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(54) COMPRESSOR

VERDICHTER

COMPRESSEUR

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JP-U- S62 180	**US-A- 3 744 267**
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Description

Technical Field

[0001] The present invention relates to a compressor.

Background Art

[0002] In the past, there has been an oil level sensor that includes a first temperature detecting element and a second temperature detecting element, and detects the oil level inside a sealed container of a compressor based on values detected by the first temperature detecting element and the second temperature detecting element (see Patent Literature 1, for example).

[0003] Further, in the past, there has been a compressor that drives a heating unit based on a value detected by a temperature detecting element. In such a compressor, when the value detected by the temperature detecting element satisfies a predetermined condition, the heating unit is driven to gasify liquid refrigerant stored inside a sealed container.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2006-47133

[0005] US 2004 0194485 A1 describes compressor protection from liquid hazards where two liquid levels are sensed in the oil sump of a compressor to determine if sufficient oil and excess refrigerant are present prior to starting the compressor and appropriate steps taken, if necessary.

[0006] US 3 744 267 describes a liquid level protection system for a refrigeration compressor.

[0007] WO 03 036090 A1 describes an apparatus for monitoring a compressor including a plurality of sensor inputs for receiving input regarding operating parameters of a compressor, at least one control action output for sending a control action to the compressor; and a control member communicated with the plurality of sensor inputs and the control action output, the control member being adapted to analyze input from the plurality of sensor inputs, to determine a control action based upon the input and to send the control action to the at least one control action output.

Summary of Invention

Technical Problem

[0008] According to the invention described in Patent Literature 1, however, the target to be detected is the oil level, and thus the state of the liquid refrigerant stored inside the sealed container is not directly detectable. In such a case, it may be erroneously detected that no liquid refrigerant is stored inside the sealed container even when the liquid refrigerant is actually stored inside the sealed container, raising an issue of possible liquid compression.

[0009] The present invention has been made with the above-described issue as background, and aims to obtain a compressor that suppresses the liquid compression better than in the past.

Solution to Problem

[0010] A compressor according to an embodiment of the present invention is described in claim 1.

Advantageous Effects of Invention

[0011] The present invention includes the control unit that drives the heating unit when the liquid surface level obtained by the liquid surface sensor is equal to or higher than the reference level. It is therefore possible to suppress the compression of the liquid refrigerant inside the sealed container. Accordingly, it is possible to suppress the liquid compression better than in the past.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a diagram illustrating an outline of a compressor 100 according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a sectional view taken along line A-A in Fig. 1.

[Fig. 3] Fig. 3 is a chart illustrating a control operation of the compressor 100 according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a chart illustrating a control operation of the compressor 100 according to Embodiment 2 of the present invention.

[Fig. 5] Fig. 5 is a chart illustrating a control operation of the compressor 100 according to Embodiment 3 of the present invention.

Description of Embodiments

Embodiment 1

[0013] Embodiment 1 of the present invention will be described below based on the drawings. In the following drawings, the dimensional relationships between component members may be different from actual ones. Further, in the following drawings, parts assigned with identical signs are identical or correspond to each other. This applies to the entire text of the specification. Further, forms of component elements described in the entire text of the specification are merely illustrative, and the present invention is not limited by the description of these.

[0014] Fig. 1 is a diagram illustrating an outline of a compressor 100 according to Embodiment 1 of the present invention. Fig. 2 is a sectional view taken along line A-A in Fig. In the present invention, a description will be given of an example in which the compressor 100 is a scroll compressor.

[0015] As illustrated in Fig. 1, the compressor 100 includes a suction pipe 1, a compression mechanism unit 2, an oil drain unit 4, a liquid surface sensor 10, a temperature sensor 20, and a heating unit 30. The exterior of the compressor 100 is formed of a sealed container 100A. Refrigerating machine oil (hereinafter occasionally simply referred to as the oil) is stored in a lower portion inside the sealed container 100A.

[0016] As illustrated in Fig. 1, the suction pipe 1 is a pipe provided to an upper portion of a side surface of the sealed container 100A. The interior of the suction pipe 1 and the interior of the sealed container 100A communicate with each other. The suction pipe 1 is supplied with refrigerant flowing on a suction side of the compressor 100. The compression mechanism unit 2 is a part that compresses the refrigerant supplied into the sealed container 100A through the suction pipe 1. As illustrated in Fig. 2, the compression mechanism unit 2 has a suction port 2a. The refrigerant flowing through the sealed container 100A is supplied to the compression mechanism unit 2 through the suction port 2a. A lower portion of the sealed container 100A has a sump unit 3. The sump unit 3 stores the oil.

[0017] The oil drain unit 4 is a member for draining the oil stored in the sump unit 3 to the outside of the sealed container 100A, and is provided to a lower portion of the side surface of the sealed container 100A, for example. The oil drain unit 4 is formed of a hollow tubular member, for example. The oil drain unit 4 includes therein an openable and closable valve (illustration omitted), for example. The amount of oil flowing through the oil drain unit 4 is adjustable through adjustment of the valve. If the oil drain unit 4 is opened, the oil stored in the lower portion of the sealed container 100A is discharged to the outside of the sealed container 100A through the oil drain unit 4. If the oil drain unit 4 is closed, the oil stored in the lower portion of the sealed container 100A continues to be stored inside the sealed container 100A without passing through the oil drain unit 4.

[0018] The liquid surface sensor 10 is a detecting unit for detecting the liquid surface of the liquid refrigerant stored inside the sealed container 100A, and is provided at a position corresponding to the height of the suction pipe 1. For example, the liquid surface sensor 10 is provided below an upper end portion 1A of the suction pipe 1 and above a lower end portion 1B of the suction pipe 1. The liquid surface sensor 10 is installed in the vicinity of the suction port 2a, for example. The temperature sensor 20 is a temperature detecting unit provided to the lower portion inside the sealed container 100A. The temperature sensor 20 detects the temperature of the lower portion of the sealed container 100A.

[0019] The heating unit 30 is a heating unit that heats the liquid refrigerant stored inside the sealed container 100A, and is provided in the lower portion of the sealed container 100A, for example. With the heating unit 30 driven, the liquid refrigerant stored inside the sealed container 100A is heated and gasified, and the liquid surface of the liquid refrigerant stored inside the sealed container 100A falls.

[0020] A control unit (illustration omitted) drives the heating unit 30, when the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than a reference level. Specifically, for example, the control unit drives the heating unit 30, when the height of the liquid surface inside the sealed container 100A is equal to or higher than the height of the suction pipe 1. The control unit is provided in, for example, a mechanical chamber formed inside an outdoor unit. Further, the control unit controls the opening and closing of the oil drain unit 4. The control unit may be capable of controlling the oil drain unit 4 only between two states, which are an "open" state and a "closed" state, or may be capable of changing the opening degree of the oil drain unit 4 in a plurality of stages. For example, the control unit is configured of hardware such as a circuit device that implements this function or software executed on an arithmetic device such as a microcomputer or a CPU.

[0021] Fig. 3 is a chart illustrating a control operation of the compressor 100 according to Embodiment 1 of the present invention. In Embodiment 1, a case is assumed in which the stagnation of the liquid refrigerant occurs for a reason such as the shutdown of the compressor 100 for an extended period of time, and the height of the liquid surface inside the sealed container 100A of the compressor 100 is measured before the start-up of the compressor 100 (when start-up control of the compressor 100 is performed). An operation of the compressor 100 according to Embodiment 1 performed before the start-up will be described below with Fig. 3.

[0022] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level (YES at step S21), the control unit proceeds to step S32 to drive the heating unit 30 or perform a liquid purge operation, and proceeds to step S21.

[0023] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is not equal to or higher than the reference level (NO at step S21), the control unit proceeds to step S22 to start up the compressor 100.

[0024] As described above, the compressor 100 according to Embodiment 1 has the sealed container 100A forming the exterior thereof, and includes the suction pipe 1 connected to the side surface portion of the sealed container 100A to allow the refrigerant flowing on the suction side of the compressor 100 to pass through the suction pipe 1, the liquid surface sensor 10 that detects the liquid surface level inside the sealed container 100A, the heating unit 30 provided inside the sealed container 100A, and the control unit that drives the heating unit 30 when the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level before the start-up of the compressor 100. After the start-up of the compressor 100, therefore, only gas refrigerant is taken into the compression mechanism unit 2, making it possible to suppress the liquid compression better than in the past. Accordingly, it is possible to suppress the damage to the compressor 100 due to start-up with liquid compression of the stagnated liquid refrigerant (stagnation start-up).

[0025] Further, with the liquid surface sensor 10 provided at the position corresponding to the height of the suction pipe 1, it is possible to further reduce the possibility that the liquid refrigerant stored inside the sealed container 100A may flow to the suction side of the compressor 100 through the suction pipe 1. Accordingly, it is possible to suppress the damage to the compressor 100 due to the start-up with the liquid compression of the stagnated liquid refrigerant (stagnation start-up).

[0026] Further, it is possible to directly detect the liquid surface of the liquid refrigerant inside the sealed container 100A with the liquid surface sensor 10. Unlike in the past, therefore, there is no need to indirectly detect the liquid surface of the liquid refrigerant inside the sealed container 100A based on the value detected by the temperature detecting unit provided to the lower portion inside the sealed container 100A. Accordingly, it is possible to grasp in real time the liquid surface inside the sealed container 100A and reduce the start-up time of the compressor 100.

Embodiment 2

[0027] In Embodiment 2, the control unit controls the compressor 100 during the operation of the compressor 100, unlike in Embodiment 1. In Embodiment 2, items not particularly described will be assumed to be similar to those of Embodiment 1, and identical functions or configurations will be described with identical signs.

[0028] Fig. 4 is a chart illustrating a control operation of the compressor 100 according to Embodiment 2 of the present invention. In Embodiment 2, the control unit performs drive control of the heating unit 30 during the operation of the compressor 100 to prevent the liquid compression. An operation of the compressor 100 according to Embodiment 2 will be described below with Fig. 4.

[0029] At step S11, the control unit performs the start-up control of the compressor 100, and proceeds to step S21. At step S21, the control unit determines whether or not the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level.

[0030] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level (YES at step S21), the control unit proceeds to step S31.

[0031] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is not equal to or higher than the reference level (NO at step S21), the control unit proceeds to step S23 and continues to drive the compressor 100.

[0032] At step S31, the control unit stops the compressor 100, and proceeds to step S32. At step S32, the control unit drives the heating unit 30 or performs the liquid purge operation, and proceeds to step S41. At step S41, the control unit starts up the compressor 100, and proceeds to step S21. The processes of steps S31 and S41 may be omitted.

[0033] As described above, in the compressor 100 according to Embodiment 2, when the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level after the start-up of the compressor 100, the control unit drives the heating unit 30. Therefore, only the gas refrigerant is taken into the compression mechanism unit 2, making it possible to suppress the liquid compression better than in the past. Accordingly, it is possible to suppress the damage to the compressor 100 due to a liquid compression operation.

Embodiment 3

[0034] In Embodiment 3, the control unit controls the compressor 100 during the operation of the compressor 100, unlike in Embodiment 1. In Embodiment 3, items not particularly described will be assumed to be similar to those of Embodiment 1, and identical functions or configurations will be described with identical signs.

[0035] Fig. 5 is a chart illustrating a control operation of the compressor 100 according to Embodiment 3 of the present invention. In Embodiment 3, the control unit controls the oil drain unit 4 during the operation of the compressor 100 to prevent oil compression. An operation of the compressor 100 according to Embodiment 3 will be described below with Fig. 5.

[0036] At step S11, the control unit performs the start-up control of the compressor 100, and proceeds to step S21. At step S21, the control unit determines whether or not the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level.

[0037] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level (YES at step S21), the control unit proceeds to step S31.

[0038] When the control unit determines at step S21 that the liquid surface level obtained by the liquid surface sensor 10 is not equal to or higher than the reference level (NO at step S21), the control unit proceeds to step S23 and continues to drive the compressor 100.

[0039] At step S31, the control unit stops the compressor 100, and proceeds to step S32. At step S32, the control unit drives the heating unit 30 or performs the liquid purge operation for a predetermined time, and proceeds to step S33. At step S33, the control unit determines whether or not the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level.

[0040] When the control unit determines at step S33 that the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level (YES at step S33), the control unit proceeds to step S34.

[0041] When the control unit determines at step S33 that the liquid surface level obtained by the liquid surface sensor 10 is not equal to or higher than the reference level (NO at step S33), the control unit proceeds to step S23 and continues to drive the compressor 100.

[0042] At step S34, the control unit controls the oil drain unit 4 to perform an oil drain operation, and proceeds to step S41. Herein, the oil drain operation is, for example, an operation of draining the oil stored in the sump unit 3 to the outside of the sealed container 100A through the oil drain unit 4. At step S41, the control unit starts up the compressor 100, and proceeds to step S21. The processes of steps S31 and S41 may be omitted.

[0043] At step S34, the control unit may continue to perform the drive control of the heating unit 30 during the oil drain operation, or may stop the drive control of the heating unit 30 during the oil drain operation.

[0044] As described above, in the compressor 100 according to Embodiment 3, the control unit drives the heating unit 30 when the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level. When the liquid surface level obtained by the liquid surface sensor 10 is equal to or higher than the reference level after the driving of the heating unit 30, the control unit controls the oil drain unit 4 to drain the oil to the outside of the sealed container 100A.

[0045] Even when the liquid surface inside the sealed container 100A is high during the operation of the compressor 100 because of a large amount of oil, therefore, it is possible to drain the oil and make the liquid surface equal to or lower than the height of the suction pipe 1. Accordingly, it is possible to suppress the introduction of the oil into the compression mechanism unit 2. It is thus possible to suppress the degradation of the performance of the compressor 100 due to the oil compression and a reduction in an operating range of the compressor 100.

[0046] Although the description has been given of an example in which only one liquid surface sensor 10 is provided, the present invention is not limited thereto, and a plurality of liquid surface sensors 10 may be provided. With the plurality of liquid surface sensors 10 thus provided, it is possible to more accurately detect the liquid surface inside the sealed container 100A than in the case in which the single liquid surface sensor 10 is provided.

[0047] Further, an electrostatic capacitance sensor or a float sensor, for example, may be adopted as the liquid surface sensor 10. When the electrostatic capacitance sensor is adopted as the liquid surface sensor 10, the liquid surface inside the sealed container 100A is detectable even under a severe environment, such as an environment in which the pressure inside the sealed container 100A is high. Further, when the float sensor is adopted as the liquid surface sensor 10, the liquid surface inside the sealed container 100A is detectable at low cost with a simple structure.

[0048] Further, although the description has been given of an example in which the reference level used at step S21 and the reference level used at step S33 are the same, the present invention is not limited thereto. For example, the reference level used at step S33 may be set to be lower than the reference level used at step S21. With this configuration, even when the oil has reached the position corresponding to the height of the suction pipe 1 but the liquid surface level inside the sealed container 100A falls somewhat owing to the driving of the heating unit 30 at step S32, the control unit is capable of determining an excess of oil at step S33 and draining the oil stored inside the sealed container 100A.

[0049] To set the reference level used at step S33 to be lower than the reference level used at step S21, the reference level used at step S33 is determined as follows, for example. When the liquid refrigerant is stored inside the sealed container 100A, the control unit stores the degree of fall of the liquid surface level inside the sealed container 100A to the driving time of the heating unit 30. Then, at step S33, when the degree of fall of the liquid surface level to the driving time of the heating unit 30 is less than the degree of fall of the liquid surface level inside the sealed container 100A to the driving time of the heating unit 30 stored by the control unit, the control unit proceeds to step S34.

Reference Signs List

[0050] 1 suction pipe 1A upper end portion 1B lower end portion 2 compression mechanism unit 2a suction port 3 sump unit 4 oil drain unit 10 liquid surface sensor 20 temperature sensor 30 heating unit 100 compressor 100A sealed container

Claims

1. A compressor (100) having a sealed container (100A) forming an exterior thereof, the compressor (100) comprising:

a suction pipe (1) connected to a side surface portion of the sealed container (100A) to allow refrigerant flowing a suction side of the compressor (100) to pass through the suction pipe (1);
a liquid surface sensor (10) configured to detect a liquid surface level inside the sealed container (100A);
a heating unit (30) provided inside the sealed container (100A); and
a control unit configured to drive the heating unit (30), when the liquid surface level obtained by the liquid surface sensor (10) is equal to or higher than a reference level,
characterized in that the control unit is configured to drive the heating unit (30), when the liquid surface level obtained by the liquid surface

sensor (10) is equal to or higher than the reference level after start-up of the compressor (100), and further comprising
an oil drain unit (4) configured to drain oil stored in the sealed container (100A) to outside of the sealed container (100A),
wherein, after start-up of the compressor (100) and when the liquid surface level obtained by the liquid surface sensor (10) is equal to or higher than the reference level after driving of the heating unit (30), the control unit is configured to control the oil drain unit (4) to drain the oil to the outside of the sealed container (100A).

2. The compressor (100) of claim 1, wherein the reference level is equal to or higher than a lower end portion (1B) of the suction pipe (1), and is equal to or lower than an upper end portion (1A) of the suction pipe (1).

3. The compressor (100) of any one of claims 1 or 2, further comprising a compression mechanism unit (2) configured to compress the refrigerant suctioned from the suction pipe (1),
wherein the compression mechanism unit (2) has a suction port (2a) into which the refrigerant suctioned from the suction pipe (1) is introduced, and
wherein the liquid surface sensor (10) is provided to the suction port (2a) of the compression mechanism unit (2).

Patentansprüche

1. Kompressor (100) mit einem abgedichteten Behälter (100A), der ein Äußeres davon bildet, wobei der Kompressor (100) Folgendes umfasst:

ein Saugrohr (1), das mit einem Seitenflächenabschnitt des abgedichteten Behälters (100A) verbunden ist, um ein Kältemittel, das auf einer Saugseite des Kompressors (100) strömt, durch das Saugrohr (1) hindurchtreten zu lassen;
einen Flüssigkeitsoberflächensensor (10), der ausgelegt ist, um einen Flüssigkeitsoberflächenpegel innerhalb des abgedichteten Behälters (100A) zu detektieren;
eine Heizeinheit (30), die im Inneren des abgedichteten Behälters (100A) bereitgestellt ist; und
eine Steuereinheit, die ausgelegt ist, um die Heizeinheit (30) anzusteuern, wenn der durch den Flüssigkeitsoberflächensensor (10) erhaltene Flüssigkeitsoberflächenpegel gleich oder höher als ein Referenzpegel ist,
dadurch gekennzeichnet, dass die Steuereinheit ausgelegt ist, um die Heizeinheit (30) anzusteuern, wenn der durch den Flüssigkeitsoberflächensensor (10) erhaltene Flüssigkeitsoberflächenpegel nach dem Start des Kompressors (100) gleich oder höher als ein Referenzpegel ist, und ferner umfassend
eine Ölablasseinheit (4), die ausgelegt ist, um in dem abgedichteten Behälter (100A) gespeichertes Öl aus dem abgedichteten Behälter (100A) nach außen abzulassen,
wobei die Steuereinheit nach dem Start des Kompressors (100) und wenn der durch den Flüssigkeitsoberflächensensor (10) erhaltene Flüssigkeitsoberflächenpegel nach dem Ansteuern der Heizeinheit (30) gleich oder höher als ein Referenzpegel ist, ausgelegt ist, um die Ölablasseinheit (4) zu steuern, um das Öl aus dem abgedichteten Behälter (100A) nach außen abzulassen.

2. Kompressor (100) nach Anspruch 1, wobei der Referenzpegel gleich oder höher als ein unterer Endabschnitt (1B) des Saugrohrs (1) und gleich oder niedriger als ein oberer Endabschnitt (1A) des Saugrohrs (1) ist.

3. Kompressor (100) nach einem der Ansprüche 1 oder 2, ferner umfassend eine Kompressionsmechanismuseinheit (2), die ausgelegt ist, um das durch das Saugrohr (1) angesaugte Kältemittel zu komprimieren,
wobei die Kompressionsmechanismuseinheit (2) eine Saugöffnung (2a) aufweist, in die das von dem Saugrohr (1) angesaugte Kältemittel eingebracht wird, und
wobei der Flüssigkeitsoberflächensensor (10) an der Saugöffnung (2a) der Kompressionsmechanismuseinheit (2) bereitgestellt ist.

Revendications

1. Compresseur (100) ayant un contenant scellé (100A) formant un extérieur de celui-ci, le compresseur (100) comprenant :

un tuyau d'aspiration (1) connecté à une partie de surface latérale du contenant scellé (100A) pour permettre à du frigorigène s'écoulant sur un côté d'aspiration du compresseur (100) de passer à travers le tuyau d'aspiration (1) ;
un capteur de surface de liquide (10) configuré pour détecter un niveau de surface de liquide à l'intérieur du contenant scellé (100A) ;
une unité de chauffage (30) prévue à l'intérieur du contenant scellé (100A) ; et
une unité de commande configurée pour entraîner l'unité de chauffage (30), lorsque le niveau de surface de liquide obtenu par le capteur de surface de liquide (10) est égal ou supérieur à un niveau de référence,

caractérisé en ce que l'unité de commande est configurée pour entraîner l'unité de chauffage (30), lorsque le niveau de surface de liquide obtenu par le capteur de surface de liquide (10) est égal ou supérieur au niveau de référence après le démarrage du compresseur (100), et comprenant en outre
une unité de vidange d'huile (4) configurée pour vidanger l'huile stockée dans le contenant scellé (100A) vers l'extérieur du contenant scellé (100A),
dans lequel, après le démarrage du compresseur (100) et lorsque le niveau de surface de liquide obtenu par le capteur de surface de liquide (10) est égal ou supérieur au niveau de référence après l'entraînement de l'unité de chauffage (30), l'unité de commande est configurée pour commander l'unité de vidange d'huile (4) afin de vidanger l'huile vers l'extérieur du contenant scellé (100A).

2. Compresseur (100) selon la revendication 1, dans lequel le niveau de référence est égal ou supérieur à une partie d'extrémité inférieure (1B) du tuyau d'aspiration (1), et est égal ou inférieur à une partie d'extrémité supérieure (1A) du tuyau d'aspiration (1).

3. Compresseur (100) selon l'une quelconque des revendications 1 ou 2, comprenant en outre une unité de mécanisme de compression (2) configurée pour comprimer le frigorigène aspiré depuis le tuyau d'aspiration (1),
dans lequel l'unité de mécanisme de compression (2) a un orifice d'aspiration (2a) dans lequel le frigorigène aspiré à partir du tuyau d'aspiration (1) est introduit, et
dans lequel le capteur de surface de liquide (10) est fourni à l'orifice d'aspiration (2a) de l'unité de mécanisme de compression (2).

FIG. 1

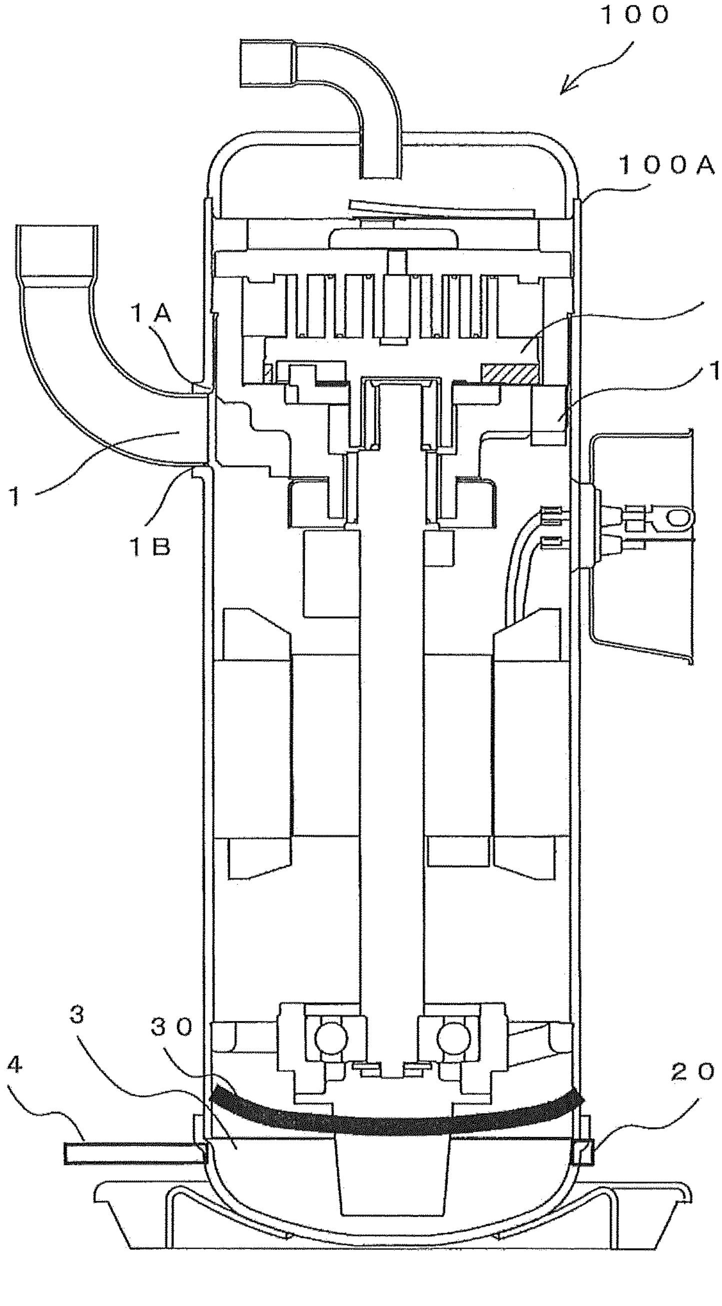


FIG. 2

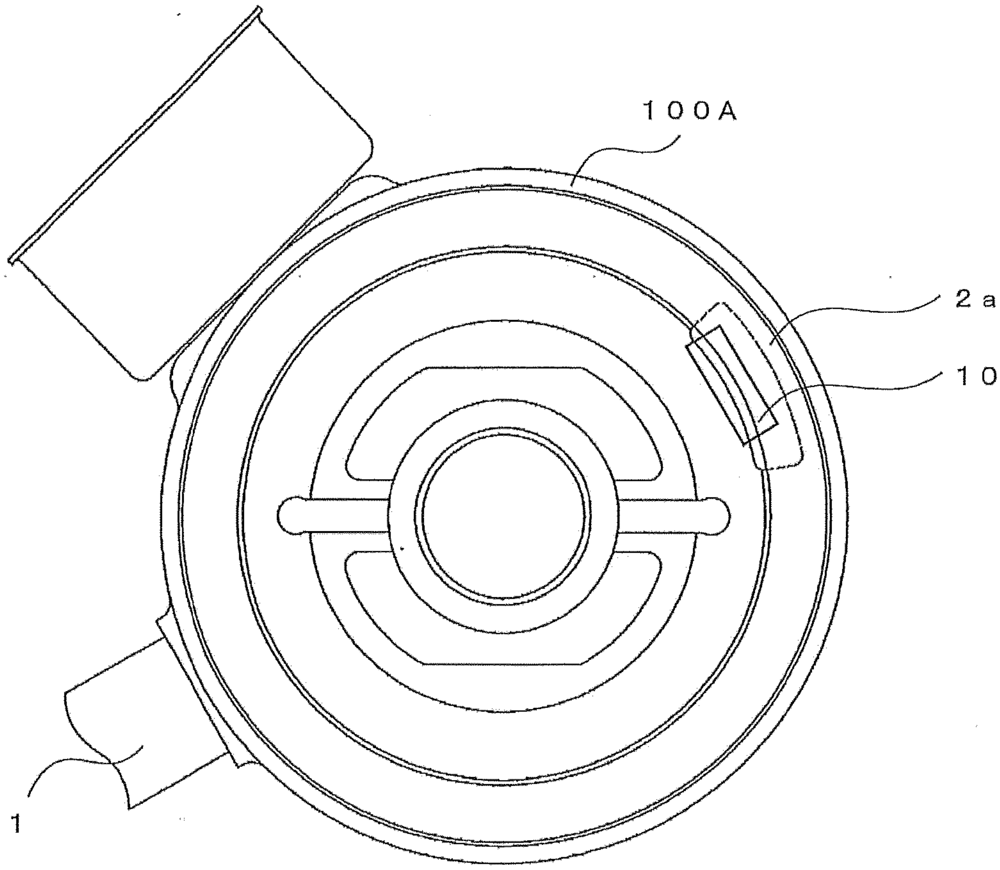


FIG. 3

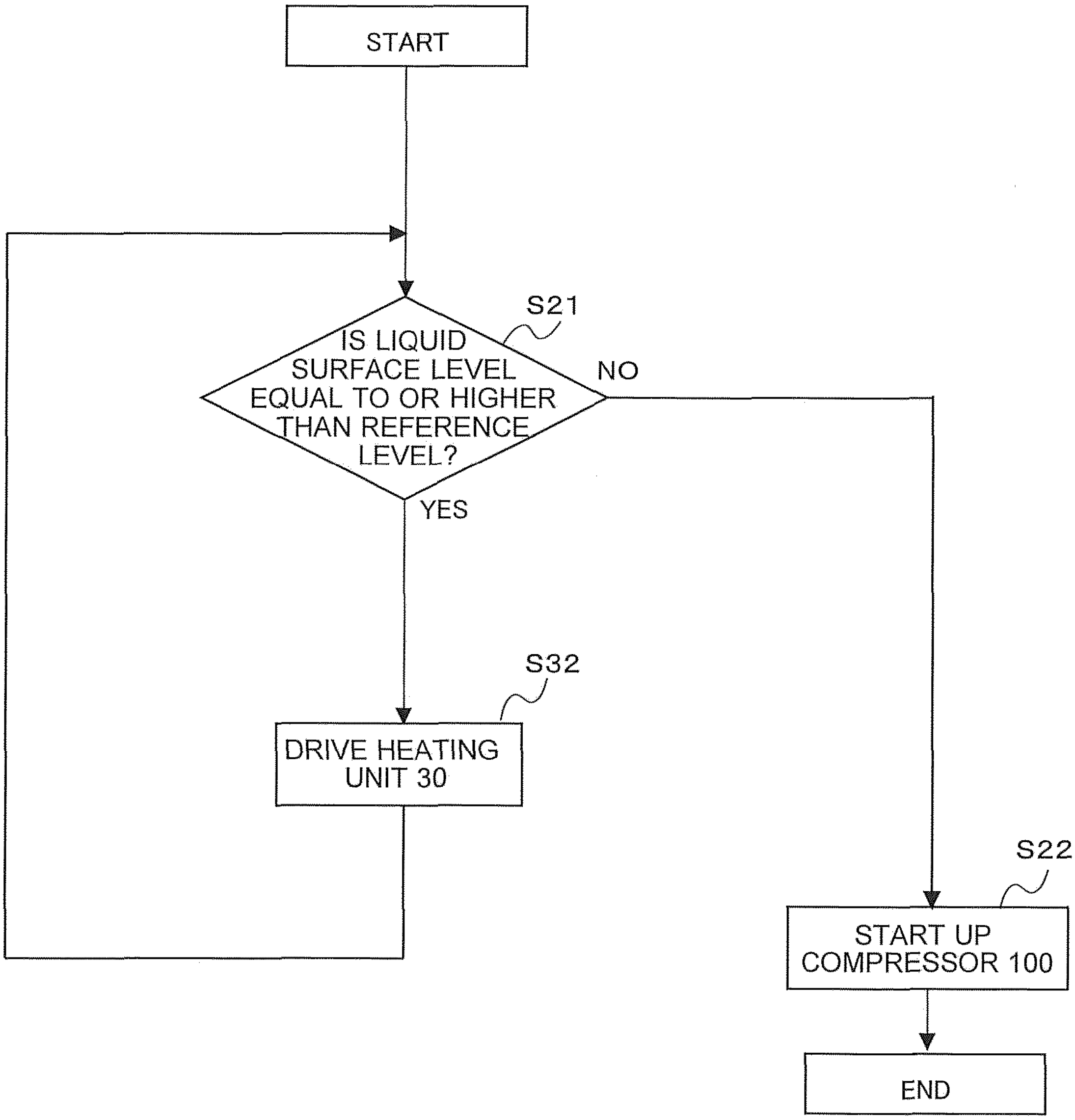

START
S21
IS LIQUID SURFACE LEVEL EQUAL TO OR HIGHER THAN REFERENCE LEVEL?
NO
YES
S32
DRIVE HEATING UNIT 30
S22
START UP COMPRESSOR 100
END

FIG. 4

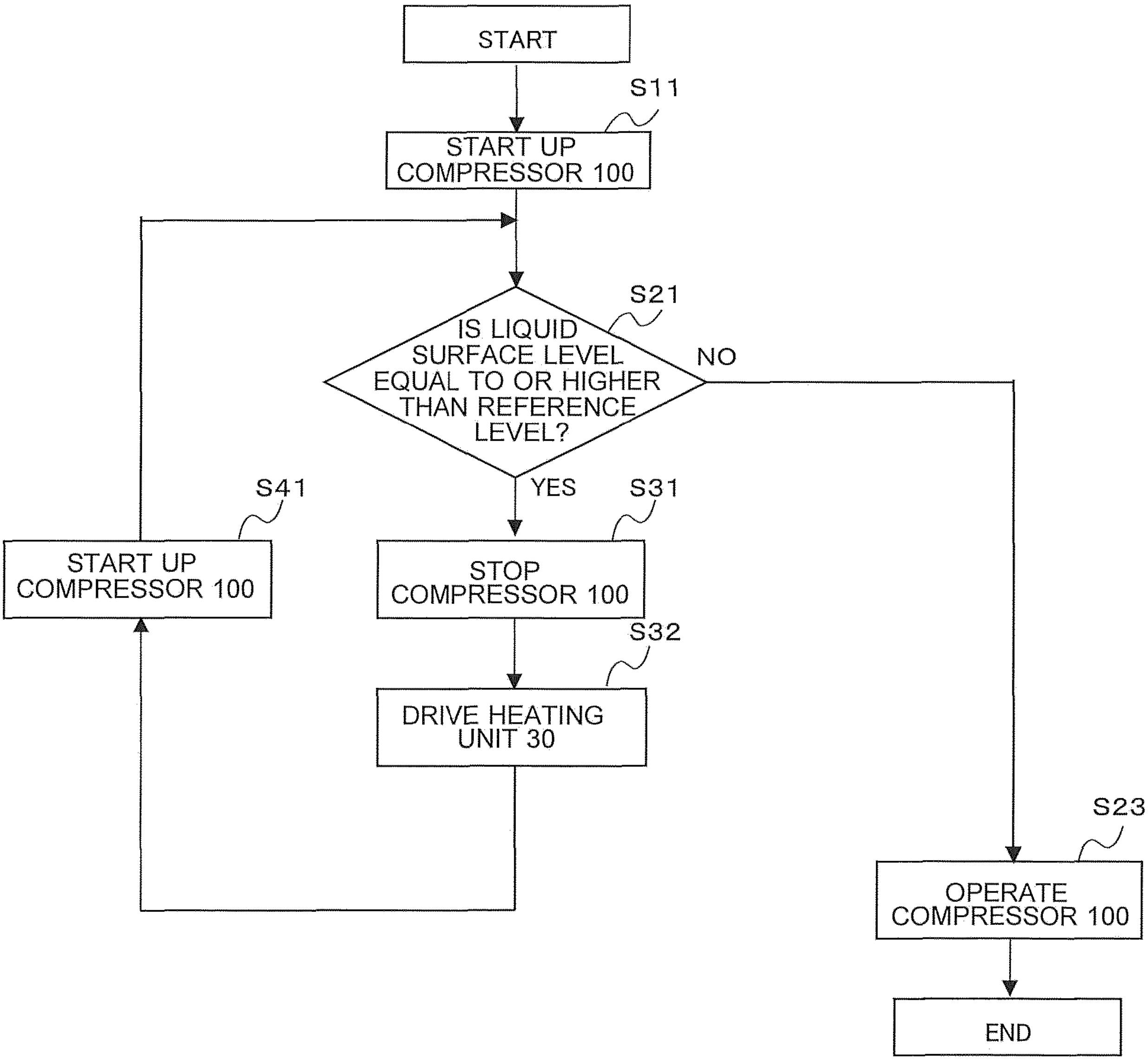
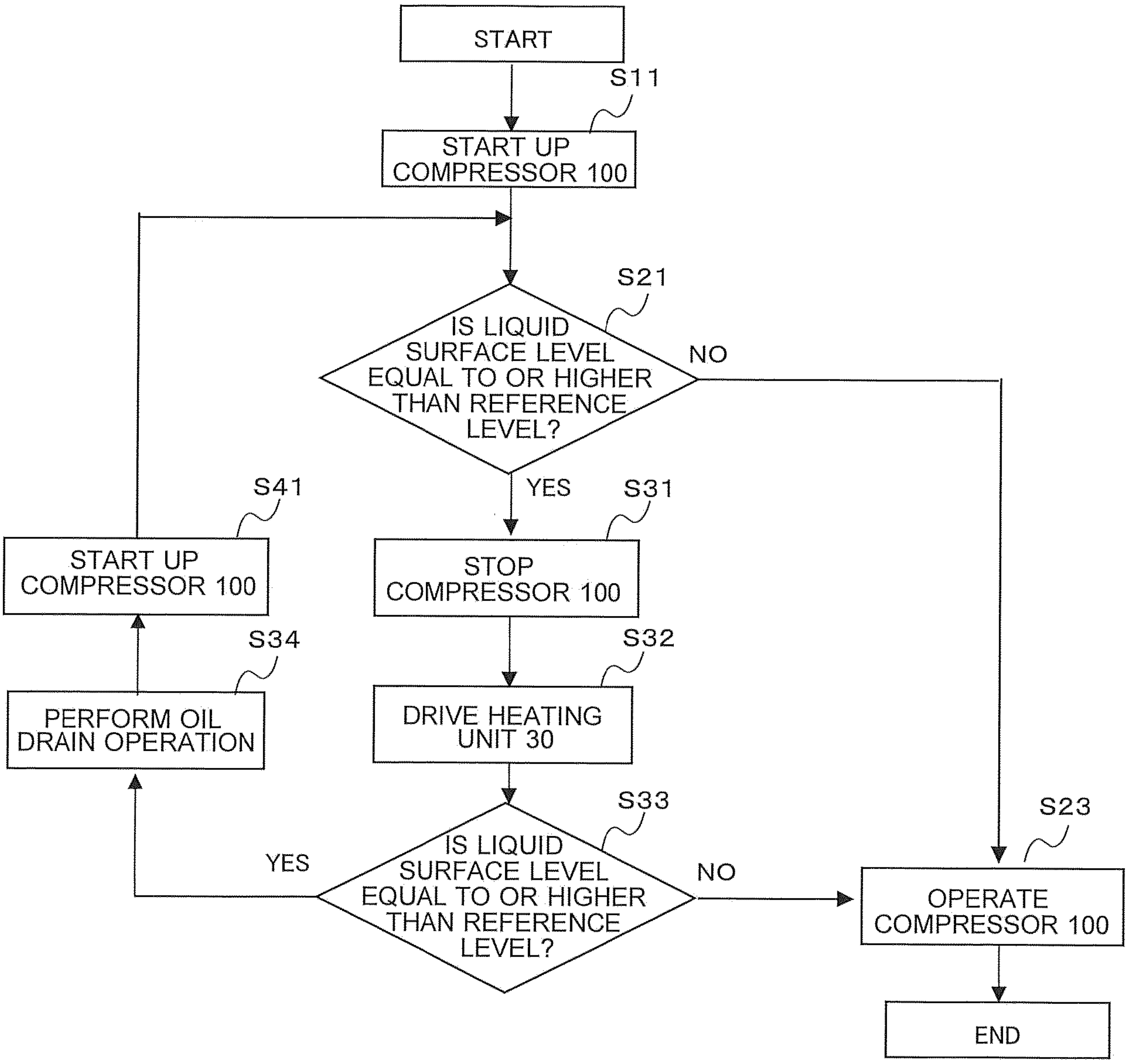

START
S11
START UP COMPRESSOR 100
S21
IS LIQUID SURFACE LEVEL EQUAL TO OR HIGHER THAN REFERENCE LEVEL?
NO
YES
S31
STOP COMPRESSOR 100
S32
DRIVE HEATING UNIT 30
S41
START UP COMPRESSOR 100
S23
OPERATE COMPRESSOR 100
END

FIG. 5


START
S11
START UP COMPRESSOR 100
S21
IS LIQUID SURFACE LEVEL EQUAL TO OR HIGHER THAN REFERENCE LEVEL?
NO
YES
S31
STOP COMPRESSOR 100
S32
DRIVE HEATING UNIT 30
S33
IS LIQUID SURFACE LEVEL EQUAL TO OR HIGHER THAN REFERENCE LEVEL?
YES
NO
S34
PERFORM OIL DRAIN OPERATION
S41
START UP COMPRESSOR 100
S23
OPERATE COMPRESSOR 100
END

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2006047133 A **[0004]**
- US 20040194485 A1 **[0005]**
- US 3744267 A **[0006]**
- WO 03036090 A1 **[0007]**