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

(11) EP 3 601 907 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
20.04.2022 Bulletin 2022/16

(21) Application number: **18715561.9**

(22) Date of filing: **23.03.2018**

(51) International Patent Classification (IPC):
F25B 49/02 *(2006.01)* ***F25B 1/10*** *(2006.01)*
F25B 9/08 *(2006.01)* ***F25B 41/20*** *(2021.01)*
F25B 5/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25B 49/02; F25B 1/10; F25B 5/02; F25B 9/08; F25B 41/20; F25B 2341/0012; F25B 2400/075; F25B 2400/16; F25B 2600/05; F25B 2700/04

(86) International application number:
PCT/EP2018/057515

(87) International publication number:
WO 2018/177956 (04.10.2018 Gazette 2018/40)

(54) **A VAPOUR COMPRESSION SYSTEM WITH A SUCTION LINE LIQUID SEPARATOR**

DAMPFKOMPRESSIONSSYSTEM MIT EINEM SAUGLEITUNGSFLÜSSIGKEITSABSCHEIDER

SYSTÈME DE COMPRESSION DE VAPEUR DOTÉ D'UN SÉPARATEUR DE LIQUIDE DE CONDUITE D'ASPIRATION

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **28.03.2017 DK PA201700214**

(43) Date of publication of application:
05.02.2020 Bulletin 2020/06

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a method for controlling a vapour compression system having a liquid separator arranged in the suction line. The method of the invention ensures that the vapour compression system is operated in an energy efficient manner, without risking that liquid refrigerant reaches the compressor.

BACKGROUND OF THE INVENTION

[0002] In a vapour compression system, such as a refrigeration system, an air condition system, a heat pump, etc., a fluid medium, such as refrigerant, is alternatingly compressed by means of one or more compressors and expanded by means of one or more expansion devices, and heat exchange between the fluid medium and the ambient takes place in one or more heat rejecting heat exchangers, e.g. in the form of condensers or gas coolers, and in one or more heat absorbing heat exchangers, e.g. in the form of evaporators.

[0003] When refrigerant passes through an evaporator arranged in a vapour compression system, the refrigerant is at least partly evaporated while heat exchange takes place with the ambient or with a secondary fluid flow across the evaporator, in such a manner that heat is absorbed by the refrigerant passing through the evaporator. The heat transfer between the refrigerant and the ambient or the secondary fluid flow is most efficient along a part of the evaporator which contains liquid refrigerant. Accordingly, it is desirable to operate the vapour compression system in such a manner that liquid refrigerant is present in as large a part of the evaporator as possible, preferably along the entire evaporator.

[0004] However, if liquid refrigerant reaches the compressor unit, there is a risk that the compressor(s) of the compressor unit is/are damaged. In order to avoid this, it is necessary to either operate the vapour compression system in such a manner that liquid refrigerant is not allowed to pass through the evaporator, or to ensure that any liquid refrigerant which passes through the evaporator is removed from the suction line, and is thereby prevented from reaching the compressor unit. To this end a liquid separating device is sometimes arranged in the suction line.

[0005] EP 2 718 642 B1 discloses a multi-evaporator refrigeration circuit comprising at least a compressor, a condenser or gas cooler, a first throttling valve, a liquid/vapour separator, a pressure limiting valve, a liquid level sensing device, at least one evaporator and a suction receiver. In the refrigeration circuit at least one ejector comprising a suction port is included in parallel to the first throttling valve. The refrigeration system is adapted to drive cold liquid from the suction receiver to the suction port of the ejector. A first control valve in the line from the suction receiver to the suction port of the ejector can be opened, based on a maximum level signal generated by the liquid level sensing device, whenever the level of liquid refrigerant in the suction receiver is above a set maximum level.

DESCRIPTION OF THE INVENTION

[0006] It is an object of embodiments of the invention to provide a method for controlling a vapour compression system in an energy efficient manner, without risking that liquid refrigerant reaches the compressor unit.

[0007] The invention provides a method for controlling a vapour compression system, the vapour compression system comprising a compressor unit, a heat rejecting heat exchanger, an ejector, a receiver, at least one expansion device and at least one evaporator arranged in a refrigerant path, the vapour compression system further comprising a liquid separating device arranged in a suction line of the vapour compression system and a liquid level sensor arranged in the liquid separating device, the liquid separating device comprising a gaseous outlet connected to the inlet of the compressor unit and a liquid outlet connected to a secondary inlet of the ejector, the method comprising the steps of:

- monitoring a liquid level in the liquid separating device by means of the liquid level sensor, and

- in the case that the liquid level in the liquid separating device is above a predefined threshold level, adjusting a control parameter of the vapour compression system in order to increase a flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector and/or decrease a flow rate of liquid refrigerant from the evaporator(s) to the liquid separating device.

[0008] The method according to the invention is for controlling a vapour compression system. In the present context the term 'vapour compression system' should be interpreted to mean any system in which a flow of fluid medium, such as refrigerant, circulates and is alternatingly compressed and expanded, thereby providing either refrigeration or heating of a volume. Thus, the vapour compression system may be a refrigeration system, an air condition system, a heat pump, etc.

[0009] The vapour compression system comprises a compressor unit comprising one or more compressors, a heat rejecting heat exchanger, an ejector, a receiver, at least one expansion device and at least one evaporator arranged in a refrigerant path. Each expansion device is arranged to supply refrigerant to an evaporator. The heat rejecting heat exchanger could, e.g., be in the form of a condenser, in which refrigerant is at least partly condensed, or in the form of a gas cooler, in which refrigerant is cooled, but remains in a gaseous or trans-critical state. The expansion device(s) could, e.g., be in the form of expansion valve(s).

[0010] The vapour compression system further comprises a liquid separating device arranged in a suction line of the vapour compression system, i.e. in a part of the refrigerant path which interconnects the outlet(s) of the evaporator(s) and the inlet of the compressor unit. The liquid separating device comprises a gaseous outlet connected to the inlet of the compressor unit and a liquid outlet connected to a secondary inlet of the ejector. Thus, the liquid separating device receives refrigerant from the outlet(s) of the evaporator(s) and separates the received refrigerant into a liquid part and a gaseous part. The liquid part of the refrigerant is supplied to the secondary inlet of the ejector, and at least part of the gaseous part of the refrigerant may be supplied to the inlet of the compressor unit. It is not ruled out that some or all of the gaseous part of the refrigerant may be supplied to the secondary inlet of the ejector, along with the liquid part of the refrigerant. However, the liquid part of the refrigerant is not supplied to the inlet of the compressor unit. Accordingly, the liquid separating device ensures that any liquid refrigerant which leaves the evaporator(s) and enters the suction line is prevented from reaching the compressor unit.

[0011] A liquid level sensor is arranged in the liquid separating device. Accordingly, the liquid level in the liquid separating device can be measured by means of the liquid level sensor.

[0012] Thus, according to the method of the invention, the liquid level in the liquid separating device is monitored by means of the liquid level sensor. This provides a measure for the amount of liquid refrigerant which has been accumulated in the liquid separating device, and may further provide an indication regarding whether the liquid level is increasing, decreasing or remaining substantially constant. In the case that the liquid level is increasing and approaching the gaseous outlet of the liquid separating device, then there is a risk that liquid refrigerant is passed from the liquid separating device towards the inlet of the compressor unit, via the gaseous outlet of the liquid separating device. This should be avoided.

[0013] Accordingly, in the case that the liquid level in the liquid separating device is above a predefined threshold level, a control parameter of the vapour compression system is adjusted in order to increase a flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector and/or decrease a flow rate of liquid refrigerant from the evaporator(s) to the liquid separating device.

[0014] Increasing the flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector will cause more liquid refrigerant to be transferred from the liquid separating device to the secondary inlet of the ejector, thereby reducing the liquid level in the liquid separating device.

[0015] Decreasing a flow rate of liquid refrigerant from the evaporator(s) to the liquid separating device will cause less liquid refrigerant to be transferred from the evaporator(s) to the liquid separating device, and this may allow the current flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector to remove enough liquid refrigerant from the liquid separating device to reduce the liquid level in the liquid separating device.

[0016] Thus, according to the invention, in the case that it is detected that the liquid level in the liquid separating device is above the predefined threshold level, steps are taken in order to ensure that the net amount of liquid refrigerant in the liquid separator is reduced, or at least is prevented from increasing further. Thereby liquid refrigerant is efficiently prevented from reaching the compressor unit, while allowing liquid refrigerant to be present along the entire length of the evaporator(s), thereby allowing the vapour compression system to be operated in an energy efficient manner.

[0017] The step of adjusting a control parameter of the vapour compression system may comprise adjusting a pressure and/or a temperature prevailing in the vapour compression system. The pressure could be a refrigerant pressure prevailing at a relevant position of the refrigerant path, such as inside the receiver, at the outlet of the heat rejecting heat exchanger, in the suction line, or in any other relevant part of the refrigerant path. Similarly, the temperature could be a refrigerant temperature prevailing at a relevant position of the refrigerant path, such as at the outlet of the heat rejecting heat exchanger, in the suction line, or in any other relevant part of the refrigerant path. Alternatively, the temperature could be an ambient temperature or a temperature of a secondary fluid flow across the heat rejecting heat exchanger.

[0018] Thus, the step of adjusting a control parameter of the vapour compression system may comprise reducing a pressure prevailing inside the receiver. When the pressure prevailing inside the receiver is reduced, the pressure difference across the ejector, i.e. the pressure difference between the refrigerant leaving the heat rejecting heat exchanger and entering the primary inlet of the ejector and the refrigerant leaving the ejector and entering the receiver, is increased. This increases the capability of the ejector to drive the secondary refrigerant flow in the ejector, i.e. the flow of refrigerant entering the ejector via the secondary inlet. Thereby the flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector is increased. Furthermore, reducing the pressure prevailing inside the receiver also reduces the pressure difference over which the ejector must lift the secondary refrigerant flow in the ejector, thereby even further improving the capability of the ejector to drive the secondary refrigerant flow.

[0019] The pressure prevailing inside the receiver could, e.g., be decreased by increasing a compressor capacity allocated for compressing refrigerant received from the gaseous outlet of the receiver.

[0020] Alternatively or additionally, the step of adjusting a control parameter of the vapour compression system may comprise increasing a pressure of refrigerant leaving the heat rejecting heat exchanger and entering the primary inlet of the ejector. Increasing the pressure of refrigerant leaving the heat rejecting heat exchanger will also increase the pressure difference across the ejector, resulting in an increase in the flow of refrigerant from the liquid separating device to the secondary inlet of the ejector, as described above.

[0021] The pressure of refrigerant leaving the heat rejecting heat exchanger could, e.g., be increased by decreasing an opening degree of the primary inlet of the ejector. Alternatively or additionally, the pressure of refrigerant leaving the heat rejecting heat exchanger could be increased by decreasing a secondary fluid flow across the heat rejecting heat exchanger, e.g. by reducing a speed of a fan driving a secondary air flow across the heat rejecting heat exchanger or by adjusting a pump driving a secondary liquid flow across the heat rejecting heat exchanger.

[0022] Alternatively or additionally, the step of adjusting a control parameter of the vapour compression system may comprise decreasing a pressure prevailing in the suction line of the vapour compression system. When the pressure prevailing in the suction line is decreased, the pressure of the refrigerant passing through the evaporator(s) is also decreased. Thereby the dew point if the refrigerant is also decreased, causing a larger portion of the refrigerant to evaporate while passing through the evaporator(s). Accordingly, the amount of liquid refrigerant passing through the evaporator(s) is decreased.

[0023] Alternatively or additionally, the step of adjusting a control parameter of the vapour compression system may comprise increasing a temperature of refrigerant leaving the heat rejecting heat exchanger and entering the primary inlet of the ejector. When the temperature of refrigerant leaving the heat rejecting heat exchanger is increased, the gas-to-liquid ratio of the refrigerant at the outlet of the ejector is increased. This increases the total flow rate of refrigerant in a refrigerant loop including the compressor unit, the heat rejecting heat exchanger, the ejector, the receiver and a bypass valve arranged between the gaseous outlet of the receiver and the inlet of the compressor unit. This increases the flow rate of refrigerant through the ejector, from the primary inlet to the outlet, thereby improving the capability of the ejector to drive the secondary refrigerant flow in the ejector, i.e. the flow of refrigerant entering the ejector via the secondary inlet. Accordingly, the flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector is increased.

[0024] The temperature of refrigerant leaving the heat rejecting heat exchanger could, e.g., be increased by decreasing a secondary fluid flow across the heat rejecting heat exchanger, e.g. by reducing a speed of a fan driving a secondary air flow across the heat rejecting heat exchanger or by adjusting a pump driving a secondary liquid flow across the heat rejecting heat exchanger.

[0025] The step of adjusting a control parameter of the vapour compression system may comprise preventing at least some of the evaporator(s) from being operated in a flooded state. When at least some of the evaporator(s) are prevented from being operated in a flooded state, it must be expected that the total amount of liquid refrigerant being supplied to the suction line, and thereby to the liquid separating device, from the evaporator(s) is reduced. This is in particular the case when the evaporator(s) was/were previously operated in a flooded state. For instance, all of the evaporators may be prevented from being operated in a flooded state. In this case, liquid refrigerant is no longer allowed to pass through any of the evaporators, i.e. no liquid refrigerant enters the suction line and thereby the liquid separating device, and the amount of liquid refrigerant in the liquid separating device is not increased, regardless of the flow rate of refrigerant from the liquid separating device to the secondary inlet of the ejector.

[0026] The evaporator(s) may, e.g., be prevented from operating in a flooded state by increasing a setpoint value or a lower limit for the superheat of refrigerant leaving the evaporator(s), and subsequently controlling the refrigerant supply to the evaporator(s) in accordance with the increased setpoint value or lower limit.

[0027] The superheat of refrigerant leaving an evaporator is the temperature difference between the temperature of refrigerant leaving the evaporator and the dew point of the refrigerant leaving the evaporator. Thus, a high superheat value indicates that all of the liquid refrigerant supplied to the evaporator is evaporated well before it reaches the outlet of the evaporator. As described above, this results in a relatively poor heat transfer in the evaporator. However, only gaseous refrigerant passes through the evaporator. Similarly, zero superheat indicates that liquid refrigerant is present along the entire length of the evaporator, i.e. that the evaporator is operated in a flooded state. Thus, selecting a positive setpoint for the superheat value will prevent the evaporator from being operated in a flooded state.

[0028] As an alternative, the evaporator(s) may be prevented from being operated in a flooded state by reducing a maximum allowable opening degree of the expansion device(s). This will limit the refrigerant supply to the evaporator(s), thereby reducing the amount of liquid refrigerant passing through the evaporator(s), entering the suction line and being supplied to the liquid separating device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention will now be described with reference to the accompanying drawings in which

Fig. 1 is a diagrammatic view of a vapour compression system being controlled in accordance with a method according to a first embodiment of the invention,

Fig. 2 is a diagrammatic view of a vapour compression system being controlled in accordance with a method according to a second embodiment of the invention, and

Fig. 3 is a diagrammatic view of a vapour compression system being controlled in accordance with a method according to a third embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0030] Fig. 1 is a diagrammatic view of a vapour compression system 1 being controlled in accordance with a method according to a first embodiment of the invention. The vapour compression system 1 comprises a compressor unit 2 comprising a number of compressors 3, 4, three of which are shown, a heat rejecting heat exchanger 5, an ejector 6, a receiver 7, an expansion device 8, in the form of an expansion valve, an evaporator 9, and a liquid separating device 10, arranged in a refrigerant path.

[0031] Two of the shown compressors 3 are connected to a gaseous outlet 11 of the liquid separating device 10. Accordingly, gaseous refrigerant leaving the evaporator 9 can be supplied to these compressors 3, via the liquid separating device 10. The third compressor 4 is connected to a gaseous outlet 12 of the receiver 7. Accordingly, gaseous refrigerant can be supplied directly from the receiver 7 to this compressor 4.

[0032] Refrigerant flowing in the refrigerant path is compressed by the compressors 3, 4 of the compressor unit 2. The compressed refrigerant is supplied to the heat rejecting heat exchanger 5, where heat exchange takes place in such a manner that heat is rejected from the refrigerant.

[0033] The refrigerant leaving the heat rejecting heat exchanger 5 is supplied to a primary inlet 13 of the ejector 6, before being supplied to the receiver 7. When passing through the ejector 6 the refrigerant undergoes expansion. Thereby the pressure of the refrigerant is reduced, and the refrigerant being supplied to the receiver 7 is in a mixed liquid and gaseous state.

[0034] In the receiver 7 the refrigerant is separated into a liquid part and a gaseous part. The liquid part of the refrigerant is supplied to the evaporator 9, via a liquid outlet 14 of the receiver 7 and the expansion device 8. In the evaporator 9, the liquid part of the refrigerant is at least partly evaporated, while heat exchange takes place in such a manner that heat is absorbed by the refrigerant.

[0035] The evaporator 9 may be operated in a flooded state, i.e. in such a manner that liquid refrigerant is present along the entire length of the evaporator 9. Accordingly, some of the refrigerant passing through the evaporator 9 and entering the suction line may be in a liquid state.

[0036] The refrigerant leaving the evaporator 9 is received in the liquid separating device 10, where the refrigerant is separated into a liquid part and a gaseous part. The liquid part of the refrigerant is supplied to a secondary inlet 15 of the ejector 6, via a liquid outlet 16 of the liquid separating device 10. At least some of the gaseous refrigerant may be supplied to the compressors 3 of the compressor unit 2 via the gaseous outlet 11 of the liquid separating device 10. However, it is not ruled out that at least some of the gaseous refrigerant is supplied to the secondary inlet 15 of the ejector 6, via the liquid outlet 16 of the liquid separating device 10.

[0037] Accordingly, the liquid separating device 10 ensures that any liquid refrigerant which passes through the evaporator 9 is prevented from reaching the compressors 3, 4 of the compressor unit 2. Instead such liquid refrigerant is supplied to the secondary inlet 15 of the ejector 6.

[0038] The gaseous part of the refrigerant in the receiver 7 may be supplied to the compressor 4. Furthermore, some of the gaseous refrigerant in the receiver 7 may be supplied to compressors 3, via a bypass valve 17. Opening the bypass valve 17 increases the compressor capacity being available for compressing refrigerant received from the gaseous outlet 12 of the receiver 7.

[0039] A liquid level sensor 18 is arranged in the liquid separating device 10. Thereby the liquid level in the liquid separating device 10 can be monitored by means of the liquid level sensor 18.

[0040] Thus, according to the method of the invention, a liquid level in the liquid separating device 10 is monitored by means of the liquid level sensor 18, and the monitored liquid level is compared to a predefined threshold level.

[0041] When the liquid level in the liquid separating device 10 is above the predefined threshold level, this is an indication that the liquid level in the liquid separating device 10 is approaching the gaseous outlet 11 of the liquid separating device 10. This may eventually result in liquid refrigerant flowing towards the compressor unit 2, via the gaseous outlet 11 of the liquid separating device 10. This is undesirable, since it may cause damage to the compressors 3, 4.

[0042] Therefore, in the case that the liquid level in the liquid separating device 10 is above the predefined threshold level, a control parameter of the vapour compression system 1 is adjusted in order to increase a flow rate of refrigerant from the liquid separating device 10 to the secondary inlet 15 of the ejector 6 and/or decrease a flow rate of liquid refrigerant from the evaporator 9 to the liquid separating device 10. Thereby it is ensured that the flow rate of refrigerant from the liquid separating device 10 to the secondary inlet 15 of the ejector 6 is sufficient to remove the liquid refrigerant produced by the evaporator 9, and accumulation of liquid refrigerant in the liquid separating device 10 is avoided.

[0043] The flow rate of refrigerant from the liquid separating device 10 to the secondary inlet 15 of the ejector 6 could, e.g., be increased by decreasing a pressure prevailing inside the receiver 7, by increasing a pressure of refrigerant leaving the heat rejecting heat exchanger 5 and entering the primary inlet 13 of the ejector 6, and/or by increasing a temperature of refrigerant leaving the heat rejecting heat exchanger 5 and entering the primary inlet 13 of the ejector 6. This has been described in detail above.

[0044] The flow rate of liquid refrigerant from the evaporator 9 to the liquid separating device 10 could, e.g., be decreased by preventing the evaporator 9 from operating in a flooded state or by decreasing a pressure prevailing in the suction line. This has been described in detail above.

[0045] Fig. 2 is a diagrammatic view of a vapour compression system 1 being controlled in accordance with a method according to a second embodiment of the invention. The vapour compression system 1 of Fig. 2 is very similar to the vapour compression system 1 of Fig. 1, and it will therefore not be described in detail here.

[0046] In the vapour compression system 1 of Fig. 2, only two compressors 3 are shown in the compressor unit 2. Both of the compressors 3 are connected to the gaseous outlet 11 of the liquid separating device 10. Accordingly, gaseous refrigerant from the receiver 7 can only be supplied to the compressor unit 2 via the bypass valve 17.

[0047] Fig. 3 is a diagrammatic view of a vapour compression system 1 being controlled in accordance with a method according to a third embodiment of the invention. The vapour compression system 1 of Fig. 3 is very similar to the vapour compression systems 1 of Figs. 1 and 2, and it will therefore not be described in detail here.

[0048] In the compressor unit 2 of the vapour compression system 1 of Fig. 3, one compressor 3 is shown as being connected to the gaseous outlet 11 of the liquid separating device 10 and one compressor 4 is shown as being connected to the gaseous outlet 12 of the receiver 7. A third compressor 19 is shown as being provided with a three way valve 20 which allows the compressor 19 to be selectively connected to the gaseous outlet 11 of the liquid separating device 10 or to the gaseous outlet 12 of the receiver 7. Thereby some of the compressor capacity of the compressor unit 2 can be shifted between 'main compressor capacity', i.e. when the compressor 19 is connected to the gaseous outlet 11 of the liquid separating device 10, and 'receiver compressor capacity', i.e. when the compressor 19 is connected to the gaseous outlet 12 of the receiver 7. Thereby it is possible to adjust the pressure prevailing inside the receiver 7, and thereby the flow rate of refrigerant from the liquid separating device 10 to the secondary inlet 15 of the ejector 6, by operating the three way valve 20, thereby increasing or decreasing the amount of compressor capacity being available for compressing refrigerant received from the gaseous outlet 12 of the receiver 7.

[0049] Furthermore, the vapour compression system 1 of Fig. 3 comprises three expansion devices 8a, 8b, 8c and three evaporators 9a, 9b, 9c, arranged fluidly in parallel in the refrigerant path. Each of the expansion devices 8a, 8b, 8c is arranged to control a flow of refrigerant to one of the evaporators 9a, 9b, 9c.

Claims

1. A method for controlling a vapour compression system (1), the vapour compression system (1) comprising a compressor unit (2), a heat rejecting heat exchanger (5), an ejector (6), a receiver (7), at least one expansion device (8) and at least one evaporator (9) arranged in a refrigerant path, the vapour compression system (1) further comprising a liquid separating device (10) arranged in a suction line of the vapour compression system (1) and a liquid level sensor (18) arranged in the liquid separating device (10), the liquid separating device (10) comprising a gaseous outlet (11) connected to the inlet of the compressor unit (2) and a liquid outlet (16) connected to a secondary inlet (15) of the ejector (6), the method comprising the step of:

- monitoring a liquid level in the liquid separating device (10) by means of the liquid level sensor (18),

characterized in that the method further comprises the step of:

- in the case that the liquid level in the liquid separating device (10) is above a predefined threshold level, adjusting a control parameter of the vapour compression system (1) in order to decrease a flow rate of liquid refrigerant from the evaporator(s) (9) to the liquid separating device (10) by, for at least some of the evaporator(s) (9), selecting a positive setpoint for a superheat value and/or reducing a maximum allowable opening degree of the expansion device(s), thereby preventing said evaporator(s) (9) from being operated in a flooded state.

2. A method according to claim 1, wherein the step of adjusting a control parameter further comprises adjusting a control parameter of the vapour compression system (1) in order to increase a flow rate of refrigerant from the liquid separating device (10) to the secondary inlet (15) of the ejector (6).

3. A method according to claim 1 or 2, wherein the step of adjusting a control parameter of the vapour compression system (1) comprises adjusting a pressure and/or a temperature prevailing in the vapour compression system (1).

4. A method according to claim 3, wherein the step of adjusting a control parameter of the vapour compression system (1) comprises reducing a pressure prevailing inside the receiver (7).

5. A method according to claim 3 or 4, wherein the step of adjusting a control parameter of the vapour compression system (1) comprises increasing a pressure of refrigerant leaving the heat rejecting heat exchanger (5) and entering the primary inlet (13) of the ejector (6).

6. A method according to any of claims 3-5, wherein the step of adjusting a control parameter of the vapour compression system (1) comprises decreasing a pressure prevailing in the suction line of the vapour compression system (1).

7. A method according to any of claims 3-6, wherein the step of adjusting a control parameter of the vapour compression system (1) comprises increasing a temperature of refrigerant leaving the heat rejecting heat exchanger (5) and entering the primary inlet (13) of the ejector (6).

Patentansprüche

1. Verfahren zum Steuern eines Dampfkompressionssystems (1), wobei das Dampfkompressionssystem (1) eine Kompressoreinheit (2), einen Wärmeabgabe-Wärmetauscher (5), eine Ausstoßeinrichtung (6), eine Aufnahme (7), mindestens eine Expansionsvorrichtung (8) und mindestens einen Verdampfer (9), die in einem Kühlmittelweg angeordnet sind, umfasst, wobei das Dampfkompressionssystem (1) ferner eine Flüssigkeitstrennvorrichtung (10), die in einer Ansaugleitung des Dampfkompressionssystems (1) angeordnet ist, und einen Flüssigkeitspegelsensor (18), der in der Flüssigkeitstrennvorrichtung (10) angeordnet ist, umfasst, wobei die Flüssigkeitstrennvorrichtung (10) einen Gasauslass (11), der mit dem Einlass der Kompressoreinheit (2) verbunden ist, und einen Flüssigkeitsauslass (16), der mit einem sekundären Einlass (15) der Ausstoßeinrichtung (6) verbunden ist, umfasst, wobei das Verfahren den Schritt umfasst zum:

   - Überwachen eines Flüssigkeitspegels in der Flüssigkeitstrennvorrichtung (10) mittels des Flüssigkeitspegelsensors (18),

   dadurch gekennzeichnet, dass das Verfahren ferner den Schritt umfasst zum:

   - im Falle, dass der Flüssigkeitspegel in der Flüssigkeitstrennvorrichtung (10) über einem vordefinierten Schwellenpegel liegt, Einstellen eines Steuerparameters des Dampfkompressionssystems (1), um eine Strömungsrate eines flüssigen Kühlmittels von dem/n Verdampfer/n (9) zu der Flüssigkeitstrennvorrichtung (10) zu verringern, indem, für mindestens einige der Verdampfer (9), ein positiver Sollwert für einen Überhitzungswert ausgewählt wird und/oder ein maximal zulässiger Öffnungsgrad der Expansionsvorrichtung/en reduziert wird, wodurch verhindert, wird, dass der/die Verdampfer (9) in einem gefluteten Zustand betrieben wird/werden.

2. Verfahren nach Anspruch 1, wobei der Schritt zum Einstellen eines Steuerparameters ferner ein Einstellen eines Steuerparameters des Dampfkompressionssystems (1) umfasst, um eine Strömungsrate eines Kühlmittels von der Flüssigkeitstrennvorrichtung (10) zu dem sekundären Einlass (15) der Ausstoßeinrichtung (6) zu erhöhen.

3. Verfahren nach Anspruch 1 oder 2, wobei der Schritt zum Einstellen eines Steuerparameters des Dampfkompressionssystems (1) ein Einstellen eines Drucks und/oder einer Temperatur umfasst, der/die in dem Dampfkompressionssystem (1) herrschen.

4. Verfahren nach Anspruch 3, wobei der Schritt zum Einstellen eines Steuerparameters des Dampfkompressionssystems (1) ein Reduzieren eines Drucks umfasst, der im Inneren der Aufnahme (7) herrscht.

5. Verfahren nach Anspruch 3 oder 4, wobei der Schritt zum Einstellen eines Steuerparameters des Dampfkompressionssystems (1) ein Erhöhen eines Drucks eines Kühlmittels umfasst, das den Wärmeabgabe-Wärmetauscher (5) verlässt und in den primären Einlass (13) der Ausstoßeinrichtung (6) eintritt.

6. Verfahren nach einem der Ansprüche 3-5, wobei der Schritt zum Einstellen eines Steuerparameters des Dampfkompressionssystems (1) ein Verringern eines Drucks umfasst, der in der Ansaugleitung des Dampfkompressionssystems (1) herrscht.

7. Verfahren nach einem der Ansprüche 3-6, wobei der Schritt zum Einstellen eines Steuerparameters des Dampfkompressionssystems (1) ein Erhöhen einer Temperatur eines Kühlmittels umfasst, das den Wärmeabgabe-Wärmetauscher (5) verlässt und in den primären Einlass (13) der Ausstoßeinrichtung (6) eintritt.

Revendications

1. Procédé de commande d’un système de compression de vapeur (1), le système de compression de vapeur (1) comprenant une unité de compression (2), un échangeur de chaleur rejetant la chaleur (5), un éjecteur (6), un récepteur (7), au moins un dispositif d’expansion (8) et au moins un évaporateur (9) disposé dans un passage réfrigérant, le système de compression de vapeur (1) comprenant en outre un dispositif de séparation de liquide (10) disposé dans une ligne de succion du système de compres-

sion de vapeur (1) et un capteur de niveau de liquide (18) disposé dans le dispositif de séparation de liquide (10), le dispositif de séparation de liquide (10) comprenant une sortie de gaz (11) connectée à l'entrée de l'unité de compression (2) et une sortie de liquide (16) connectée à une entrée secondaire (15) de l'éjecteur (6), le procédé comprenant l'étape de :

- surveillance d'un niveau de liquide dans le dispositif de séparation de liquide (10) au moyen du capteur de niveau de liquide (18),

caractérisé en ce que le procédé comprend en outre l'étape de :

- dans le cas où le niveau de liquide dans le dispositif de séparation de liquide (10) est audessus d'un niveau seuil prédéfini, le réglage d'un paramètre de commande du système de compression de vapeur (1) afin de diminuer un débit de réfrigérant liquide provenant de l'évaporateur ou des évaporateurs (9) vers le dispositif de séparation de liquide (10) en sélectionnant, pour au moins certains des évaporateurs (9), un point de réglage positif pour une valeur de super-chaleur et/ou en réduisant un degré d'ouverture admissible maximal du ou des dispositifs d'expansion, en empêchant ainsi ledit ou lesdits évaporateurs (9) d'être actionnés en état inondé.

2. Procédé selon la revendication 1, dans lequel l'étape de réglage d'un paramètre de commande comprend en outre le réglage d'un paramètre de commande du système de compression de vapeur (1) afin d'augmenter un débit de réfrigérant depuis le dispositif de séparation de liquide (10) vers l'entrée secondaire (15) de l'éjecteur (6).

3. Procédé selon la revendication 1 ou 2, dans lequel l'étape de réglage d'un paramètre de commande du système de compression de vapeur (1) comprend le réglage d'une pression et/ou d'une température régnant dans le système de compression de vapeur (1).

4. Procédé selon la revendication 3, dans lequel l'étape de réglage d'un paramètre de commande du système de compression de vapeur (1) comprend la réduction d'une pression régnant à l'intérieur du récepteur (7).

5. Procédé selon la revendication 3 ou 4, dans lequel l'étape de réglage d'un paramètre de commande du système de compression de vapeur (1) comprend l'augmentation d'une pression de réfrigérant quittant l'échangeur de chaleur rejetant la chaleur (5) et entrant dans l'entrée primaire (13) de l'éjecteur (6).

6. Procédé selon l'une quelconque des revendications 3 à 5, dans lequel l'étape de réglage d'un paramètre de commande du système de compression de vapeur (1) comprend la réduction d'une pression régnant dans la ligne de succion du système de compression de vapeur (1) .

7. Procédé selon l'une quelconque des revendications 3 à 6, dans lequel l'étape de réglage d'un paramètre de commande du système de compression de vapeur (1) comprend l'augmentation d'une température de réfrigérant quittant l'échangeur de chaleur rejetant la chaleur (5) et entrant dans l'entrée primaire (13) de l'éjecteur (6).

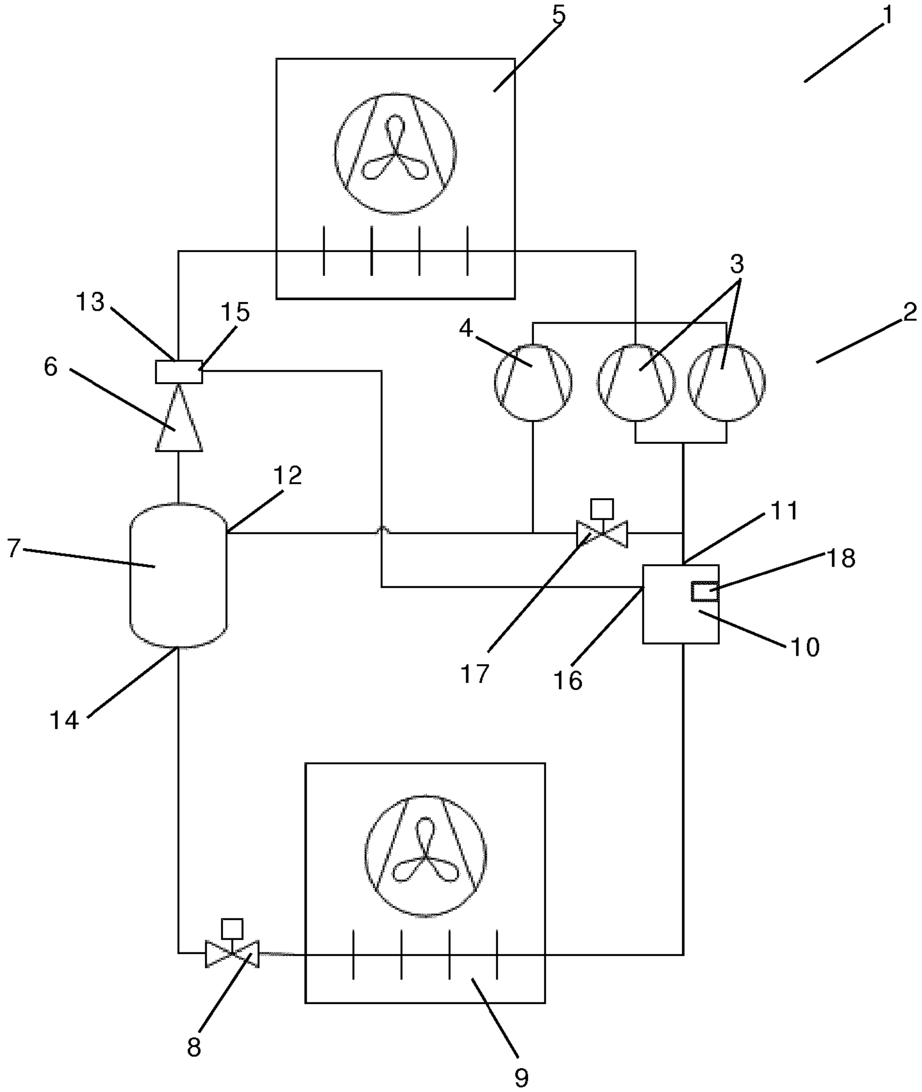

Fig. 1

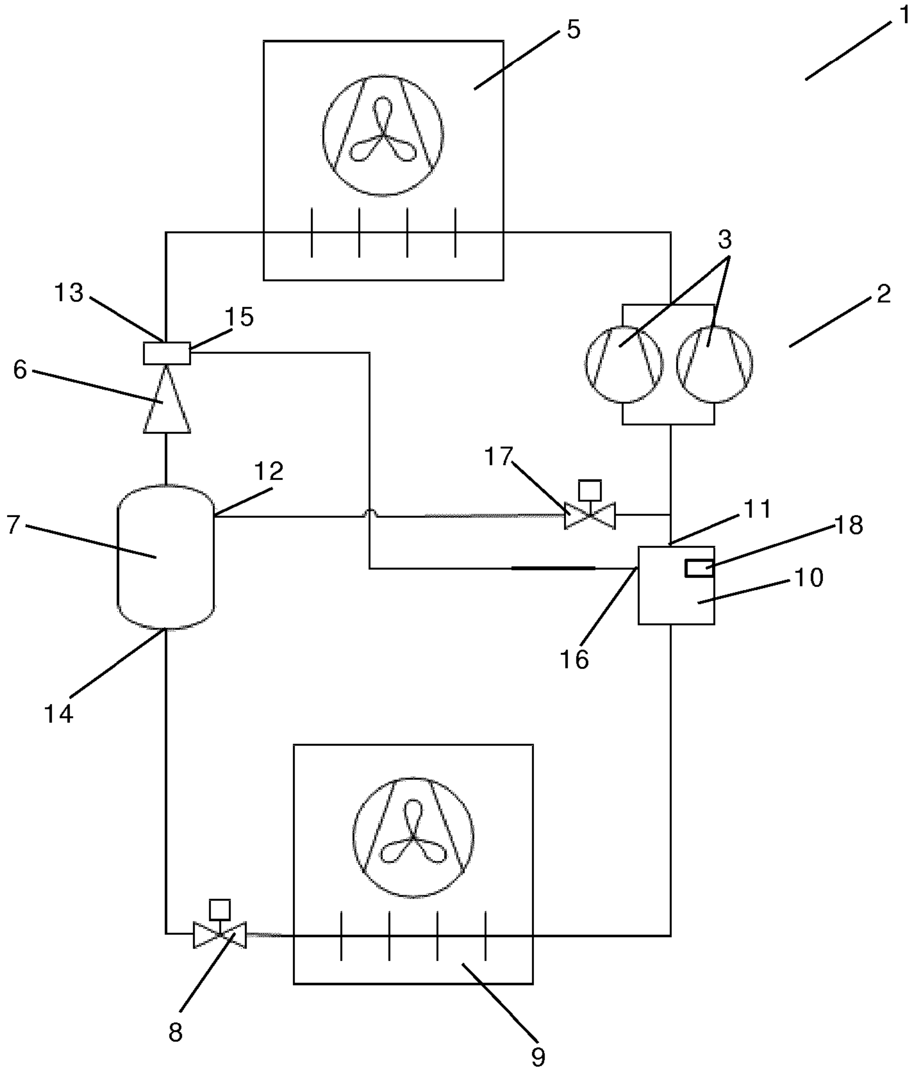

Fig. 2

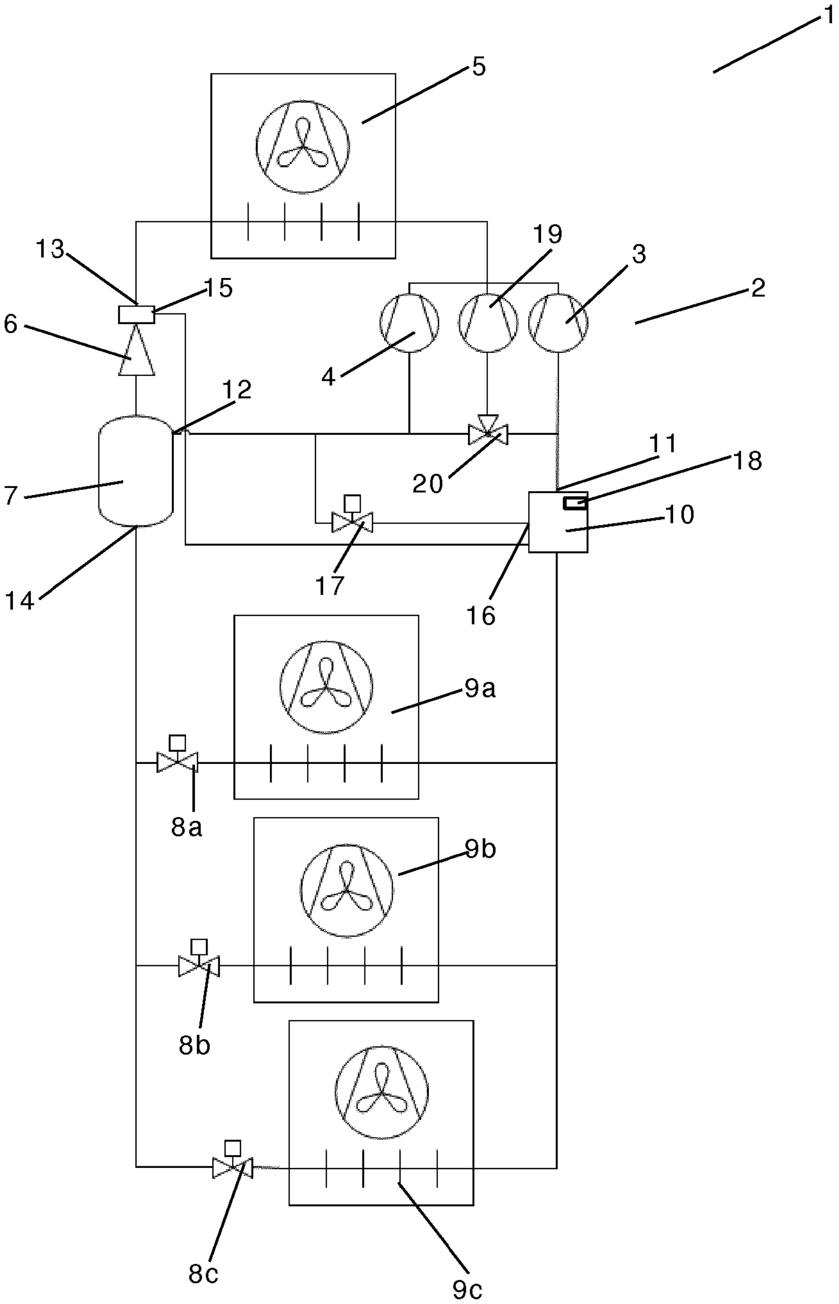

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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