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

(11) EP 3 635 310 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
02.08.2023 Bulletin 2023/31

(21) Application number: **18724767.1**

(22) Date of filing: **01.05.2018**

(51) International Patent Classification (IPC):
F25B 31/00 *(2006.01)* ***F25B 39/02*** *(2006.01)*
F25B 43/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25B 39/02; F25B 31/004; F25B 43/02; F28D 5/02;
F25B 2339/021; F28D 2021/0071

(86) International application number:
PCT/US2018/030427

(87) International publication number:
WO 2018/212983 (22.11.2018 Gazette 2018/47)

(54) **REFRIGERATION SYSTEM AND FALL FILM EVAPORATOR**

KÜHLSYSTEM UND FALLFILMVERDAMPFER

SYSTÈME DE RÉFRIGÉRATION ET ÉVAPORATEUR À FILM TOMBANT

(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: **19.05.2017 CN 201710357044**

(43) Date of publication of application:
15.04.2020 Bulletin 2020/16

(73) Proprietor: **Carrier Corporation**
Jupiter, FL 33478 (US)

(72) Inventor: **GUO, Junjie**
Shanghai 201206 (CN)

(74) Representative: **Dehns**
St. Bride's House
10 Salisbury Square
London EC4Y 8JD (GB)

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Description

TECHNICAL FIELD

[0001] The present invention relates to the refrigeration field, and in particular, to a refrigeration system having a falling film evaporator.

BACKGROUND ART

[0002] Currently, for a refrigeration system using a falling film evaporator, the oil-rich region in the system generally exists at the lower portion inside the housing of the falling film evaporator. Therefore, an oil intake point corresponding to an oil return branch generally is also disposed at the lower portion inside the housing of the falling film evaporator, to suck refrigerant in which the lubricating oil is dissolved into the compressor for lubrication. In this case, if only a small amount of liquid phase refrigerant is accumulated in the falling film evaporator in the working mode, an unduly high oil concentration in the refrigerant liquid is caused, increasing the flow resistance and affecting the oil return. As the amount of lubricating oil accumulated in the evaporator increases, the heat transfer effect deteriorates. Accordingly, the amount of lubricating oil entering the compressor will decrease, affecting the lubrication performance of the compressor, increasing wear and affecting the reliability. If the charging amount of the refrigerant in the entire refrigeration system is increased to a sufficient extent, and the throttle valve is opened widely to preferentially ensure a sufficiently high liquid level in the evaporator rather than ensuring the throttling performance, the problem that the lubricating oil cannot be fully dissolved in the liquid phase refrigerant can be resolved by increasing the amount of the liquid phase refrigerant accumulated in the falling film evaporator to a sufficiently large value. However, this limits the thermodynamic property of the system and increases the costs. Therefore, how to balance the costs and the lubricating oil recovery effect has become a technical problem to be resolved in the art.

[0003] US 5561987 A discloses a compression refrigeration apparatus using a falling film evaporator and utilizing a vapor-liquid separator where refrigerant vapor is conveyed by a bypass line to the evaporator inlet located on the lower heat exchange surface below the nominal level of the pool so that vapor agitates the mixture of refrigerant and lubrication oil in the pool.

SUMMARY OF THE INVENTION

[0004] An objective of the present invention is to provide a refrigeration system and a falling film evaporator, to balance the thermodynamic property and the lubricating oil recovery effect of the refrigeration system having the falling film evaporator.

[0005] The present invention provides a refrigeration system as defined in claim 1. It comprises: a refrigeration loop having an air outlet of a compressor, a condenser, a throttle element, a falling film evaporator, and an air inlet of the compressor which are connected in sequence by pipes, wherein the falling film evaporator comprises a housing, a distributor located at an upper portion inside the housing, and a heat exchange pipeline located below the distributor; an oil return branch having an oil intake point connected to a lower portion of the falling film evaporator and an oil return point connected to the air inlet of the compressor; and characterized by a bypass branch having a bypass inlet disposed on the distributor and connected to downstream of the throttle element, and a bypass outlet connected to the lower portion of the falling film evaporator and used for introducing part of gas-liquid two-phase refrigerant into the falling film evaporator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 is a schematic diagram of a falling film evaporator and an oil return loop according to an embodiment of the present invention.

Fig. 2 is a schematic diagram of a refrigeration system according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0007] As shown in Fig. 1 and Fig. 2, an embodiment of a refrigeration system. The refrigeration system comprises: a refrigeration loop 100 for realizing a main refrigeration function, an oil return branch 200 for providing a lubricating oil return to the compressor, and a bypass branch 300.

[0008] The refrigeration loop 100 has an air outlet 110b of a compressor 110, an oil separator 150, a condenser 120, a throttle element 130, a falling film evaporator 140, and an air inlet 110a of the compressor 110 which are connected in sequence by pipes. Specifically, the falling film evaporator 140 comprises a housing 141, a distributor 142 located at an upper portion inside the housing 141, and a heat exchange pipeline 143 located below the distributor 142. In a normal working mode, refrigerant, after being compressed by the compressor 110, flows from the air outlet 110b into the condenser 120 for condensation, and is then throttled by the throttle element 130. The throttled two-phase refrigerant enters the falling film evaporator 140. The gas phase refrigerant will be directly sucked into the compressor 110. The liquid phase refrigerant is distributed by the distributor 142, forms a refrigerant liquid film to flow through the heat exchange pipeline 143 inside the falling film evaporator 140, and exchanges heat with a to-be-cooled medium therein. After the heat exchange, the gas phase refrigerant obtained by evaporation is sucked into the compressor 110, to participate in a new working cycle.

[0009] In addition, the oil return branch 200 has an oil intake point 210 connected to a lower portion of the falling film evaporator 140 and an oil return point 220 connected to the air inlet 110a of the compressor 110. In the normal working mode, part of lubricating oil that provides lubrication for the compressor 110 will enter the refrigeration cycle along with the flow of the refrigerant. In this case, this part of lubricating oil that enters the refrigeration cycle can be sucked from the lower portion of the falling film evaporator 140 back into the compressor 110. Therefore, impact on both the heat exchange effect of the refrigerant and the lubrication effect of the compressor can be avoided.

[0010] Furthermore, the bypass branch 300 has a bypass inlet 320 connected to downstream of the throttle element 130 and a bypass outlet 310 connected to the lower portion of the falling film evaporator 140. According to the invention, the bypass inlet 320 is disposed on the distributor 142, and is used for introducing part of gas-liquid two-phase refrigerant into the falling film evaporator 140. In this case, under a pressure difference, part of gas-liquid two-phase refrigerant downstream of the throttle element 130 will flow into the lower portion of the falling film evaporator 140 through the bypass branch 300, so that the refrigerant in the lower portion inside the housing 141 of the falling film evaporator reaches a preset liquid level. The preset liquid level enables the liquid phase refrigerant to form a sufficiently large liquid level at the lower portion inside the housing 141 of the falling film evaporator, so that droplets of lubricating oil from above the falling film evaporator can substantially come into contact with the liquid level and be dissolved in the refrigerant. Such a configuration makes it easier to suck most of the lubricating oil back to the compressor through the oil return branch, achieving an efficient oil return function. The specific height value of the preset liquid level or the specific value of the area of the liquid level depends on various parameters such as a profile of the housing of the evaporator and a required oil return ratio. Under the teachings of the foregoing embodiment, a person skilled in the art can integrate the related parameters and set the liquid level in an actual application environment without creative efforts.

[0011] In order that the lubricating oil can be fully dissolved in the liquid phase refrigerant at the lower portion of the falling film evaporator, the bypass branch is improved from multiple aspects, which will be described one by one.

[0012] For example, the bypass inlet 320 is higher than the bypass outlet 310 in a vertical direction. For such a configuration, in addition to the pressure difference between the refrigerant on the bypass inlet side and the refrigerant on the bypass outlet side, the gravity of the refrigerant caused by the height difference between the two can also be used as a power source for driving the bypass refrigerant to flow. Further, in some cases, an auxiliary driving apparatus may be additionally disposed on the bypass branch 300, to provide more power to suck the two-phase refrigerant from the bypass inlet 320 to the bypass outlet 310.

[0013] For another example, the bypass branch 300 has a plurality of bypass inlets 320 and/or a plurality of bypass outlets 310. The bypass inlets 320 and the bypass outlets 310 may belong to a same bypass branch, i.e., similar to the configuration of a liquid collector or liquid separator; or may belong to different bypass branches. In this case, the falling film evaporator comprises a plurality of bypass branches 300, and each of the bypass branches may comprise at least one bypass inlet and/or bypass outlet. Such a configuration can effectively and evenly increase the bypass flux. Optionally, the plurality of bypass outlets 310 can also be arranged in an evenly spaced manner on the lower portion of the housing 141 of the falling film evaporator. Thereby, the bypass refrigerant can be fed to the evaporator more evenly, thereby avoiding undue impact.

[0014] Optionally, as a specific position for arrangement, the bypass outlet 310 may be arranged at the bottom of the housing 141 of the falling film evaporator. Thereby, the refrigerant that enters the evaporator through the bypass outlet 310 basically does not unduly affect the original refrigerant liquid level in the evaporator, making the entire bypass process more stable.

[0015] Optionally, a smallest flow cross-sectional area of a pipe of the bypass branch 300 is 0.5%-20% of a flow cross-sectional area of a pipe of the refrigeration loop 100 downstream of the throttle element 130. In this case, it is ensured that the amount of the bypass refrigerant can meet the requirement for increasing the liquid level, and will not cause great impact to the normal cycle. Generally, an unduly large amount of refrigerant accumulated in the housing of the falling film evaporator is not desirable in the present invention, because this has only a limited effect in improving the heat exchange efficiency and greatly increases the charging amount of the refrigerant as well as material costs. Therefore, the foregoing problem can be well resolved by limiting the flow area of the bypass branch to control the bypass flux, and a balance between efficiency and costs can be achieved.

[0016] Optionally, a pipe of the bypass branch 300 has a circular and/or rectangular and/or trough-type cross-section, to adapt to different application scenarios and flow conditions.

[0017] In addition, as another embodiment, the bypass inlet of the bypass branch may further be connected to the distributor, though not shown in the figure. In this case, the bypass branch can be considered to be part of the falling film evaporator.

[0018] In particular, the falling film evaporator according to an example, which is not part of the present nvention, comprises: a housing; a distributor disposed at an upper portion inside the housing; a heat exchange pipeline disposed inside the housing and below the distributor; an oil intake point disposed at a lower portion of the falling film evaporator; and a bypass branch having a bypass inlet connected to the distributor and a bypass outlet connected to the lower portion of the falling film evaporator and used for introducing part of gas-liquid two-phase refrigerant into the lower portion of the falling film evaporator, so that the refrigerant in the lower portion inside the housing of the falling film evaporator reaches a preset liquid level. The preset liquid level enables the liquid phase refrigerant to form a sufficiently large liquid level at the lower portion inside the housing of the falling film evaporator, so that droplets of lubricating oil from above the falling film evaporator can substantially come into contact with the liquid level and be dissolved in the refrigerant, thereby achieving an efficient oil return function.

[0019] Similarly, in order that the lubricating oil can be fully dissolved in the liquid phase refrigerant at the lower portion of the falling film evaporator, the bypass branch is improved from multiple aspects, which will also be described one by one.

[0020] According to the configuration in the foregoing example, the bypass inlet is generally higher than the bypass outlet in a vertical direction. In this case, in addition to the pressure difference between the refrigerant on the bypass inlet side and the refrigerant on the bypass outlet side, the gravity of the refrigerant caused by the height difference between the two can also be used as a power source for driving the bypass refrigerant to flow. Further, in some cases, an auxiliary driving apparatus may be additionally disposed on the bypass branch, to provide more power to suck the two-phase refrigerant from the bypass inlet to the bypass outlet.

[0021] For another example, the bypass branch has a plurality of bypass inlets and/or a plurality of bypass outlets. The bypass inlets and the bypass outlets may belong to a same bypass branch, i.e., similar to the configuration of a liquid collector or liquid separator; or may belong to different bypass branches. In this case, the falling film evaporator comprises a plurality of bypass branches, and each of the bypass branches may comprise at least one bypass inlet and/or bypass outlet. Such a configuration can effectively and evenly increase the bypass flux. Optionally, the plurality of bypass outlets can also be arranged in an evenly spaced manner on the lower portion of the housing of the falling film evaporator. Thereby, the bypass refrigerant can be fed to the evaporator more evenly, thereby avoiding undue impact.

[0022] Optionally, as a specific position for arrangement, the bypass outlet may be arranged at the bottom of the housing of the falling film evaporator. Thereby, the refrigerant that enters the evaporator through the bypass outlet basically does not unduly affect the original refrigerant liquid level in the evaporator, making the entire bypass process more stable.

[0023] Optionally, a pipe of the bypass branch has a circular and/or rectangular and/or trough-type cross-section, to adapt to different application scenarios and flow conditions.

[0024] More improvements in terms of the oil return branch in the refrigeration system according to the foregoing embodiments will be further described with reference to Fig. 1 and Fig. 2 again.

[0025] The oil return branch 200 has a plurality of oil intake points 210. The oil intake points 210 may belong to a same oil return branch, i.e., similar to the configuration of a liquid collector or liquid separator; or may belong to different oil return branches. In this case, the refrigeration system comprises a plurality of oil return branches 200, and each of the oil return branches may comprise at least one oil intake point and/or oil return point. Such a configuration can effectively and evenly increase the oil return amount. Optionally, a plurality of a plurality of oil intake points 210 can also be arranged in an evenly spaced manner on the lower portion of the housing 141 of the falling film evaporator. Thereby, the recovered lubricating oil can be sucked from the evaporator more evenly, thereby avoiding undue impact.

[0026] Optionally, as a specific position for arrangement, the oil intake point 210 may be arranged at the bottom of the housing 141 of the falling film evaporator. Thereby, the lubricating oil in the evaporator basically can all be recovered through the oil intake point 210, and the amount of lubricating oil accumulated in the evaporator will not be unduly large to affect the heat exchange performance of the evaporator and the lubrication performance of the compressor.

[0027] Optionally, an ejector 230 may further be disposed on the oil return branch 200. The ejector 230 has a first ejection inlet connected to the oil intake point 210, a second ejection inlet connected to an inlet side of the condenser 120, and an ejection outlet connected to the air inlet 110a of the compressor 110, to provides power for the oil return. Definitely, other oil return methods well known in the art can also be adopted according to different application scenarios.

[0028] The and implementations provided herein should be construed as exemplary rather than limiting. The present invention can encompass various modifications and replacements made without departing from the scope of the present invention as defined by the appended claims.

Claims

1. A refrigeration system, comprising:

a refrigeration loop (100) having an air outlet (110b) of a compressor (110), a condenser (120), a throttle element (130), a falling film evaporator (140), and an air inlet (110a) of the compressor which are connected in sequence by pipes, wherein the falling film evaporator comprises a housing (141), a distributor (142) located at an upper portion inside the housing, and a heat exchange pipeline (143) located below the distributor;

an oil return branch (200) having an oil intake

point (210) connected to a lower portion of the falling film evaporator (140) and an oil return point (220) connected to the air inlet (110a) of the compressor (110); and **characterized by**
a bypass branch (300) having a bypass inlet (320) disposed on the distributor (142) and connected to downstream of the throttle element (130), and a bypass outlet (310) connected to the lower portion of the falling film evaporator and used for introducing part of gas-liquid two-phase refrigerant into the falling film evaporator (140).

2. The refrigeration system according to claim 1, wherein the bypass inlet (320) is higher than the bypass outlet (310) in a vertical direction.

3. The refrigeration system according to claim 1 or 2, wherein the bypass branch (300) has a plurality of bypass inlets (320) and/or a plurality of bypass outlets (310).

4. The refrigeration system according to claim 3, wherein the plurality of bypass outlets (310) are arranged in an evenly spaced manner on a lower portion of the housing (141) of the falling film evaporator (140).

5. The refrigeration system according to claim 1 or 2, wherein the bypass outlet (310) is arranged at the bottom of the housing (141) of the falling film evaporator (140).

6. The refrigeration system according to claim 1 or 2, comprising a plurality of the bypass branches (300).

7. The refrigeration system according to claim 1 or 2, wherein a smallest flow cross-sectional area of a pipe of the bypass branch (300) is 0.5%-20% of a flow cross-sectional area of a pipe of the refrigeration loop (100) downstream of the throttle element (130).

8. The refrigeration system according to claim 1 or 2, wherein a pipe of the bypass branch (300) has a circular and/or rectangular and/or trough-type cross-section.

9. The refrigeration system according to any one of claims 1 to 7, wherein the oil return branch (200) has a plurality of oil intake points (210).

10. The refrigeration system according to claim 8, wherein the plurality of oil intake points (210) are arranged in an evenly spaced manner on the lower portion of the housing (141) of the falling film evaporator (140).

11. The refrigeration system according to any one of claims 1 to 9, wherein the oil intake point (210) is arranged at the bottom of the housing (141) of the falling film evaporator (140).

12. The refrigeration system according to any one of claims 1 to 7, wherein an ejector (230) is disposed on the oil return branch (200), the ejector having a first ejection inlet connected to the oil intake point (210), a second ejection inlet connected to an inlet side of the condenser (120), and an ejection outlet connected to the air inlet (110a) of the compressor (110).

13. The refrigeration system according to any one of claims 1 to 7, comprising a plurality of the oil return branches (200).

14. The refrigeration system according to any one of claims 1 to 7, wherein an auxiliary driving apparatus for sucking the two-phase refrigerant from the bypass inlet (320) to the bypass outlet (310) is disposed on the bypass branch (300).

Patentansprüche

1. Kälteanlage, umfassend:

einen Kühlkreislauf (100), der einen Luftauslass (110b) eines Kompressors (110), einen Kondensator (120), ein Drosselelement (130), einen Fallfilmverdampfer (140) und einen Lufteinlass (110a) des Kompressors aufweist, die nacheinander durch Rohre verbunden sind, wobei der Fallfilmverdampfer ein Gehäuse (141), einen Verteiler (142), der an einem oberen Abschnitt innerhalb des Gehäuses angeordnet ist, und eine Wärmeaustauschrohrleitung (143) umfasst, die unterhalb des Verteilers angeordnet ist;
einen Ölrückführzweig (200), der einen Öleinlasspunkt (210), der mit einem unteren Abschnitt des Fallfilmverdampfers (140) verbunden ist, und einen Ölrückführpunkt (220) aufweist, der mit dem Lufteinlass (110a) des Kompressors (110) verbunden ist; und **gekennzeichnet durch**
einen Bypass-Zweig (300), der einen Bypass-Einlass (320), der an dem Verteiler (142) angeordnet und stromabwärts des Drosselelements (130) verbunden ist, und einen Bypass-Auslass (310) aufweist, der mit dem unteren Abschnitt des Fallfilmverdampfers verbunden ist und zum Einleiten eines Teils von zweiphasigem Gas-Flüssigkeit-Kältemittel in den Fallfilmverdampfer (140) verwendet wird.

2. Kälteanlage nach Anspruch 1, wobei der Bypass-Einlass (320) in vertikaler Richtung höher liegt als der Bypass-Auslass (310) .

3. Kälteanlage nach Anspruch 1 oder 2, wobei der Bypass-Zweig (300) eine Vielzahl von Bypass-Einlässen (320) und/oder eine Vielzahl von Bypass-Auslässen (310) aufweist.

4. Kälteanlage nach Anspruch 3, wobei die Vielzahl von Bypass-Auslässen (310) auf gleichmäßig beabstandete Weise an einem unteren Abschnitt des Gehäuses (141) des Fallfilmverdampfers (140) angeordnet ist.

5. Kälteanlage nach Anspruch 1 oder 2, wobei der Bypass-Auslass (310) am Boden des Gehäuses (141) des Fallfilmverdampfers (140) angeordnet ist.

6. Kälteanlage nach Anspruch 1 oder 2, umfassend eine Vielzahl von Bypass-Zweigen (300).

7. Kälteanlage nach Anspruch 1 oder 2, wobei eine kleinste Strömungsquerschnittsfläche eines Rohrs des Bypass-Zweigs (300) 0,5 %-20 % einer Strömungsquerschnittsfläche eines Rohrs des Kühlkreislaufs (100) stromabwärts des Drosselelements (130) beträgt.

8. Kälteanlage nach Anspruch 1 oder 2, wobei ein Rohr des Bypass-Zweigs (300) einen kreisförmigen und/oder rechteckigen und/oder wannenförmigen Querschnitt aufweist.

9. Kälteanlage nach einem der Ansprüche 1 bis 7, wobei der Ölrückführzweig (200) eine Vielzahl von Ölansaugpunkten (210) aufweist.

10. Kälteanlage nach Anspruch 8, wobei die Vielzahl von Ölansaugpunkten (210) auf gleichmäßig beabstandete Weise an dem unteren Abschnitt des Gehäuses (141) des Fallfilmverdampfers (140) angeordnet ist.

11. Kälteanlage nach einem der Ansprüche 1 bis 9, wobei der Ölansaugpunkt (210) am Boden des Gehäuses (141) des Fallfilmverdampfers (140) angeordnet ist.

12. Kälteanlage nach einem der Ansprüche 1 bis 7, wobei ein Ejektor (230) an dem Ölrückführzweig (200) angeordnet ist, wobei der Ejektor einen ersten Ejektionseinlass, der mit dem Öleinlasspunkt (210) verbunden ist, einen zweiten Ejektionseinlass, der mit einer Einlassseite des Kondensators (120) verbunden ist, und einen Ejektionsauslass aufweist, der mit dem Lufteinlass (110a) des Kompressors (110) verbunden ist.

13. Kälteanlage nach einem der Ansprüche 1 bis 7, umfassend eine Vielzahl von Ölrückführzweigen (200).

14. Kälteanlage nach einem der Ansprüche 1 bis 7, wobei eine Hilfsantriebsvorrichtung zum Saugen des zweiphasigen Kältemittels von dem Bypass-Einlass (320) zu dem Bypass-Auslass (310) an dem Bypass-Zweig (300) angeordnet ist.

Revendications

1. Système de réfrigération, comprenant :

une boucle de réfrigération (100) ayant une sortie d'air (110b) d'un compresseur (110), un condenseur (120), un élément d'étranglement (130), un évaporateur à film tombant (140) et une entrée d'air (110a) du compresseur qui sont reliés en séquence par des tuyaux, dans lequel l'évaporateur à film tombant comprend un boîtier (141), un distributeur (142) situé à une partie supérieure à l'intérieur du boîtier, et une conduite d'échange de chaleur (143) située sous le distributeur ;

une branche de retour d'huile (200) ayant un point d'admission d'huile (210) relié à une partie inférieure de l'évaporateur à film tombant (140) et un point de retour d'huile (220) relié à l'entrée d'air (110a) du compresseur (110) ; et **caractérisé par**

une branche de dérivation (300) ayant une entrée de dérivation (320) disposée sur le distributeur (142) et reliée en aval de l'élément d'étranglement (130), et une sortie de dérivation (310) reliée à la partie inférieure de l'évaporateur à film tombant et utilisée pour introduire une partie du réfrigérant biphasique gaz-liquide dans l'évaporateur à film tombant (140) .

2. Système de réfrigération selon la revendication 1, dans lequel l'entrée de dérivation (320) est plus haute que la sortie de dérivation (310) dans une direction verticale.

3. Système de réfrigération selon la revendication 1 ou 2, dans lequel la branche de dérivation (300) présente une pluralité d'entrées de dérivation (320) et/ou une pluralité de sorties de dérivation (310).

4. Système de réfrigération selon la revendication 3, dans lequel la pluralité de sorties de dérivation (310) sont agencées de manière régulièrement espacée sur une partie inférieure du boîtier (141) de l'évaporateur à film tombant (140) .

5. Système de réfrigération selon la revendication 1 ou 2, dans lequel la sortie de dérivation (310) est agencée au fond du boîtier (141) de l'évaporateur à film tombant (140).

6. Système de réfrigération selon la revendication 1 ou 2, comprenant une pluralité des branches de dérivation (300).

7. Système de réfrigération selon la revendication 1 ou 2, dans lequel une plus petite surface de section transversale d'écoulement d'un tuyau de la branche de dérivation (300) est de 0,5 % à 20 % d'une surface de section transversale d'écoulement d'un tuyau de la boucle de réfrigération (100) en aval de l'élément d'étranglement (130).

8. Système de réfrigération selon la revendication 1 ou 2, dans lequel un tuyau de la branche de dérivation (300) a une section circulaire et/ou rectangulaire et/ou en forme de cuve.

9. Système de réfrigération selon l'une quelconque des revendications 1 à 7, dans lequel la branche de retour d'huile (200) présente une pluralité de points d'admission d'huile (210) .

10. Système de réfrigération selon la revendication 8, dans lequel la pluralité de points d'admission d'huile (210) sont agencés de manière régulièrement espacée sur la partie inférieure du boîtier (141) de l'évaporateur à film tombant (140) .

11. Système de réfrigération selon l'une quelconque des revendications 1 à 9, dans lequel le point d'admission d'huile (210) est agencé au fond du boîtier (141) de l'évaporateur à film tombant (140).

12. Système de réfrigération selon l'une quelconque des revendications 1 à 7, dans lequel un éjecteur (230) est disposé sur la branche de retour d'huile (200), l'éjecteur ayant une première entrée d'éjection reliée au point d'admission d'huile (210), une seconde entrée d'éjection reliée à un côté entrée du condenseur (120), et une sortie d'éjection reliée à l'entrée d'air (110a) du compresseur (110) .

13. Système de réfrigération selon l'une quelconque des revendications 1 à 7, comprenant une pluralité de branches de retour d'huile (200).

14. Système de réfrigération selon l'une quelconque des revendications 1 à 7, dans lequel un appareil d'entraînement auxiliaire pour aspirer le réfrigérant biphasique de l'entrée de dérivation (320) à la sortie de dérivation (310) est disposé sur la branche de dérivation (300).

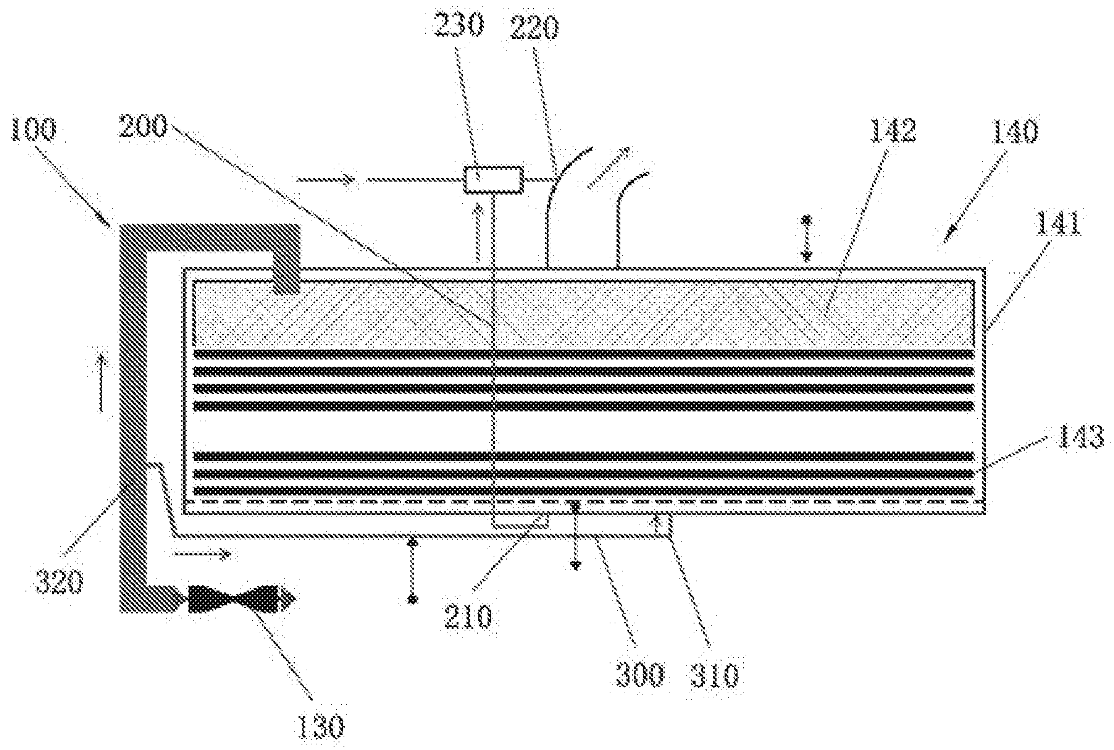
230
220
100
200
142
140
141
143
320
210
300
310
130

FIG. 1

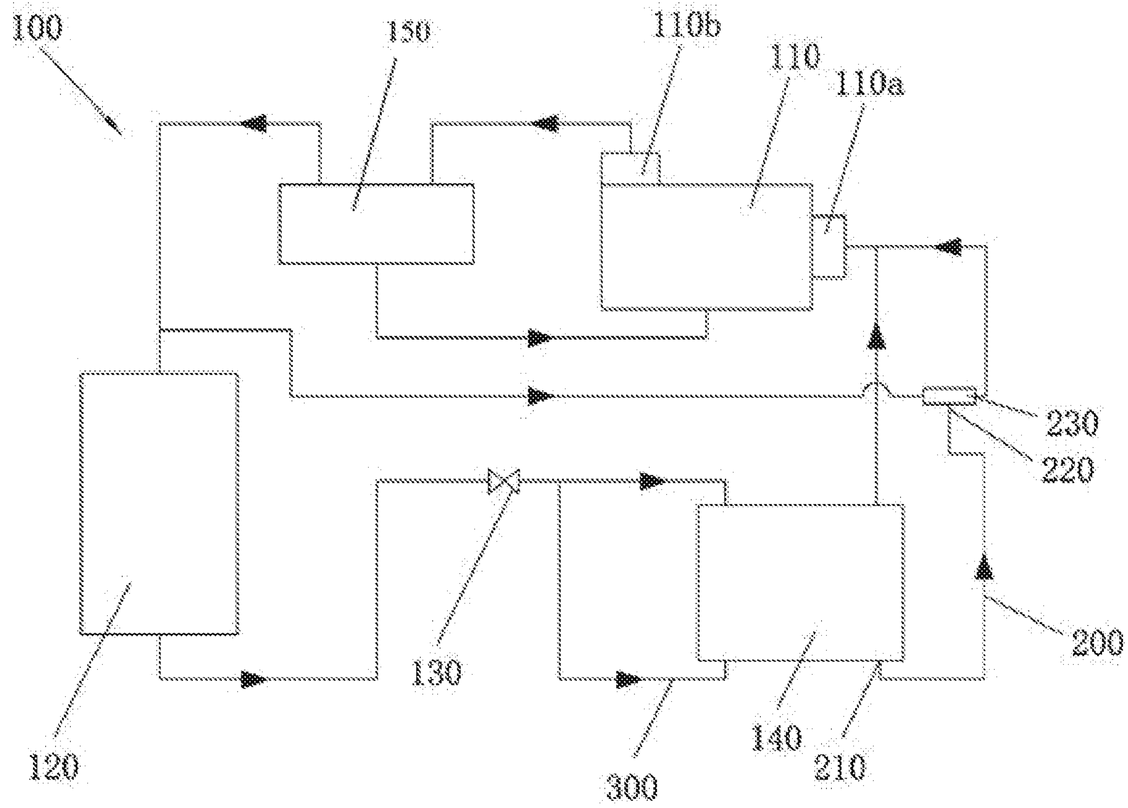
100
150
110b
110
110a
230
220
200
120
130
300
140
210

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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