**2** of the evaporator **204** are mixed at the suction inlet A**1** of the compressor **201**, so the temperature of the refrigerant entering the compressor **201** is at least 60° C. or higher, for example, 61° C.-62° C. In this way, the temperature of the refrigerant entering the compressor **201** can be increased by 1-2° C., that is, the suction superheat of the refrigerant entering the compressor **201** is increased by 1-2° C., thus ensuring that the refrigerant enters the compressor **201** in a gaseous state.

[0050] Of course, 1-2° C. mentioned here is merely an example, and the actual temperature rise is not limited to this. By controlling the flow rate and temperature of the refrigerant in the inlet line **3**, the temperature and flow rate of the oil and refrigerant mixture flowing through the heat exchanger **2** and other parameters, the suction superheat of the refrigerant can be regulated properly.

[0051] In some embodiments of the disclosure, the temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line in the heat exchanger **2** is within 20-50° C. If the temperature of the lubricating oil flowing out of the mixture outlet C**3** of the oil separator **205** is 110° C., the temperature of the lubricating oil flowing into the compressor **101** after heat exchange in the heat exchanger **2** can be decreased to, for example, about 85° C. (90° C.-60° C.).

[0052] Optionally, in some embodiments of the disclosure, the heat exchange system **1** further comprises a second regulating device **6**, wherein the second regulating device **6** is arranged on the outlet line **5** and used for regulating the flow rate of the refrigerant gas in the outlet line **5**. In other words, the second regulating device **6** may be used for controlling the flow ratio of the high-temperature refrigerant (for example, at a temperature of 90° C.), subjected to heat exchange in the heat exchanger **2**, at the suction inlet A**1** of the compressor **201**. After the high-temperature refrigerant is mixed with the low-temperature refrigerant (for example, at a temperature of 60° C.) discharged from the outlet B**2** of the evaporator **204**, the mixing ratio of the high-temperature refrigerant (for example, at a temperature of 90° C.) subjected to heat exchange in the heat exchanger **2** and the low-temperature refrigerant (for example, at a temperature of 60° C.) discharged from the outlet B**2** of the evaporator **204** can be controlled to control the temperature of the refrigerant entering the compressor **101** (the suction inlet A**1** of the compressor **101**), that is, the superheat of the refrigerant entering the compressor **101** is controlled.

[0053] Specifically, when the second regulating device **6** is controlled to increase the flow rate of the gas in the outlet line **5**, the proportion of the high-temperature refrigerant (for example, at a temperature of 90° C.) at the suction inlet A**1** of the compressor **201** will be increased, and the temperature of the refrigerant entering the compressor **201** will be increased accordingly. On the contrary, when the second regulating device **6** is controlled to control decrease the flow rate of the gas in the outlet line **5**, the proportion of the high-temperature refrigerant (for example, at a temperature of 90° C.) at the suction inlet A**1** of the compressor **201** will be decreased, and the temperature of the refrigerant entering the compressor **201** will be decreased accordingly. Of course, when the second regulating device **6** is controlled to decrease the flow rate of the gas in the outlet line **5**, if the temperature and flow rate of the oil and refrigerant flowing through the heat exchanger **2** remain unchanged, the temperature of the refrigerant flowing out of the outlet line **5** will be higher, for example, higher than 90° C. After a small quantity of the refrigerant at a higher temperature is mixed with the refrigerant flowing out of outlet B**2** of evaporator **204**, the refrigerant entering compressor **201** can still be maintained at a suitable temperature (superheat).

[0054] In the one or more embodiments of the disclosure, the heat exchange system **1** can increase the temperature of the refrigerant entering the compressor **201** and decrease the temperature of lubricating oil entering the compressor **201**, thus increasing the suction superheat of the refrigerant in the compressor **201** and the viscosity of the lubricating oil in the compressor **201**. In addition, the heat exchange system **1** performs heat exchange by means of heat generated in the circulation process of the refrigeration system **200**, and no extra heating/refrigeration equipment is needed, such that the heat exchange system **1** has a low cost, a simple structure and a small size and is suitable for different types of refrigeration systems **200**.

[0055] In actual use of the disclosure, the second regulating device **6** is a flow control valve. Specifically, the second regulating device **6** may be a capillary tube, a thermal expansion valve, an electronic expansion valve, or the like, and the disclosure has no limitation in this aspect.

[0056] FIG. **4** is a flow diagram of a heat exchange method according to some embodiments of the application.

[0057] Referring to FIG. **4**, some embodiments of the application further provides a heat exchange method, which is applied to the heat exchange system **1**. The heat exchange method comprises: a step S**1** of heat exchange: pumping a refrigerant from the inlet line **3** into the secondary-side line of the heat exchange line in the heat exchanger **2** to exchange heat with an oil and refrigerant mixture flowing through the primary-side line of the heat exchange line in the heat exchanger **2**; and a step S**2** of discharging: discharging the refrigerant subjected to heat exchange to the suction inlet A**1** of the compressor **201** by means of the outlet line **5**.

[0058] By adopting the heat exchange method in some embodiments of the disclosure, the temperature of the refrigerant entering the compressor **201** can be increased, and the temperature of lubricating oil entering the compressor **201** can be decreased, thus increasing the suction superheat of the refrigerant in the compressor **201** and the viscosity of the lubricating oil in the compressor **201**. In addition, the heat exchange method performs heat exchange by means of heat generated in the circulation process of the refrigeration system **200** and fulfills a good effect, and the steps of the heat exchange method can be performed easily and efficiently.

[0059] Optionally, in some embodiments of the application, the heat exchange method further comprises a step of regulation: regulating the pressure of the refrigerant and the flow rate of the refrigerant in the inlet line **3** and/or the outlet line **5** respectively by means of the first regulating device **4** arranged on the inlet line **3** and/or the second regulating device **6** arranged on the outlet line **5**. In other words, the first regulating device **4** and the second regulating device **6** can respectively regulate the inlet pressure and output of the refrigerant in the heat exchanger **2**, such that the temperature of the refrigerant flowing out of the heat exchanger **2** (the temperature of the refrigerant in the outlet line **5**) can be controlled to a desired temperature by controlling the heat exchange amount of the refrigerant in the heat exchanger **2**.

[0060] Specifically, when the first regulating device **4** and the second regulating device **6** are controlled to maintain a low flow rate of the refrigerant in the inlet line **3**, a difference between the temperature of the refrigerant in the outlet line **5** and the temperature of the refrigerant in the inlet line **3** will be increased under the condition where the temperature and flow rate of the oil and refrigerant flowing through the heat exchanger **2** remain unchanged, and the superheat will be increased accordingly. On the contrary, when the first regulating device **4** and the second regulating device **6** are controlled to maintain a high flow rate of the refrigerant in the inlet line **3**, the difference between the temperature of the refrigerant in the outlet line **5** and the temperature of the refrigerant in the inlet line **3** will be decreased under the condition where the temperature and flow rate of the oil and refrigerant flowing through the heat exchanger **2** remain unchanged, and the superheat will be decreased accordingly.

[0061] Optionally, in some embodiments of the disclosure, according to the heat exchange method, the temperature of the refrigerant in outlet line **5** is increased by 20-40° C., as compared with the temperature of the refrigerant in the inlet line **3**.

[0062] Optionally, in some embodiments of the disclosure, according to the heat exchange method, the temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line in the heat exchanger **2** is within 20-50° C.

[0063] Although the technical solution of the disclosure has been described above in conjunction with the accompanying drawings, those skilled in the art can easily understand that the protection scope of the disclosure is not limited to the above one or more embodiments. Equivalent modifications or substitutions of related technical features can be made by those skilled in the art without departing from the principle of the disclosure, and all these modifications or substitutions should also fall within the protection scope of the disclosure.

1. A heat exchange system, comprising:
a compressor;
an evaporator, in which a refrigerant circulates;
a heat exchanger, in which a heat exchange line is arranged;
an inlet line, connected to the evaporator and the heat exchange line;
a first regulating device, arranged on the inlet line and used for pumping the refrigerant from the evaporator into the heat exchange line; and
an outlet line, connected to a suction inlet of the compressor and the heat exchange line.

2. The heat exchange system according to claim **1**, further comprising a second regulating device arranged on the outlet line.

3. The heat exchange system according to claim **2**, wherein the heat exchange line comprises a primary-side line and a secondary-side line;
the heat exchange system further comprises an oil separator, and an oil and refrigerant mixture from the oil separator flows through the primary-side line;
the refrigerant from the inlet line flows through the secondary-side line.

4. The heat exchange system according to claim **3**, wherein a temperature difference between the refrigerant in the inlet line and the refrigerant in the outlet line is within 20-40° C., and a temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line is within 20-50° C.

5. The heat exchange system according to claim **4**, wherein the first regulating device and/or the second regulating device is configured as an air pump or a flow control valve.

6. A heat exchange method, being applied to the heat exchange system according to claim **5**, and comprising:
a step of heat exchange: pumping the refrigerant from the inlet line into the heat exchange line to exchange heat with the oil and refrigerant mixture in the heat exchange line; and
a step of discharging: discharging the refrigerant subjected to heat exchange to the suction inlet of the compressor by means of the outlet line.

7. The heat exchange method according to claim **6**, further comprising a step of regulation: regulating a pressure of the refrigerant or a flow rate of the refrigerant in the inlet line and/or in the outlet line respectively by means of the first regulating device arranged on the inlet line and/or the second regulating device arranged on the outlet line.

8. The heat exchange method according to claim **7**, wherein a temperature of the refrigerant in the outlet line is increased by 20° C.-40° C., compared with a temperature of the refrigerant in the inlet line.

9. The heat exchange method according to claim **7**, wherein a temperature difference of the oil and refrigerant mixture before and after flowing through the heat exchange line is within 20-50° C.

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