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(54) **REFRIGERANT CIRCUIT AND METHOD FOR MANAGING OIL THEREIN**

KÄLTEMITTELKREISLAUF UND VERFAHREN ZUM UMGANG MIT ÖL DARIN

CIRCUIT DE RÉFRIGÉRANT ET PROCÉDÉ POUR GÉRER DE L'HUILE DANS CELUI-CI

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- **GEBHARDT D ET AL: "ENTWICKLUNG EINER TRANSKRITISCHEN ZWEISTUFIGEN SUPERMARKTKAELTEANLAGE FUER TIEF- UND NORMALKUEHLUNG (2) DEVELOPMENT OF A SUPERMARKET TRANSCRITICAL MULTISTAGE REFRIGERATING PLANT FOR CHILLING AND FREEZING" KALTE UND KLIMATECHNIK, GENTNER, STUTTGART, DE, vol. 56, October 2003 (2003-10), pages 54-65, XP008028730 ISSN: 0343-2246**

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Description

[0001] Refrigerant circuits are known and widely induced, for example in air conditioning systems, refrigeration apparatus, etc.. A conventional refrigerant circuit comprises a compressor unit, comprising one or a plurality of individual compressors, a heat rejecting heat exchanger, an expansion device and an evaporator in flow direction serially connected with each other. A two-stage refrigerant circuit comprises two refrigerant circuits working at different temperature levels and connected with each other. In a so called cascade arrangement the two refrigerant circuits are fluidly disconnected from each other and only in a heat exchange relationship connected with each other. In a booster arrangement, the two different level refrigerant circuits are fluidly connected with each other with the outlet of the lower compressor unit being typically at the same pressure level as the inlet of the higher pressure refrigerant circuit.

[0002] In order to maintain lubrication of the components and particularly of the pressure unit in the refrigerant circuit, a lubricant, typically oil, is admixed to the refrigerant in a predetermined amount. Typically approximately 2 % of the refrigerant is lubricant and oil, respectively, while the remaining approximately 98 % are the actual refrigerant. In order to maintain correct lubrication of the compressor unit an oil separator is typically provided in the high pressure line leaving the compressor unit and an oil level regulator is provided for the compressor unit in order to inject lubricant and oil, respectively, into a respective compressor of the compressor unit once the oil level therein is below a predetermined minimum oil level. In two stage refrigerant circuit having the two stages fluidly connected with each other, there is the risk for accumulating lubricant in one of the two stages. While it is relatively easy to inject lubricant accumulated from the higher pressure sub-circuit into the low pressure sub-circuit, the opposite, i.e. transferring lubricant from the low pressure sub-circuit into the higher pressure sub-circuit requires to bridge a substantial pressure difference.

[0003] EP-A-1 550 832 discloses a refrigerant circuit according to the preamble of claim 1.

[0004] Accordingly, it would be beneficial to provide means for transferring lubricant from the low pressure sub-circuit to the higher pressure sub-circuit.

[0005] Exemplary embodiments of the invention include a refrigerant circuit according to claim 1.

[0006] It is to be noted that in the context of this description the terms lubricant and oil are exchangeable, i.e. the term oil is not restricted to oil in its narrow meaning but extends to lubricants as a whole.

[0007] The respective compressor units may each comprise a single or a plurality of individual compressors.

[0008] An other exemplary embodiment of the invention includes a method for managing oil in a refrigerant circuit according to claim 9.

[0009] Embodiments of the invention are described in greater detail below with reference to the figures, wherein:

Fig. 1 shows a refrigerant circuit in accordance with one embodiment of the present invention;

Fig. 2 shows part of a refrigerant circuit in accordance with an other embodi- ment of the present invention;

Fig. 3 shows an other embodiment; and

Fig. 4 shows an other embodiment.

[0010] The respective embodiments comprise similar or identical portions and elements and like reference numbers correspond to similar or identical features.

[0011] Any disclosures given with respect to any of the embodiments likewise applies to the other embodiments unless it is technically impossible in view of the differences between the embodiments.

[0012] Fig. 1 shows a refrigerant circuit 2 comprising a low pressure sub-circuit 4 and a higher pressure sub-circuit 6. The higher pressure sub-circuit 6 comprises a higher pressure compressor unit 8 having a number of individual compressors 10, at least some thereof having a common higher pressure refrigerant inlet 12. A higher pressure refrigerant outlet 14 connects compressor unit 18 via a high pressure refrigerant line 16 to a heat rejecting heat exchanger 18 which in case of a conventional refrigerant is typically termed a condenser and in case of a transcritical refrigerant is typically termed a gas cooler. While the present invention is applicable with conventional refrigerants and transcritical refrigerants, a transcritical refrigerant circuit embodying the present invention is preferred. Carbondioxide is a preferred transcritical refrigerant.

[0013] Line 20 connects the heat rejecting heat exchanger 18 with a receiver 22. Receiver outlet 24 is connected via an expansion means 26 to an evaporator 28. Line 30 connects the output 32 of the evaporator 28 with the medium pressure line 34 which further connects to the higher pressure refrigerant inlet 12. An inter cooler circuit 36 serves for sub cooling a refrigerant leaving the receiver 22, as known in the art.

[0014] Optionally, a branch-off line 45 can be provided connecting a refrigerant line portion at a position before the expansion means 26 with the line 30 at a position before the low pressure expansion device 44, especially at a position between the branching off medium pressure line 34 and the low pressure expansion device 44.

[0015] Low pressure sub-circuit 4 similarly comprises a low pressure compressor unit 38 having a plurality of individual compressors 40 and a common low pressure refrigerant outlet 42 which, in this embodiment, is identical to the medium pressure line 34 and the higher pressure refrigerant inlet 12, but is at least fluidly connected to the higher pressure refrigerant inlet 12.

[0016] A low pressure expansion device 44 and a low pressure evaporator 46 close the low pressure sub-circuit 4 to the low pressure refrigerant inlet 48.

[0017] The embodiment of Fig. 1 as well as the further embodiments as described here are refrigerant circuits 2 comprising a transcritical refrigerant and particularly carbondioxide. This type of refrigerant circuit is adapted for use in a refrigeration apparatus, but the present invention can be used with other refrigerant apparatus, like air conditioning apparatus, etc.. In a supermarket refrigerant apparatus the low pressure expansion device 44 and evaporator 46, respectively provide the so-called deep temperature cooling, i.e. the cooling of frozen goods in a temperature range of approximately minus 20 to minus 25 °C within the goods compartment. On the other hand, the higher pressure expansion device 26 and evaporator 28 provide the so-called normal temperature cooling for conventional non-frozen goods in a temperature range of around 0 to plus 5 °C within the goods compartment. In an operational mode providing the before mentioned temperatures for the low pressure refrigeration consumer 46 and the normal pressure refrigeration consumer 28, the temperatures and the pressures of the refrigerant in the system are approximately 10 to 12 bar and minus 40 to minus 35 °C in the low pressure refrigerant inlet line, approximately 30,5 bar and minus 5 °C at the low pressure refrigerant outlet 42 and depending on the ambient temperature of the heat rejecting teat exchanger 18 between approximately 80 to 90 bar and approximately 40 °C in summer operational mode and 45 bar and plus 10 °C in winter operational mode.

[0018] A higher pressure oil system 50 connects the oil sumps of the compressors 10 with each other in order to provide an equal oil level within the compressors. A similar compensation conduit 52 connects the individual compressors 40 of the low pressure compressor unit 38. This compensation conduit 52 is further connected via low pressure oil inlet conduit 54 to an oil reservoir 56. A low pressure shut-off valve 58 is arranged in the oil inlet conduit 54. Oil reservoir 56 is connected by means of oil discharge conduit 60 to the higher pressure sub-circuit 6 and preferably to the higher pressure refrigerant inlet 12. The oil discharge conduit 60 comprises an oil discharge valve 62 which preferably is a non-return valve 62, but may also be a shut-off valve. Moreover, a pressure release means 64 is connected to the oil reservoir 56. Preferably, the pressure release means 64 comprises a release conduit 66 connecting the oil reservoir 56 with a low pressure section line 48 and comprises a release valve 68.

[0019] During normal operation, the low pressure discharge valve 58 is open, while the oil discharge valve 62 and the release valve 68 are closed. Excess oil from the low pressure compressor unit 38 may flow through the low pressure oil inlet conduit 54 into the oil reservoir 56. Oil reservoir 56 can be fluidly connected to the oil sump of the low pressure compressor unit 38 and particularly to the individual oil sumps of the compressors 40 so that oil level in the oil sump(s) and the oil reservoir 56 are always flush, if the low pressure discharge valve 58 is in its open state. Alternatively, a tapping means (not shown) can be provided for each individual compressor 40 or the whole low pressure compressor unit 38 for tapping just the excess oil from the low pressure compressor unit 38. In both cases excess oil is collected in the oil reservoir 56. Once oil has accumulated in the oil reservoir 56, the low pressure discharge valve 58 is closed and the pressure in the oil reservoir 56 is increased, for example by allowing heating of the oil reservoir 56 and the refrigerant and oil therein by means of ambient conditions. Typically the oil reservoir 56 will be in a machine room at a temperature of roughly 20 °C, while the temperature of the oil and the refrigerant in the oil reservoir 56 will be much lower, dependent on the fluid exchange with the low pressure compressor unit 38. If for example carbondioxide having a temperature of approximately minus 30 °C and a pressure of approximately 14,3 bar is allowed to warm up to approximately 20 °C, the pressure within the oil reservoir 56 will substantially increase and will particularly be above the pressure of roughly 30 bar at the higher pressure refrigerant inlet 12 and once the oil discharge valve 62 opens, the oil can be transferred due to the pressure difference to the higher pressure refrigerant in the line 12. If the oil discharge valve 62 is a non-return valve, which opens for example if the pressure difference is approximately 0.07 bar, it will automatically open once the pressure in the oil reservoir 56 exceeds the pressure of the higher pressure refrigerant inlet 12. Alternatively, if the oil discharge valve 62 is a shut-off valve, it can actively be opened and closed for transferring the oil.

[0020] Once the oil has been transferred, the oil discharge valve 62 closes automatically or will be actively closed and the overpressure of the oil reservoir 56 is discharged to the release valve 68 to the low pressure suction line 48. Once the pressure in the low pressure suction line 48 and the oil reservoir 56 is balanced, the low pressure discharge valve 58 can be opened again in order to allow the collection of excess oil in the oil reservoir 56.

[0021] Sensor means (not shown) can be provided for detecting whether sufficient excess oil has been collected in the oil reservoir 56 and a control (not shown) can initiate the oil transportation as previously described. It is also possible to provide a timer which after a pre-determined time has elapsed, starts a corresponding oil transfer operation. It is within the average skill of the skilled person in the field to provide the necessary sensors, control, etc. for implementing either of the described oil transfer modes.

[0022] Situations might exist where the temperature in the machine room for the oil reservoir 56 is not sufficient to generate sufficient pressure within the reservoir 56. For initiating or accelerating the built up of the pressure in the oil reservoir 56, it is possible to open the oil discharge valve 62 once the low pressure discharge valve 58 has been closed for oil transfer. Once the oil discharge valve 62 is opened, higher pressure refrigerant from the higher pressure refrigerant inlet 12 may flow into to oil reservoir 56 at a pressure of approximately 30,5 bar and a temperature of approximately minus 5 °C. Accordingly, the pressure in the oil reservoir 56 will be relatively close to the target pressure for transferring the oil and at a relatively low temperature. Subsequently, the oil discharge valve 62 is closed again and ambient air around the oil reservoir 56 may heat up the refrigerant and oil within the oil reservoir 56. Already a slight temperature increase will be sufficient to provide a sufficient pressure difference between the oil reservoir and the higher pressure refrigerant inlet line 12 for transferring the oil thereto.

[0023] Fig. 2 discloses an other alternative for generating the necessary pressure difference in the oil reservoir 56 by means of a heater 70 which can be an autonomous heater 70, which is for example electrically powered. It is also possible to direct any hot refrigerant from any other part of the refrigerant circuit through heating lines thus serving as heater 70. With the exception of heater 70, the embodiment of Fig. 2 corresponds to that of Fig. 1. Also the oil transfer operation corresponds more or less to that of the embodiment of Fig. 1 with the exception that instead of allowing heating up of the oil and refrigerant in the reservoir 56 the heater 70 will be turned on once the low pressure discharge valve 58 has been closed. Again, the oil discharge valve 62 will automatically opened or actively opened so that the pressure difference can drive the oil through the oil discharge line 60 to the higher pressure sub-circuit 6 and preferably the higher pressure refrigerant inlet of the higher pressure compressor unit 8.

[0024] In the embodiment of Fig. 3, which is again very similar to that of Fig. 1 and 2, high pressure refrigerant from receiver 22 can be used for pressurizing the oil reservoir 56. To this effect, a pressurizing line 72 connects receiver 22 via pressurizing valve 74 with the oil reservoir 56. The oil transfer operation with the embodiment of fig. 3 is again very similar to that of fig. 1 and 2, respectively. Once the pressure discharge valve 58 has been closed and once the oil reservoir 56 was accordingly isolated, the pressurizing valve 74 is opened and allows inflow of high pressure refrigerant having a pressure of approximately 40 bar into the oil reservoir 56. Once the pressurizing valve 74 has been closed, the discharge valve 62 can open automatically or can actively be opened so that oil is transferred to the higher pressure sub-circuit 6.

[0025] The embodiment of fig. 4 is very similar to the embodiment of fig. 3 but allows to transfer oil from the higher pressure sub-circuit 6 to the low pressure sub-circuit 4 by means of oil transfer conduit 76 and oil transfer valve 78. Particularly, the oil transfer conduit 76 is connected to the higher pressure oil compensation line 8 which connects individual pressures 10 of the higher pressure compressor unit 8 or an individual oil sump of at least one compressor 10. Again, a tapping means (not shown) can be provided for tapping just excess oil to the oil transfer conduit 76. The conventional oil transfer operation transferring oil from the low pressure sub-circuit 4 to the higher pressure sub-circuit 8 is conventional as disclosed with respect to sub-circuit 4. The oil transfer in the opposite direction can for example be performed once the oil discharge valve 62 was closed. If the oil transfer valve 78 is subsequently opened, excess oil from the higher pressure compressor unit 8 may flow, for example due to difference in pressure to the oil reservoir 56. Subsequently, the oil transfer valve 78 will be closed and once the low pressure discharge valve 58 will be opened after releasing the surplus pressure through the release valve 68, normal operation is resumed.

[0026] Alternatively, beginning with the normal operation mode, where only the low pressure discharge valve 50 is open, this low pressure discharge valve 58 can be closed and the oil transfer valve 78 can be opened, so that pressure difference with drive excess oil from the higher pressure sub-circuit to the oil reservoir 56.

[0027] It is to be noted, that the individual approaches as shown above for increasing the pressure in the oil reservoir 56 for transferring oil to the higher pressure sub-circuit can be used various combinations with each other. It is also possible to use the additional oil transfer conduit 76 and oil transfer valve 78 with any of the above embodiments of Fig. 1 to 3. With the exception of the above-mentioned automatic non-return valve, the actively controlled valves can be solenoid valves, etc..

[0028] In general the pressure figures are given as absolute pressures.

[0029] While the invention has been described with reference to-exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalence my be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that it is not limited to the particular embodiment disclosed, but that the invention will include all embodiments within the scope of the dependent claims.

Claims

1. Refrigerant circuit (2) comprising a low pressure compressor unit (38) having a low pressure refrigerant outlet (42) in a low pressure sub-circuit (4) and a higher pressure compressor unit (8) having a higher pressure refrigerant inlet (12) in a higher pressure sub-circuit (6), wherein the low pressure refrigerant outlet (42) and the higher pressure refrigerant inlet (12) are fluidly connected with each other, further comprising an oil reservoir (56) connected by a low pressure oil inlet conduit (54) to the low pressure sub-circuit (4) for receiving oil therefrom and connected via an oil discharge (62) to the higher pressure sub-circuit (6) and **characterised in that** it fur-

ther comprises a receiver (22) in the higher pressure sub-circuit (6), a pressurizing line (72) connecting the receiver (22) with the oils reservoir (56) and a pressurizing valve (74) in the pressurizing line (72).

2. Refrigerant circuit (2) according to claim 1, wherein the oil reservoir (56) is connected to a tapping means for tapping excess oil from the low pressure compressor unit (38).

3. Refrigerant circuit (2) according to claim 1 or 2, wherein the oil reservoir (56) is fluidly connected to the oil sump of the low pressure compressor unit (38) so that the oil level in the oil reservoir (56) and that of the oil sump in the low pressure compressor unit (38) are same level during operation.

4. Refrigerant circuit (2) according to any of claims 1 to 3, further comprising a low pressure shut-off valve (58) in the oil inlet conduit (54).

5. Refrigerant circuit (2) according to any of claims 1 to 4, wherein the oil reservoir (56) further comprises a pressure release means (64).

6. Refrigerant circuit (2) according to claim 5, wherein the pressure relief means (64) is a release conduit (66) connecting the oil reservoir (56) with a low pressure section line (48) and comprising a release valve (68).

7. Refrigerant circuit (2) according to any of claims 1 to 6, further comprising a heater (70) connected to the oil reservoir (56) and/ or a oil transfer conduit (76) with an oil transfer valve (78) connecting the higher pressure compressor unit (8) to the oil reservoir (56).

8. Refrigeration apparatus comprising a refrigerant circuit according to any of claims 1 to 7.

9. Method for managing oils in a refrigerant circuit (2) comprising a low pressure compressor unit (38) having a low pressure refrigerant outlet (42) in a low pressure sub-circuit (4) and a higher pressure compressor unit (8) having a higher pressure refrigerant inlet (12) in a higher pressure sub-circuit (6), wherein the low pressure refrigerant outlet (42) and the higher pressure refrigerant inlet (12) are fluidly connected with each other, further comprising a receiver (22) in the higher pressure sub-circuit (6), a pressurizing line (72) connecting the receiver (22) with the oils reservoir (56) and a pressurizing valve (74) in the pressurizing line (72), comprising the step of collecting excess oil from the low pressure sub-circuit in an oil reservoir (56) and pressurizing the oil in the oil reservoir (56) for transferring oil into the higher pressure sub-circuit (6), wherein the step of pressurizing the oil reservoir (56) comprises supplying refrigerant from the high pressure portion of the higher pressure sub-circuit (6) into the oil reservoir (56).

10. Method according to claim 9, further comprising the step of tapping excess oil fromthe low pressure compressor unit (38) by means of a tapping means.

11. Method according to claim 9 or 10, wherein the pressurizing is perfomed in intervals and further comprising the step of maintaining an equal oil level in the oil reservoir (56) and the compressor unit (38) at times where the oil in the reservoir (56) is not pressurized.

12. Method according to any of claims 9 to 11, further comprising the step of closing a shut-off valve (58) in the oil inlet conduit (54) to the oil reservoir (56) before pressurizing the same.

13. Method according to claim 12, further comprising the step of releasing pressure for the oil reservoir (56) before opening the shut-off valve (58) again.

14. Method according to any of claims 9 to 13, wherein the step of pressurizing the oil reservoir (56) comprises the heating thereof.

15. Method according to any of claims 9 to 14, further comprising the step of transferring excess oil from the higher pressure sub-circuit (6) to the oil reservoir (56).

Patentansprüche

1. Kältemittelkreislauf (2) mit einer Verdichtereinheit (38) für niedrigen Druck, die einen Kältemittelauslass (42) für niedrigen Druck in einen Unterkreislauf (4) für niedrigen Druck aufweist, und mit einer Verdichtereinheit (8) für höheren Druck, die einen Kältemitteleinlass (12) für höheren Druck in einem Unterkreislauf (6) für höheren Druck aufweist, wobei der Kältemittelauslass (42) für niedrigen Druck und der Kältemitteleinlass (12) für höheren Druck miteinander in Fluidverbindung stehen, weiterhin mit einem Ölreservoir (56), das über eine Öleinlassleitung (54) für niedrigen Druck mit dem Unterkreislauf (4) für niedrigen Druck verbunden ist, um von diesem Öl zu erhalten, und über einen Ölaustritt (62) mit dem Unterkreislauf (6) für höheren Druck verbunden ist, **dadurch gekennzeichnet, dass** er ferner einen Empfänger (22) in dem Unterkreislauf (6) für höheren Druck aufweist, wobei eine Druckbeaufschlagungsleitung (72) den Empfänger (22) mit den Ölreservoirs (56) und einem Druckbeaufschlagungsventil (74) in der Druckbeaufschlagungsleitung (72) verbindet.

2. Kältemittelkreislauf (2) nach Anspruch 1, wobei das Ölreservoir (56) mit einer Ablasseinrichtung zum Ablassen von überschüssigem Öl aus der Verdichtereinheit (38) für niedrigen Druck verbunden ist.

3. Kältemittelkreislauf (2) nach Anspruch 1 oder 2, wobei das Ölreservoir (56) mit dem Ölsumpf der Verdichtereinheit (38) für niedrigen Druck derart verbunden ist, dass der Ölstand in dem Ölreservoir (56) und der Ölstand des Ölsumpfes in der Verdichtereinheit (38) für niedrigen Druck während des Betriebs die gleiche Höhe aufweisen.

4. Kältemittelkreislauf (2) nach einem der Ansprüche 1 bis 3, weiterhin aufweisend ein Absperrventil (58) für niedrigen Druck in der Öleinlassleitung (54).

5. Kältemittelkreislauf (2) nach einem der Ansprüche 1 bis 4, wobei das Ölreservoir (56) ferner eine Druckentlastungseinrichtung (64) aufweist.

6. Kältemittelkreislauf (2) nach Anspruch 5, wobei es sich bei der Druckentlastungseinrichtung (64) um eine Freisetzleitung (66) handelt, die das Ölreservoir (56) mit einer Leitung (48) in einem Abschnitt für niedrigen Druck verbindet und ein Freisetzventil (68) aufweist.

7. Kältemittelkreislauf (2) nach einem der Ansprüche 1 bis 6, weiterhin aufweisend eine Heizeinrichtung (70), die mit dem Ölreservoir (56) verbunden ist, und/oder eine Öltransferleitung (76) mit einem Öltransferventil (78), die die Verdichtereinheit (8) für höheren Druck mit dem Ölreservoir (56) verbindet.

8. Kältevorrichtung mit einem Kältemittelkreislauf nach einem der Ansprüche 1 bis 7.

9. Verfahren für die Handhabung von Ölströmen in einem Kältemittelkreislauf (2) mit einer Verdichtereinheit (38) für niedrigen Druck, die einen Kältemittelauslass (42) für niedrigen Druck in einem Unterkreislauf (4) für niedrigen Druck aufweist, und mit einer Verdichtereinheit (8) für höheren Druck, die einen Kältemitteleinlass (12) für höheren Druck in einem Unterkreislauf (6) für höheren Druck aufweist, wobei der Kältemittelauslass (42) für niedrigen Druck und der Kältemitteleinlass (12) für höheren Druck miteinander in Fluidverbindung stehen, weiterhin mit einem Empfänger (22) in dem Unterkreislauf (6) für höheren Druck, wobei eine Druckbeaufschlagungsleitung (72) den Empfänger (22) mit den Ölreservoirs (56) und einem Druckbeaufschlagungsventil (74) in der Druckbeaufschlagungsleitung (72) verbindet, wobei das Verfahren den Schritt aufweist, in dem überschüssiges Öl von dem Unterkreislauf für niedrigen Druck in einem Ölreservoir (56) gesammelt wird und das Öl in dem Ölreservoir (56) mit Druck beaufschlagt wird, um Öl in den Unterkreislauf (6) für höheren Druck zu transferieren, wobei der Schritt der Druckbeaufschlagung des Ölreservoirs (56) das Zuführen von Kältemittel von dem Hochdruckbereich des Unterkreislaufs (6) für höheren Druck in das Ölreservoir (56) beinhaltet.

10. Verfahren nach Anspruch 9, das ferner den Schritt beinhaltet, in dem überschüssiges Öl von der Verdichtereinheit (38) für niedrigen Druck mittels einer Ablasseinrichtung abgelassen wird.

11. Verfahren nach Anspruch 9 oder 10, bei dem die Druckbeaufschlagung in Intervallen ausgeführt wird und das ferner den Schritt aufweist, in dem ein gleicher Ölstand in dem Ölreservoir (56) und der Verdichtereinheit (38) zu Zeiten aufrechterhalten wird, zu denen das Öl in dem Reservoir (56) nicht mit Druck beaufschlagt wird.

12. Verfahren nach einem der Ansprüche 9 bis 11, das ferner den Schritt beinhaltet, in dem ein Absperrventil (58) in der Öleinlassleitung (54) zu dem Ölreservoir (56) vor der Druckbeaufschlagung von diesem geschlossen wird.

13. Verfahren nach Anspruch 12, das ferner den Schritt beinhaltet, in dem Druck für das Ölreservoir (56) freigesetzt wird, bevor das Absperrventil (58) wieder geöffnet wird.

14. Verfahren nach einem der Ansprüche 9 bis 13, bei dem der Schritt der Druckbeaufschlagung des Ölreservoirs (56) das Beheizen von diesem beinhaltet.

15. Verfahren nach einem der Ansprüche 9 bis 14, das ferner den Schritt aufweist, in dem überschüssiges Öl von dem Unterkreislauf (6) für höheren Druck zu dem Ölreservoir (56) transferiert wird.

Revendications

1. Circuit de réfrigérant (2) comprenant une unité de compresseur basse pression (38) ayant une sortie de réfrigérant basse pression (42) dans un sous-circuit basse pression (4) et une unité de compresseur de pression supérieure (8) ayant une entrée de réfrigérant de pression supérieure (12) dans un sous-circuit de pression supérieure (6), dans lequel la sortie de réfrigérant basse pression (42) et l'entrée de réfrigérant de pression supérieure (12) sont raccor-

dées de manière fluidique l'une à l'autre, comprenant en outre un réservoir d'huile (56) raccordé par un conduit d'entrée d'huile basse pression (54) au sous-circuit basse pression (4) pour recevoir l'huile de celui-ci et raccordé par le biais d'une évacuation d'huile (62) au sous-circuit de pression supérieure (6), **caractérisé en ce qu'**il comprend en outre un récepteur (22) dans le sous-circuit de pression supérieure (6), une conduite de pressurisation (72) raccordant le récepteur (22) au réservoir d'huile (56) et un clapet de pressurisation (74) dans la conduite de pressurisation (72).

2. Circuit de réfrigérant (2) selon la revendication 1, dans lequel le réservoir d'huile (56) est raccordé à un moyen de soutirage pour soutirer l'excès d'huile de l'unité de compresseur basse pression (38).

3. Circuit de réfrigérant (2) selon la revendication 1 ou 2, dans lequel le réservoir d'huile (56) est raccordé de manière fluidique au carter d'huile de l'unité de compresseur basse pression (38) de sorte que le niveau d'huile dans le réservoir d'huile (56) et le niveau d'huile dans le carter d'huile dans l'unité de compresseur basse pression (38) soient identiques pendant le fonctionnement.

4. Circuit de réfrigérant (2) selon l'une quelconque des revendications 1 à 3, comprenant en outre un clapet de coupure basse pression (58) dans le conduit d'entrée d'huile (54).

5. Circuit de réfrigérant (2) selon l'une quelconque des revendications 1 à 4, dans lequel le réservoir d'huile (56) comprend en outre un moyen de détente de pression (64).

6. Circuit de réfrigérant (2) selon la revendication 5, dans lequel le moyen de détente de pression (64) est un conduit d'évacuation (66) raccordant le réservoir d'huile (56) à une conduite de partie basse pression (48) et comprenant un clapet de détente (68).

7. Circuit de réfrigérant (2) selon l'une quelconque des revendications 1 à 6, comprenant en outre un réchauffeur (70) raccordé au réservoir d'huile (56) et/ou un conduit de transfert d'huile (76) avec un clapet de transfert d'huile (78) raccordant l'unité de compresseur de pression supérieure (8) au réservoir d'huile (56).

8. Appareil de réfrigération comprenant un circuit de réfrigérant selon l'une quelconque des revendications 1 à 7.

9. Procédé de gestion d'huile dans un circuit de réfrigérant (2) comprenant une unité de compresseur basse pression (38) ayant une sortie de réfrigérant basse pression (42) dans un sous-circuit basse pression (4) et une unité de compresseur de pression supérieure (8) ayant une entrée de réfrigérant de pression supérieure (12) dans un sous-circuit de pression supérieure (6), dans lequel la sortie de réfrigérant basse pression (42) et l'entrée de réfrigérant de pression supérieure (12) sont raccordées de manière fluidique l'une à l'autre, comprenant en outre un récepteur (22) dans le sous-circuit de pression supérieure (6), une conduite de pressurisation (72) raccordant le récepteur (22) au réservoir d'huile (56) et un clapet de pressurisation (74) dans la conduite de pressurisation (72), comprenant l'étape consistant à collecter l'excès d'huile du sous-circuit basse pression dans un réservoir d'huile (56) et à pressuriser l'huile dans le réservoir d'huile (56) pour transférer l'huile dans le sous-circuit de pression supérieure (6), dans lequel l'étape de pressurisation du réservoir d'huile (56) comprend l'alimentation du réfrigérant de la partie de haute pression du sous-circuit de pression supérieure (6) dans le réservoir d'huile (56).

10. Procédé selon la revendication 9, comprenant en outre l'étape consistant à soutirer l'excès d'huile de l'unité de compresseur basse pression (38) par le biais d'un moyen de soutirage.

11. Procédé selon la revendication 9 ou 10, dans lequel la pressurisation est effectuée par intervalles et comprenant en outre l'étape consistant à maintenir un niveau d'huile égal dans le réservoir d'huile (56) et dans l'unité de compresseur (38) lorsque l'huile dans le réservoir (56) n'est pas pressurisée.

12. Procédé selon l'une quelconque des revendications 9 à 11, comprenant en outre l'étape consistant à fermer un clapet de coupure (58) dans le conduit d'entrée d'huile (54) vers le réservoir d'huile (56) avant de le pressuriser.

13. Procédé selon la revendication 12, comprenant en outre l'étape consistant à détendre la pression pour le réservoir d'huile (56) avant de rouvrir le clapet de coupure (58).

14. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel l'étape de pressurisation du réservoir d'huile (56) comprend le réchauffage de celui-ci.

15. Procédé selon l'une quelconque des revendications 9 à 14, comprenant en outre l'étape de transfert de l'excès d'huile du sous-circuit de pression supérieure (6) au réservoir d'huile (56).

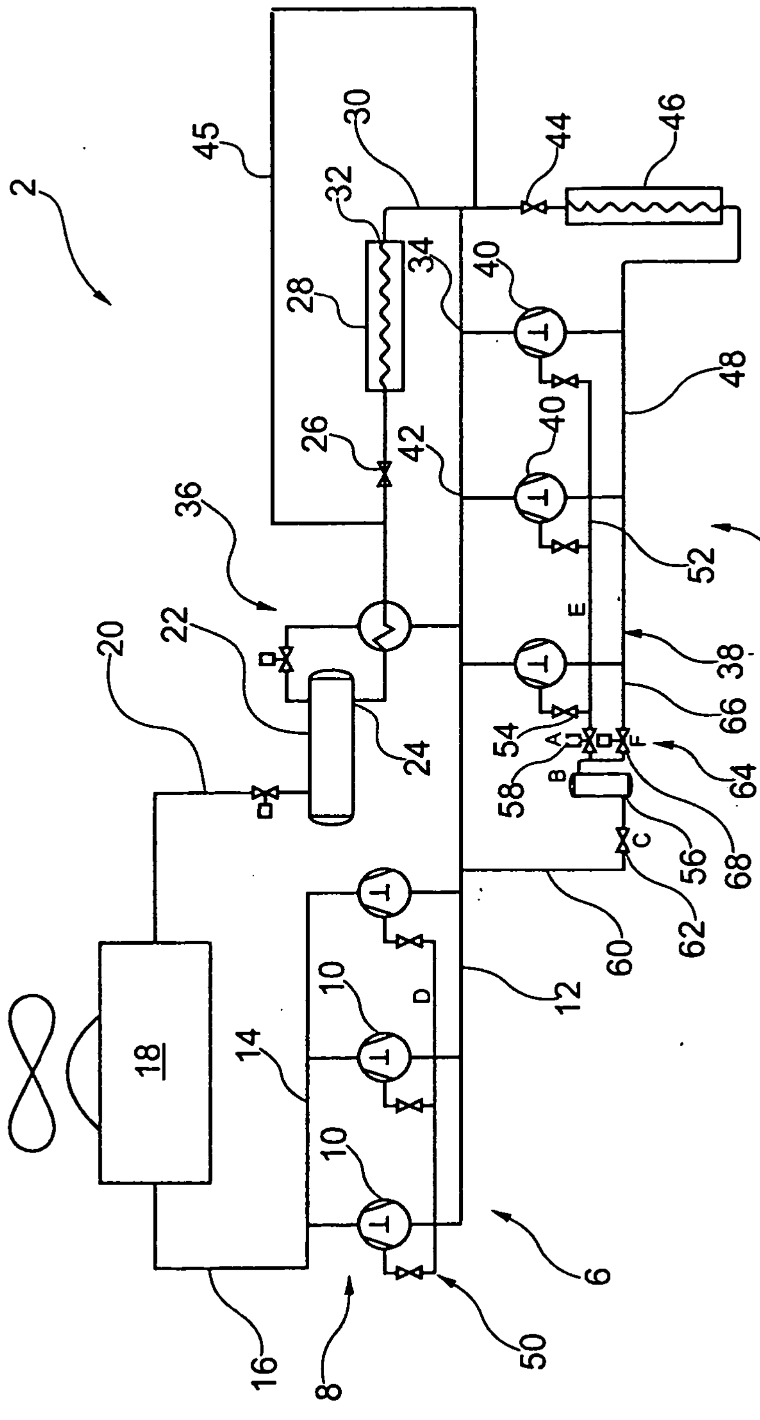
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Fig. 1

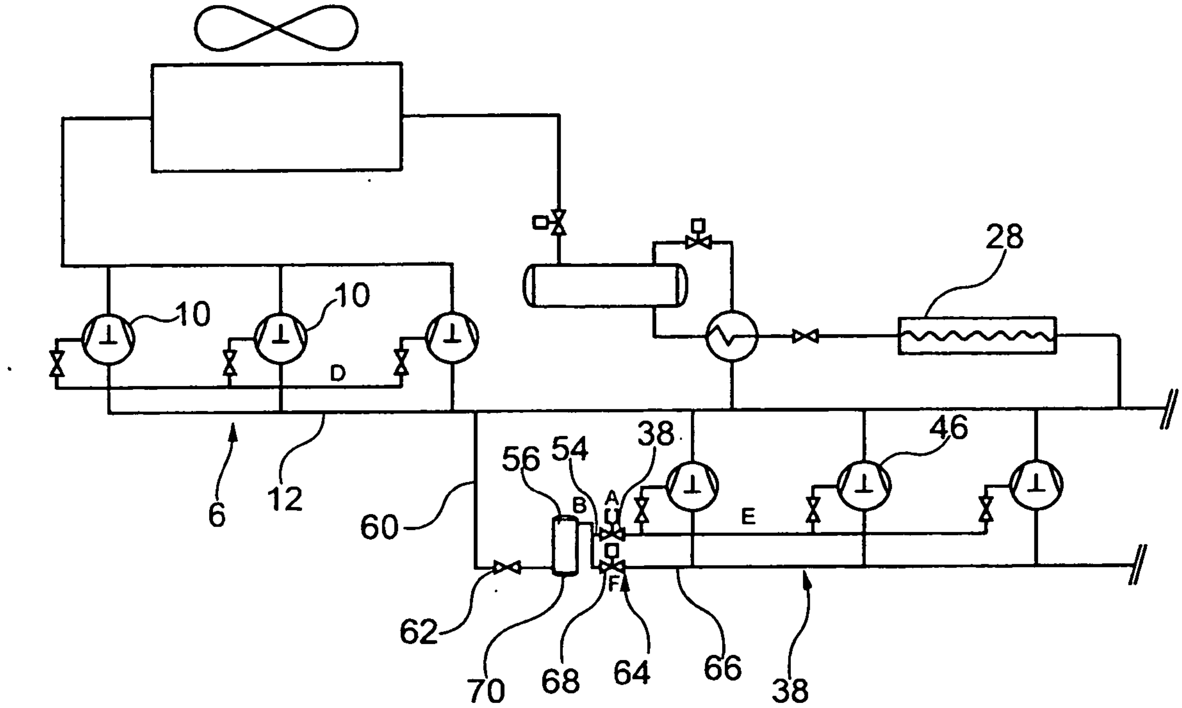
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Fig. 2

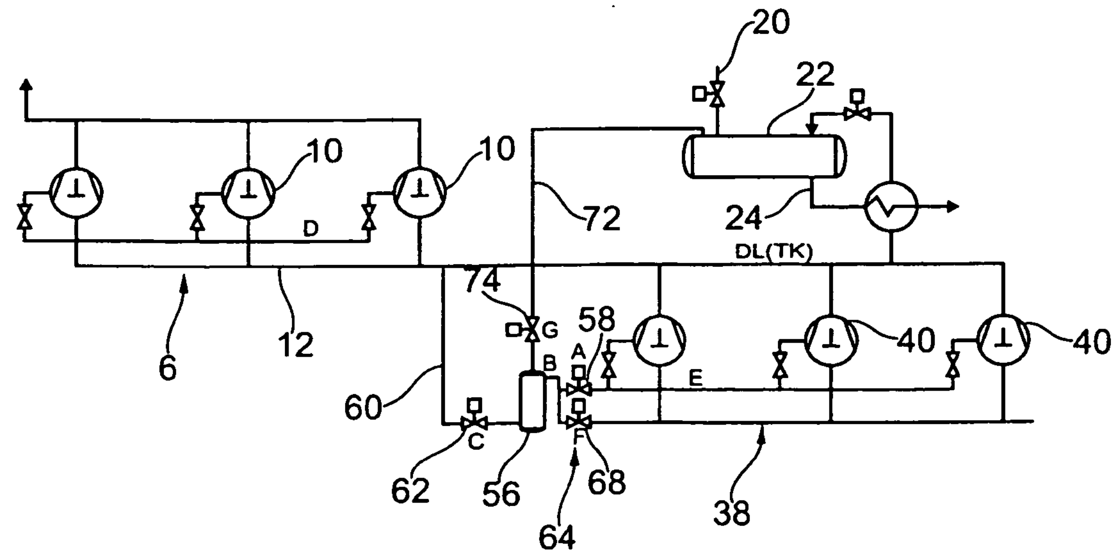
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Fig. 3

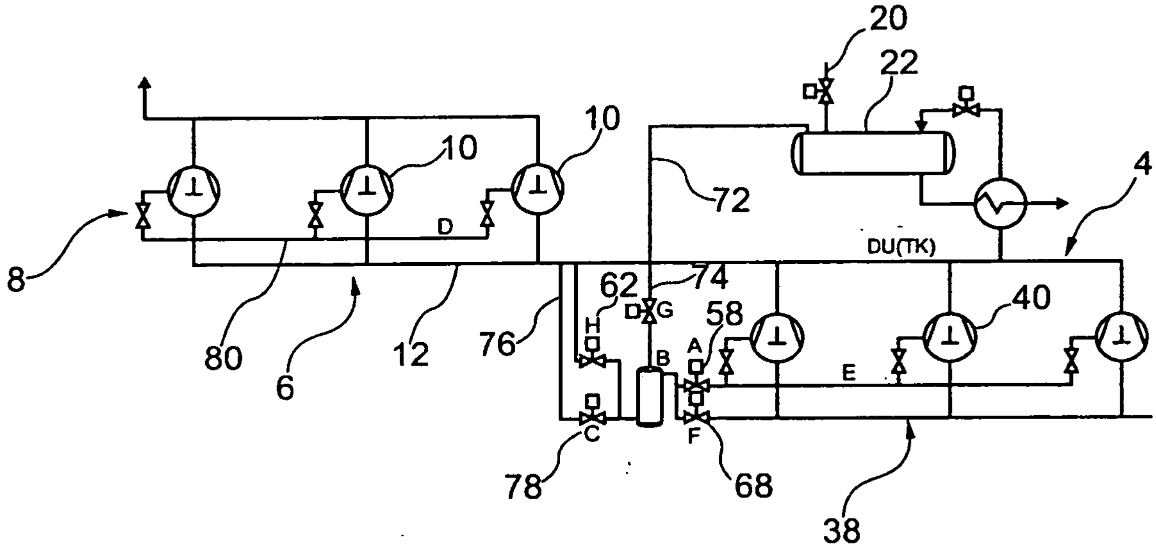

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- EP 1550832 A **[0003]**