



US 20170058900A1

(19) **United States**

(12) **Patent Application Publication**
PARK et al.

(10) **Pub. No.: US 2017/0058900 A1**

(43) **Pub. Date: Mar. 2, 2017**

(54) **LUBRICATION SYSTEM OF ELECTRIC COMPRESSOR**

F04C 29/00 (2006.01)

F04C 18/02 (2006.01)

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(52) **U.S. Cl.**

CPC **F04C 29/026** (2013.01); **F04C 18/0215** (2013.01); **F04C 29/12** (2013.01); **F04C 29/0057** (2013.01); **F04C 2240/40** (2013.01); **F04C 2240/30** (2013.01); **F04C 2240/60** (2013.01); **F04C 2240/809** (2013.01)

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(21) Appl. No.: **15/232,162**

(57)

ABSTRACT

(22) Filed: **Aug. 9, 2016**

A lubrication system of an electric compressor may include a lower housing having a refrigerant inlet port formed to pierce an outer side plane thereof, a rotational shaft supported rotatably by the lower housing and a frame, a rotor for rotating the rotational shaft, an orbiting scroll disposed on a top portion of the frame to be orbited by the rotational shaft, a fixed scroll disposed on a top portion of the orbiting scroll to allow the orbiting scroll to orbit therein, and an upper housing disposed on a top portion of the fixed scroll and having a refrigerant outlet formed in an outer side plane thereof.

(30) **Foreign Application Priority Data**

Aug. 26, 2015 (KR) 10-2015-0120377

Publication Classification

(51) **Int. Cl.**

F04C 29/02 (2006.01)

F04C 29/12 (2006.01)

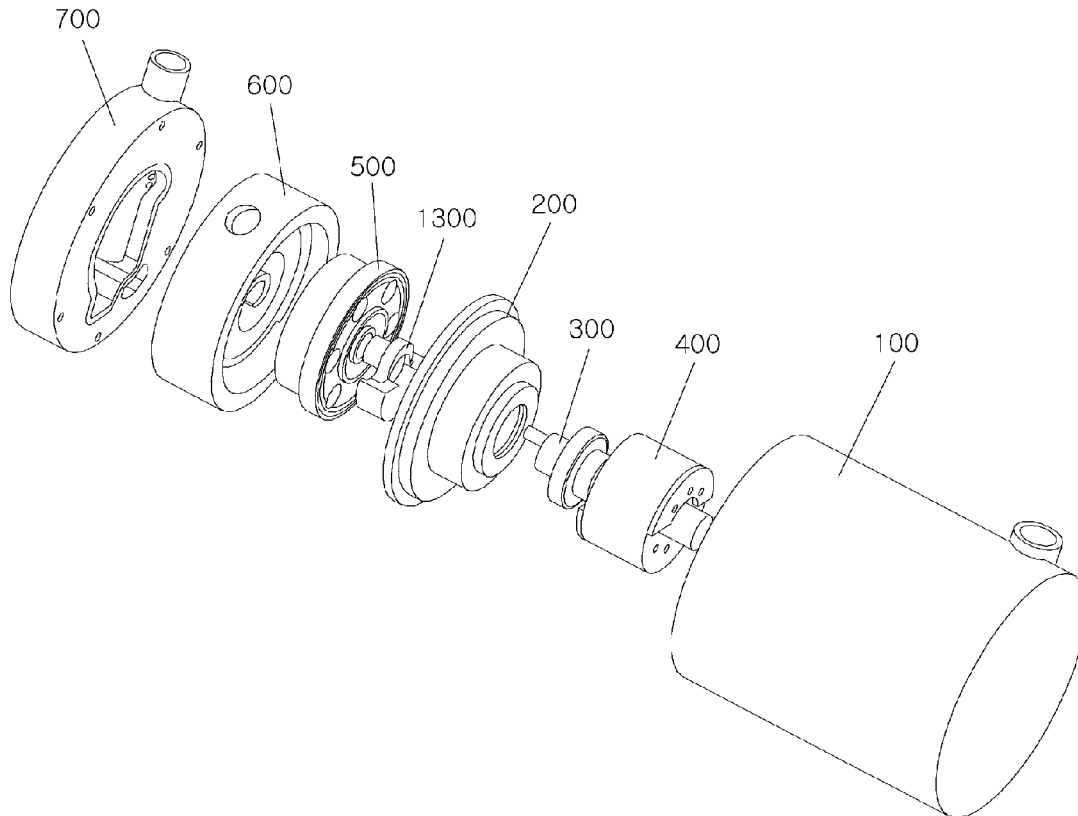


FIG.1

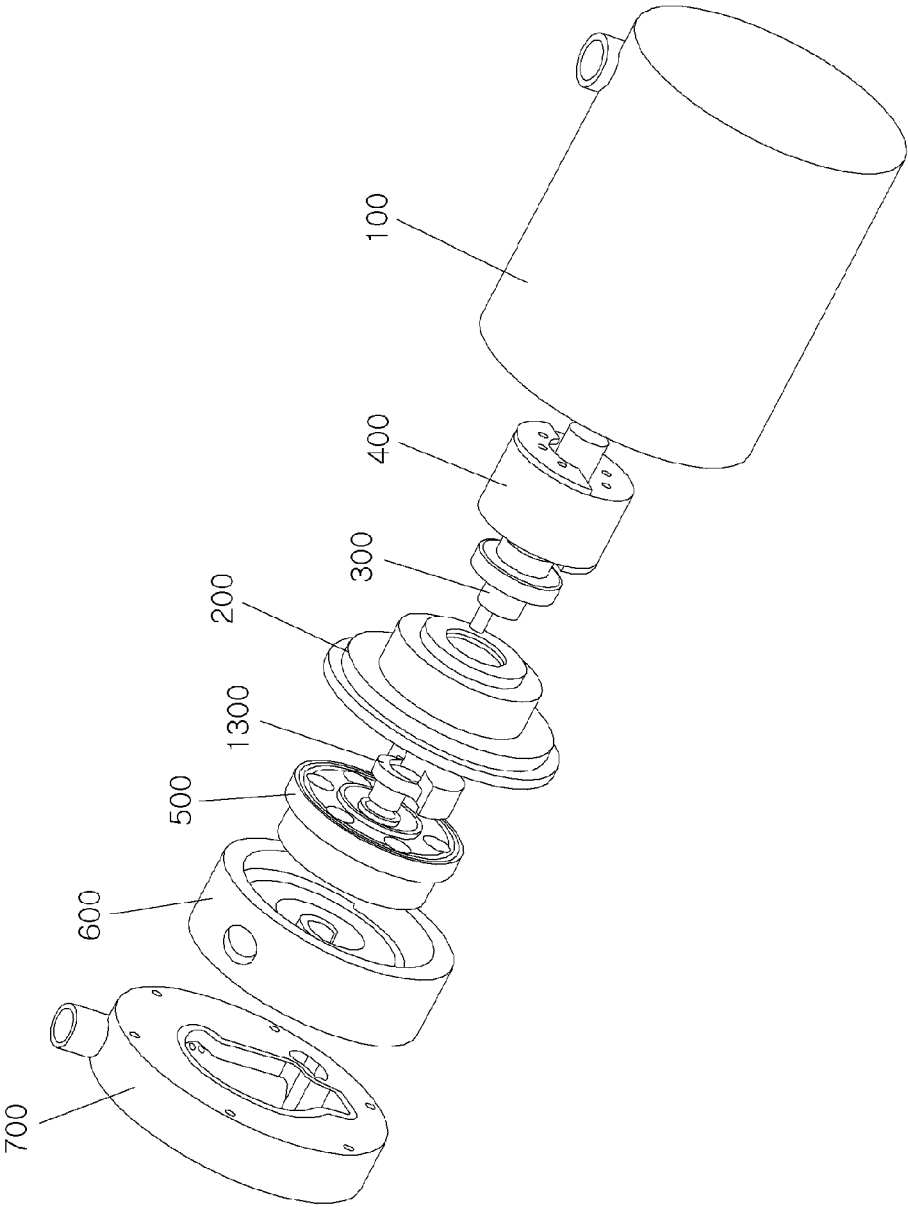


FIG.3

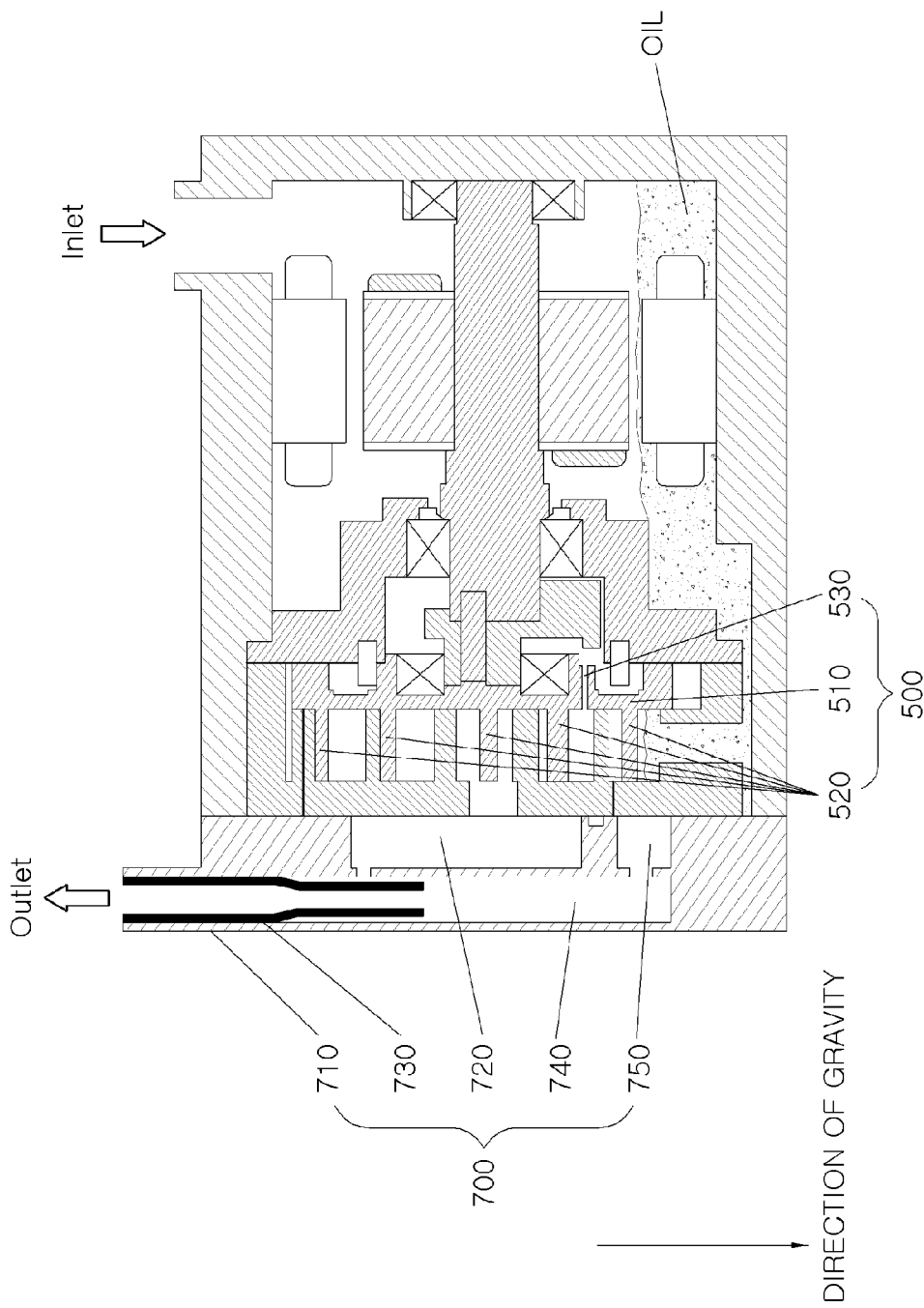


FIG.4

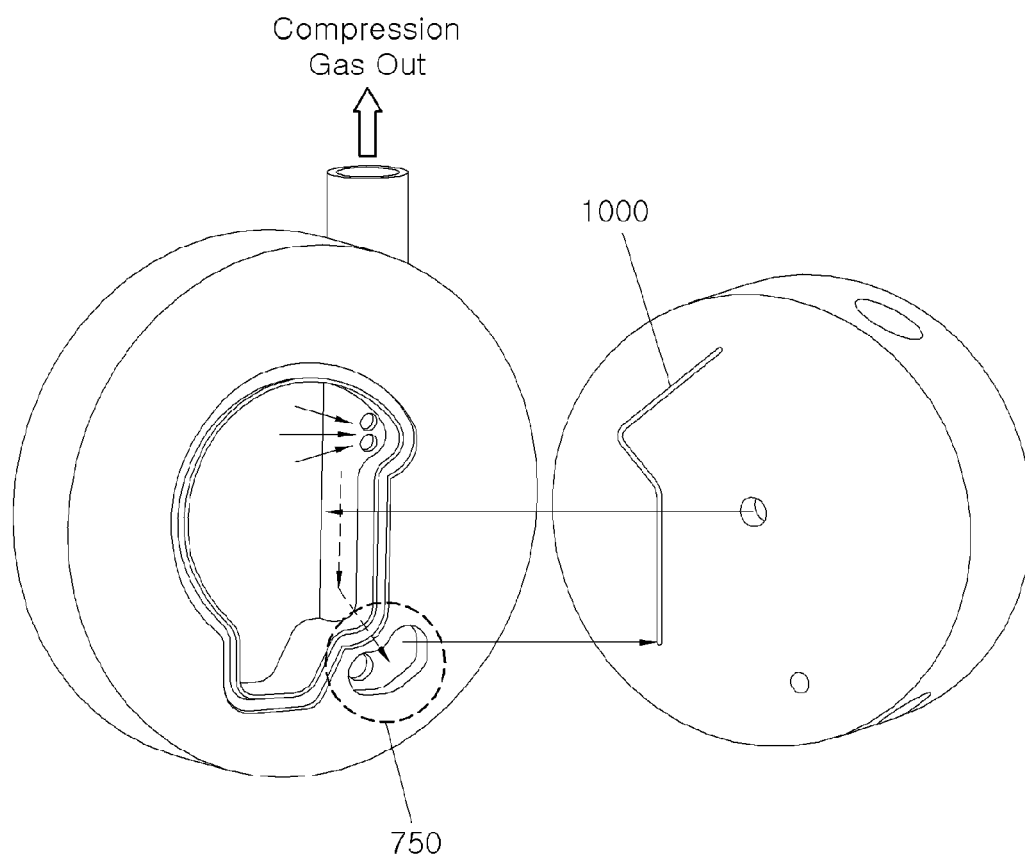


FIG.5

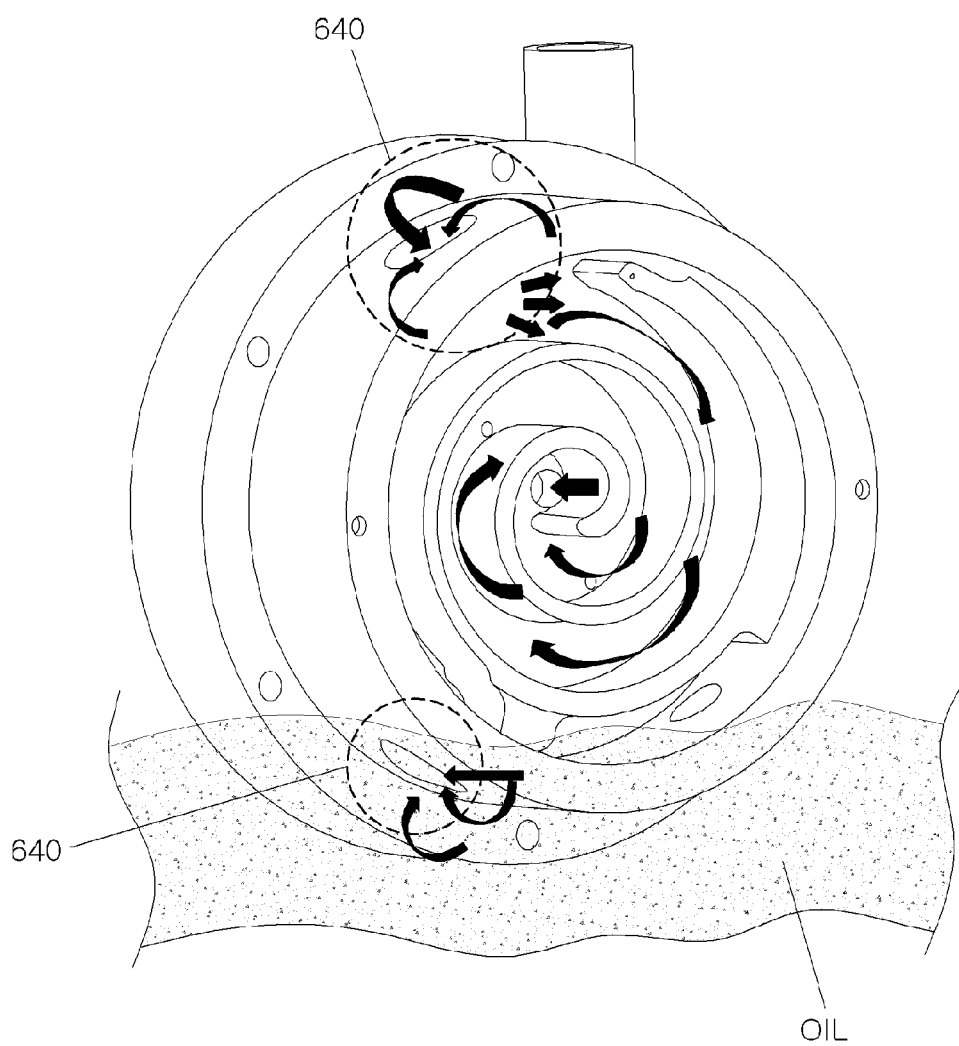


FIG.6

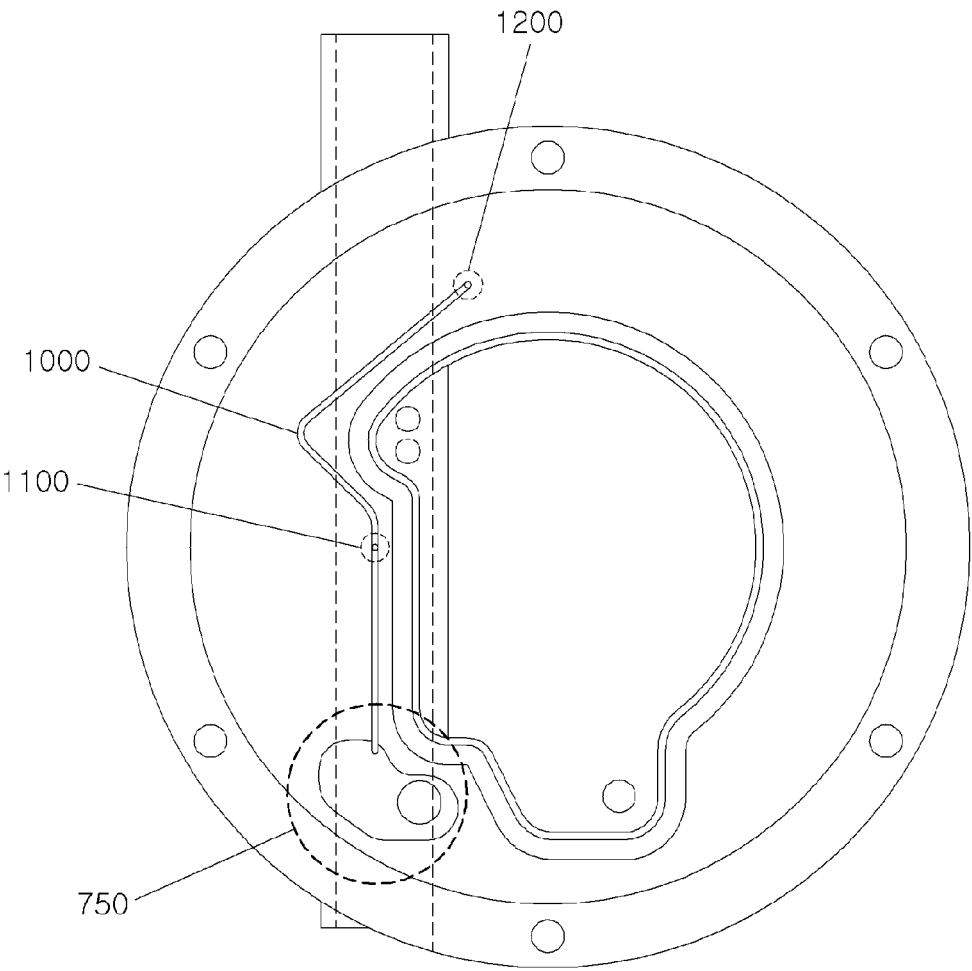


FIG.7

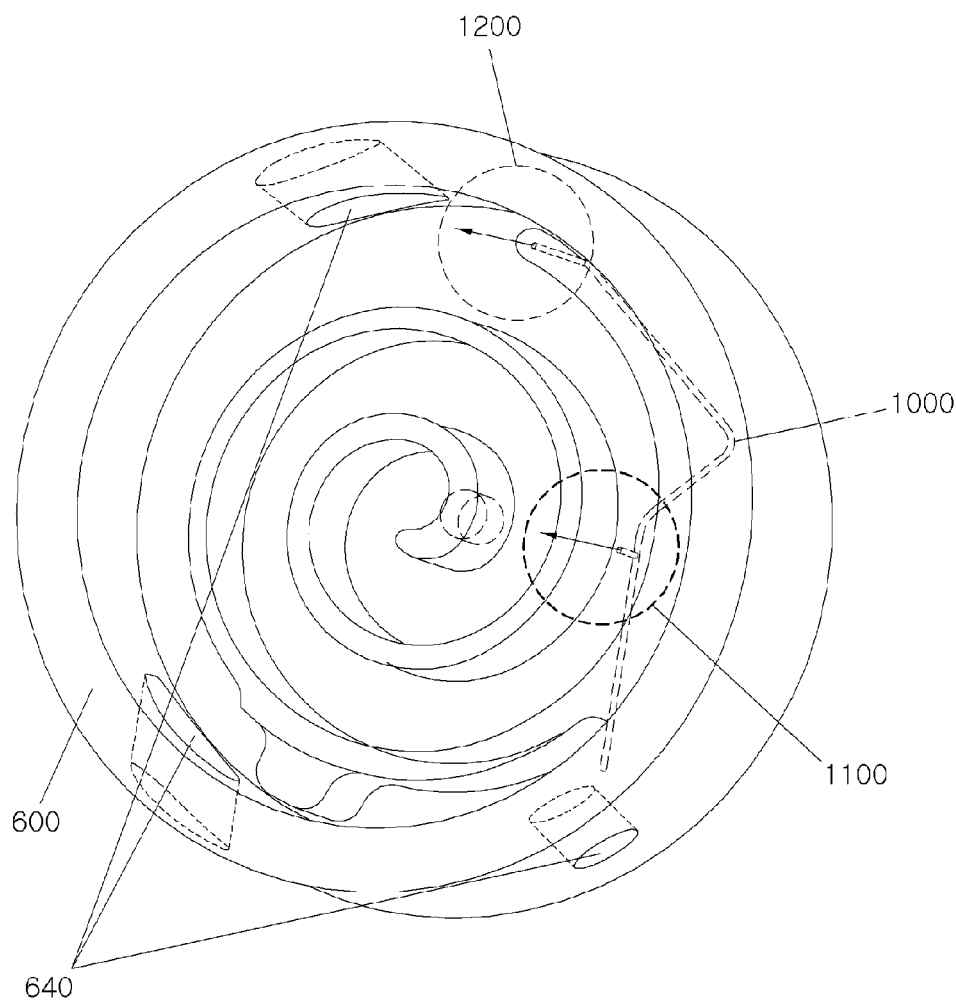
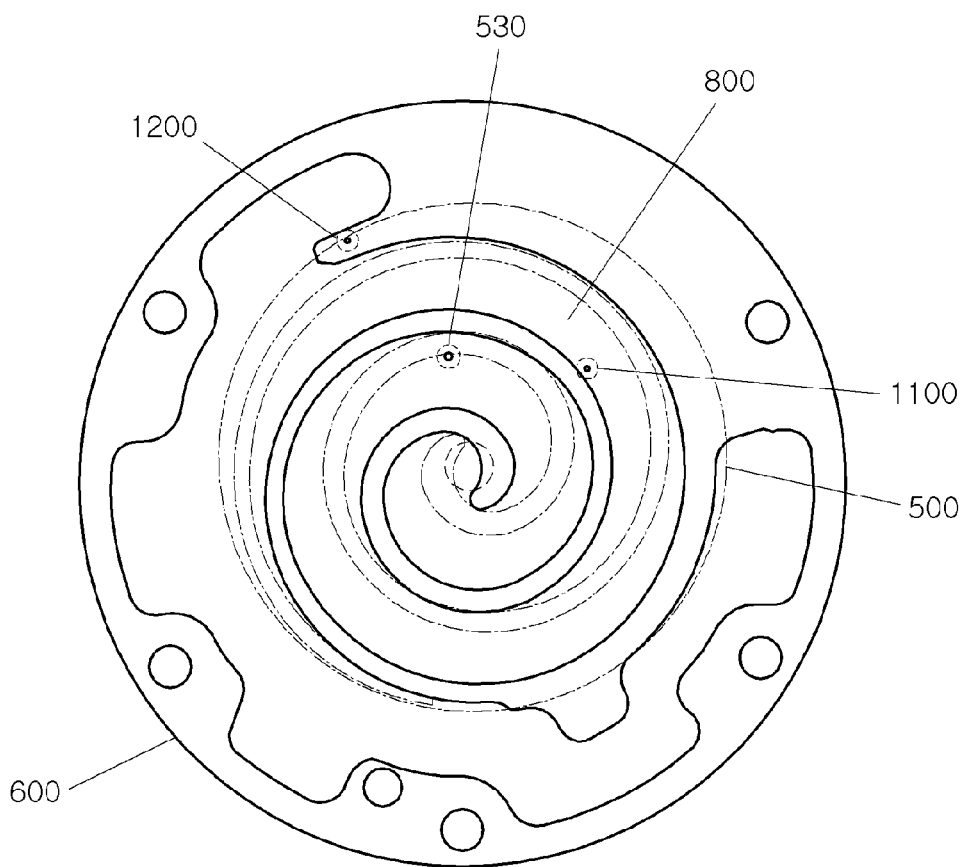


FIG.8



LUBRICATION SYSTEM OF ELECTRIC COMPRESSOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from and the benefit of Korean Patent Application No. 10-2015-0120377, filed on Aug. 26, 2015, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

Field

[0002] Exemplary embodiments relate to a lubrication system of an electric compressor, and more particularly, to a lubrication system of an electric compressor capable of reducing frictional loss occurring between an orbiting scroll and a fixed scroll.

[0003] Discussion of the Background

[0004] Scroll compressors are compressors for compressing a refrigerant gas by changing volume of a compression chamber defined by a pair of opposing scrolls. Scroll compressors have high efficiency, low vibration and noise levels, and can be more compact and more lightweight as compared to reciprocating compressors or rotary compressors, so that there is a trend that they are widely utilized in an air conditioning system.

[0005] Scroll compressors are broadly divided into low-pressure type scroll compressors and high-pressure type scroll compressors depending on pressure of a refrigerant filled in the internal space of their casing. The low-pressure type scroll compressor is a type where a suction pipe is in fluid contact with the internal space of a casing while a discharge pipe is in fluid contact with a discharge side of a compression unit so that a refrigerant is sucked indirectly into a compression chamber. In contrast, the high-pressure type scroll compressor is a type where a suction pipe is in fluid contact directly with a suction side of a compression unit while a discharge pipe is in fluid contact with the internal space of a casing so that a refrigerant is sucked directly into a compression chamber.

[0006] The low pressure type scroll compressor is constituted such that the internal space of the casing is divided into a suction space and a discharge space while the compression unit is arranged between the suction space and the discharge space. Further, as for types of sealing between the fixed scroll and the orbiting scroll in the low-pressure type scroll compressors, a tip seal type and a back pressure type are widely known. A tip seal type is a type where tip seals are provided on leading end faces of the wraps of each scroll, respectively, such that the tip seals cling to an opposite mirror plate portion to seal the compression chamber. A back pressure type is a type where a backside of the fixed scroll or the orbiting scroll is pressed such that the wraps and mirror plate portions of both scrolls cling to each other to seal the compression chamber.

[0007] There is a technique wherein a conventional low-pressure type scroll compressor is provided with a back pressure control mechanism for controlling the pressure in a back pressure chamber in connection with the pressure of a discharging refrigerant such that the orbiting scroll is supported by the pressure in the back pressure chamber without any internal leakage or power loss.

[0008] The back pressure control mechanism is installed in either a fixed scroll or a housing and includes a high pressure passage connecting the back pressure control mechanism to a discharge chamber, a back pressure passage connecting the back pressure control mechanism to the back pressure chamber, and a low pressure passage connecting the back pressure control mechanism to a suction chamber. Further, the high pressure passage, the back pressure passage and the low pressure passage are formed as capillary tubes such that pressure can be reduced when the refrigerant is transferred through each of the passages.

[0009] However, in the prior art as described above, there is a problem in that it is difficult to actively control the pressure in the back pressure chamber to cope with a variation of operating conditions because the pressure in the back pressure chamber is determined mainly by the shape and dimension of the flow path of the capillary tubes constituting the high pressure and back pressure passages. Furthermore, there is a problem in that oil is excessively introduced into the back pressure chamber and fluid resistance against the movement of a counterweight in the back pressure chamber is increased. Moreover, since additional components such as a back pressure control mechanism for selecting a flow path is required to be installed in the compressor, there is also a problem that the unit cost of manufacturing the compressor rose due to increase in the number of components and processing steps.

[0010] The above information disclosed in this Background section is only for enhancement of understanding of the background of the inventive concept, and, therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

[0011] Exemplary embodiments provide a lubrication system of an electric compressor having oil injection holes which are machined to inject oil directly into a compression chamber and a suction chamber and a back pressure hole which is machined in a mirror plate of an orbiting scroll wrap.

[0012] Additional aspects will be set forth in the detailed description which follows, and, in part, will be apparent from the disclosure, or may be learned by practice of the inventive concept.

[0013] According to exemplary embodiments, a lubrication system of an electric compressor includes a lower housing having a refrigerant inlet port formed to pierce an outer side plane thereof, a rotational shaft supported by the lower housing and a frame, a rotor for rotating the rotational shaft, an orbiting scroll disposed on a top portion of the frame to be orbited by the rotational shaft, a fixed scroll disposed on a top portion of the orbiting scroll so as to allow the orbiting scroll to orbit therein, and an upper housing disposed on a top portion of the fixed scroll and having a refrigerant outlet formed in an outer side plane thereof.

[0014] The fixed scroll may include a fixed scroll mirror plate in a disc shape disposed horizontally, a discharge port piercing a center of the fixed scroll mirror plate in a vertical direction, an outer side plane formed to protrude downward along an outer peripheral surface of the fixed scroll mirror plate, a plurality of suction ports piercing the outer side plane in a horizontal direction, a fixed scroll wrap in a spiral shape protruding vertically from a bottom plane of the fixed

scroll mirror plate, and a suction chamber that is a space formed between the fixed scroll wrap and the outer side plane.

[0015] The upper housing may include a discharge chamber connected with the discharge port, an oil separation chamber connected with the discharge chamber and provided with an oil separation tube for separating refrigerant and oil which are pressurized in the compression chamber, and an oil chamber connected with the oil separation chamber and storing oil separated from the oil separation tube.

[0016] The lubrication system of an electric compressor may include an oil groove formed on a top plane of the fixed scroll mirror plate to bypass a bottom plane of the discharge chamber and having one end connected with a bottom plane of the oil chamber and where the other end reaches a top portion of an outer side end of the fixed scroll wrap.

[0017] The orbiting scroll may include an orbiting scroll mirror plate in a disc shape disposed horizontally, an orbiting scroll wrap formed in a spiral shape and protruding in a vertical direction from the top plane of the orbiting scroll mirror plate so as to be disposed crisscross at an angle of about 180 degrees with respect to the fixed scroll wrap, and a back pressure hole piercing the orbiting scroll mirror plate in a vertical direction.

[0018] The lubrication system of an electric compressor may include a compression chamber for compressing the refrigerant and the oil flowing therein through the suction port, wherein the compression chamber is defined by being surrounded by the fixed scroll mirror plate, the fixed scroll wrap, the orbiting scroll mirror plate, and the orbiting scroll wrap.

[0019] The lubrication system of an electric compressor may include a back pressure chamber connected with the compression chamber via the back pressure hole, wherein back pressure chamber is defined by being surrounded by the bottom plane of the orbiting scroll mirror plate and the frame.

[0020] The lubrication system of an electric compressor may include a first oil injection hole formed to pierce the top plane of the fixed scroll mirror plate in a vertical direction to communicate fluidly with the oil groove and thus the compression chamber.

[0021] The lubrication system of an electric compressor may include a second oil injection hole formed to pierce the fixed scroll wrap in a vertical direction at the other end of the oil groove.

[0022] The lubrication system of an electric compressor may include an eccentric counterweight fastened to an upper end of the rotational shaft and disposed in the back pressure chamber.

[0023] The lubrication system of an electric compressor may include a thrust plate disposed between the frame and the orbiting scroll.

[0024] The lubrication system of an electric compressor may include an Oldham pin for fastening the frame and the thrust plate.

[0025] The lubrication system of an electric compressor may include a lip seal for sealing a space between the frame and the rotational shaft.

[0026] According to exemplary embodiments, it is possible to reduce frictional losses occurring between the orbiting scroll and the fixed scroll, enhance formation of a fluid

film on the fixed scroll wrap, and reduce leakage of compressed refrigerant, thereby increasing efficiency of the compressor.

[0027] Further, it is possible to form an optimum back pressure by introducing oil and refrigerant in an intermediate pressure in the compression chamber into the back pressure chamber and thereby actively controlling back pressure depending on operating conditions.

[0028] The foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The accompanying drawings, which are included to provide a further understanding of the inventive concept, and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the inventive concept, and, together with the description, serve to explain principles of the inventive concept.

[0030] FIG. 1 is an exploded perspective view of a lubrication system of an electric compressor according to an exemplary embodiment.

[0031] FIGS. 2 and 3 are cross-sectional views of a lubrication system of an electric compressor according to an exemplary embodiment.

[0032] FIG. 4 is a view illustrating a coupling relationship between an upper housing and a fixed scroll in a lubrication system of an electric compressor according to an exemplary embodiment.

[0033] FIG. 5 is a perspective view of an assembly of an upper housing and a fixed scroll in a lubrication system of an electric compressor according to an exemplary embodiment.

[0034] FIG. 6 is a view illustrating arrangement of an oil chamber, an oil groove and oil injection holes in a lubrication system of an electric compressor according to an exemplary embodiment.

[0035] FIGS. 7 and 8 are a view illustrating arrangement of oil injection holes in a lubrication system of an electric compressor according to an exemplary embodiment.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0036] In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of various exemplary embodiments. It is apparent, however, that various exemplary embodiments may be practiced without these specific details or with one or more equivalent arrangements. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring various exemplary embodiments.

[0037] In the accompanying figures, the size and relative sizes of films, panels, regions, etc., may be exaggerated for clarity and descriptive purposes. Also, like reference numerals denote like elements.

[0038] When an element is referred to as being “on,” “connected to,” or “coupled to” another element it may be directly on, connected to, or coupled to the other element or intervening elements may be present. When, however, an element is referred to as being “directly on,” “directly connected to,” or “directly coupled to” another element there

are no intervening elements present. For the purposes of this disclosure, “at least one of X, Y, and Z” and “at least one selected from the group consisting of X, Y, and Z” may be construed as X only, Y only, Z only, or any combination of two or more of X, Y, and Z, such as, for instance, XYZ, XYY, YZ, and ZZ. Like numbers refer to like elements throughout. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0039] Although the terms first, second, etc. may be used herein to describe various elements, components, regions, and/or sections, these elements, components, regions, and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, and/or section from another element, component, region, and/or section. Thus, a first element, component, region, and/or section discussed below could be termed a second element, component, region, and/or section without departing from the teachings of the present disclosure.

[0040] Spatially relative terms, such as “beneath,” “below,” “lower,” “above,” “upper,” and the like, may be used herein for descriptive purposes, and, thereby, to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the drawings. Spatially relative terms are intended to encompass different orientations of an apparatus in use, operation, and/or manufacture in addition to the orientation depicted in the drawings. For example, if the apparatus in the drawings is turned over, elements described as “below” or “beneath” other elements or features would then be oriented “above” the other elements or features. Thus, the exemplary term “below” can encompass both an orientation of above and below. Furthermore, the apparatus may be otherwise oriented (e.g., rotated 90 degrees or at other orientations), and, as such, the spatially relative descriptors used herein interpreted accordingly.

[0041] The terminology used herein is for the purpose of describing particular embodiments and is not intended to be limiting. As used herein, the singular forms, “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. Moreover, the terms “comprises,” “comprising,” “includes,” and/or “including,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, components, and/or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0042] Various exemplary embodiments are described herein with reference to sectional illustrations that are schematic illustrations of idealized exemplary embodiments and/or intermediate structures. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, exemplary embodiments disclosed herein should not be construed as limited to the particular illustrated shapes of regions, but are to include deviations in shapes that result from, for instance, manufacturing. As such, the regions illustrated in the drawings are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to be limiting.

[0043] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same mean-

ing as commonly understood by one of ordinary skill in the art to which this disclosure is a part. Terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense, unless expressly so defined herein.

[0044] Exemplary embodiments of the present disclosure will be described below in more detail with reference to the accompanying drawings.

[0045] FIG. 1 is an exploded perspective view of a lubrication system of an electric compressor according to an exemplary embodiment. FIGS. 2 and 3 are cross-sectional views of a lubrication system of an electric compressor according to an exemplary embodiment.

[0046] Referring to FIGS. 1, 2, and 3, the lubrication system of an electric compressor according to the present disclosure may include a lower housing 100 having a refrigerant inlet port 110 formed to pierce an outer side plane thereof, a rotational shaft 300 supported by the lower housing 100 and a frame 200, a rotor 400 for rotating the rotational shaft 300, an orbiting scroll 500 disposed on a top portion of the frame 200 to be orbited by the rotational shaft 300, a fixed scroll 600 disposed on a top portion of the orbiting scroll 500 so as to allow the orbiting scroll 500 to orbit therein; and an upper housing 700 disposed on a top portion of the fixed scroll 600 and having a refrigerant outlet 710 formed in an outer side thereof. The lubrication system of an electric compressor may include a thrust plate 1400 disposed between the frame 200 and the orbiting scroll 500, an Oldham pin 1500 for fastening the frame 200 and the thrust plate 1400, and a lip seal 1600 for sealing a space between the frame 200 and the rotational shaft 300.

[0047] The fixed scroll 600 may include a fixed scroll mirror plate 610 in a disc shape disposed horizontally, a discharge port 620 piercing a center of the fixed scroll mirror plate 610 in a vertical direction; an outer side plane 630 formed to protrude downward along an outer peripheral surface of the fixed scroll mirror plate 610, a plurality of suction ports 640 piercing the outer side plane 630 in a horizontal direction, a fixed scroll wrap 650 in a spiral shape protruding vertically from a bottom plane of the fixed scroll mirror plate 610, and a suction chamber 660 that is a space formed between the fixed scroll wrap 650 and the outer side plane 630.

[0048] The upper housing 700 may include a discharge chamber 720 connected with the discharge port 620, an oil separation chamber 740 connected with the discharge chamber 720 and provided with an oil separation tube 730 for separating refrigerant and oil which are pressurized in the compression chamber 800, and an oil chamber 750 connected with the oil separation chamber 740 and storing oil separated from the oil separation tube 730.

[0049] The lubrication system of an electric compressor may include an oil groove 1000 formed on a top plane of the fixed scroll mirror plate 610 to bypass a bottom plane of the discharge chamber 720 and having one end connected with a bottom plane of the oil chamber 750 and where the other end reaches a top portion of an outer side end of the fixed scroll wrap 650.

[0050] The orbiting scroll 500 may include an orbiting scroll mirror plate 510 formed in a disc shape and disposed horizontally, an orbiting scroll wrap 520 formed in a spiral shape and protruding in a vertical direction from the top

plane of the orbiting scroll mirror plate **510** so as to be disposed crisscross at an angle of about **180** degrees with respect to the fixed scroll wrap **650**, and a back pressure hole **530** piercing the orbiting scroll mirror plate **510** in a vertical direction.

[0051] The lubrication system of an electric compressor may include a compression chamber **800** for compressing the refrigerant and the oil flowing therein through the suction port **640**, wherein the compression chamber is defined by being surrounded by the fixed scroll mirror plate **610**, the fixed scroll wrap **650**, the orbiting scroll mirror plate **510**, and the orbiting scroll wrap **520**.

[0052] The lubrication system of an electric compressor may include a back pressure chamber **900** connected with the compression chamber **800** via the back pressure hole **530**, wherein the back pressure chamber **900** is defined by being surrounded by the bottom plane of the orbiting scroll mirror plate **510** and the frame **200**. The back pressure hole **530** may be machined at a position where pressure in the back pressure chamber **900** can be controlled actively. Accordingly, it is possible to maintain an optimal back pressure for every operating condition so that performance of the compressor can be optimized.

[0053] Further, the lubrication system of an electric compressor may include a first oil injection hole **1100** formed to pierce the top plane of the fixed scroll mirror plate **610** in a vertical direction to communicate fluidly with the oil groove **1000** and the compression chamber **800**, a second oil injection hole **1200** formed to pierce the fixed scroll wrap **650** in a vertical direction at the other end of the oil groove **1000**, and an eccentric counterweight **1300** fastened to an upper end of the rotational shaft **300** and disposed in the back pressure chamber **900**.

[0054] FIG. **4** is a view illustrating a coupling relationship between an upper housing and a fixed scroll in a lubrication system of an electric compressor according to an exemplary embodiment and FIG. **5** is a perspective view of an assembly of an upper housing and a fixed scroll in a lubrication system of an electric compressor according to an exemplary embodiment. FIG. **6** is a view illustrating arrangement of an oil chamber, an oil groove and oil injection holes in a lubrication system of an electric compressor according to an exemplary embodiment and FIGS. **7** and **8** are a view illustrating arrangement of oil injection holes in a lubrication system of an electric compressor according to an exemplary embodiment. Hereinafter, operation of the present disclosure will be described with reference to FIGS. **4**, **5**, **6**, **7**, and **8**.

[0055] Refrigerant in a relatively low pressure state introduced into the refrigerant inlet port **110** of the lower housing **100** flows into the suction chamber **660** through the suction ports **640**. At this time, the refrigerant flows into the suction chamber along with oil in the compressor. Furthermore, at the same time, the oil flows into the suction chamber **660** through the suction ports **640** submerged in the oil (see FIGS. **2** and **5**).

[0056] The refrigerant and oil introduced into the suction chamber **660** are compressed as the orbiting scroll **500** rotates, and the compressed refrigerant and oil, which are in a relatively high pressure state, flow into the discharge chamber **720** through the discharge port **620** (see solid line in FIG. **4**).

[0057] The refrigerant and oil introduced into the discharge chamber **720** flows into the oil separation chamber **740** and then collides against the outer wall of the oil

separation tube **730**. After the collision, the lighter weight gas may be discharged to the outside of the compressor through a refrigerant outlet pipe **710**, whereas the heavier weight oil may drop to the bottom portion of the oil separation chamber **740** due to gravity and then collected within the oil chamber **750** (see dashed lines in FIGS. **2** and **4**).

[0058] The oil collected within the oil chamber **750** moves upward along the oil groove **1000** and pressure of the oil is depressurized due to friction and the like while moving upward (see FIG. **4**). This is intended to prevent efficiency of the compressor from being deteriorated due to injection of the oil at a high pressure when the oil is injected into the compression chamber **800**, or the suction chamber **660**, etc. after the oil is collected.

[0059] The oil rising along the oil groove **1000** is injected first from the first oil injection hole **1100** directly into the compression chamber **800**. Accordingly, it is possible to reduce frictional losses occurring at the tip of the orbiting scroll wrap **520** or the fixed scroll wrap **650**. Further, there is an effect of sealing the orbiting scroll wrap **520** or the fixed scroll wrap **650** and hence it is possible to reduce leakage of the compressed refrigerant, so that efficiency of the compressor is improved. Moreover, since the oil discharged into the compression chamber **800** is supplied to the back pressure chamber **900** through the back pressure hole **530**, frictional losses occurring at the inside of the back pressure chamber **900** is also reduced.

[0060] The remainder of the oil rising along the oil groove **1000** is discharged from the second oil injection hole **1200** to the other end of the fixed scroll wrap **650**. Accordingly, since the oil is injected directly to a frictional area between the fixed scroll wrap **650** and the orbiting scroll mirror plate **510**, frictional loss is reduced and the oil having a relatively high pressure is depressurized to a lower pressure. Further, the oil can be discharged from the second oil injection hole **1200**, which serves to supply oil to the suction chamber.

[0061] Although certain exemplary embodiments and implementations have been described herein, other embodiments and modifications will be apparent from this description. Accordingly, the inventive concept is not limited to such embodiments, but rather to the broader scope of the presented claims and various obvious modifications and equivalent arrangements.

What is claimed is:

1. A lubrication system of an electric compressor comprising:

- a lower housing comprising a refrigerant inlet port disposed to pierce an outer side plane thereof;
- a rotational shaft supported by the lower housing and a frame;
- a rotor for rotating the rotational shaft;
- an orbiting scroll disposed on a top portion of the frame to be orbited by the rotational shaft;
- a fixed scroll disposed on a top portion of the orbiting scroll to allow the orbiting scroll to orbit therein; and
- an upper housing disposed on a top portion of the fixed scroll and comprising a refrigerant outlet disposed in an outer side plane thereof.

2. The lubrication system according to claim 1, wherein the fixed scroll comprises:

- a fixed scroll mirror plate in a disc shape disposed horizontally;

- a discharge port piercing a center of the fixed scroll mirror plate in a vertical direction;
 - an outer side plane disposed to protrude downward along an outer peripheral surface of the fixed scroll mirror plate;
 - a plurality of suction ports piercing the outer side plane in a horizontal direction;
 - a fixed scroll wrap in a spiral shape protruding vertically from a bottom plane of the fixed scroll mirror plate; and
 - a suction chamber that is a space formed between the fixed scroll wrap and the outer side plane.
3. The lubrication system according to claim 2, wherein the upper housing comprises:
- a discharge chamber connected with the discharge port;
 - an oil separation chamber connected with the discharge chamber and provided with an oil separation tube for separating refrigerant and oil pressurized; and
 - an oil chamber connected with the oil separation chamber and storing oil separated from the oil separation tube.
4. The lubrication system according to claim 3, wherein the lubrication system comprises an oil groove formed on a top plane of the fixed scroll mirror plate to bypass a bottom plane of the discharge chamber and comprising one end of the oil groove connected with a bottom plane of the oil chamber and where an other end of the oil groove reaches an upper portion of an outer side end of the fixed scroll wrap.
5. The lubrication system according to claim 4, wherein the orbiting scroll comprises:
- an orbiting scroll mirror plate formed in a disc shape and disposed horizontally;
 - an orbiting scroll wrap formed in a spiral shape and protruding in a vertical direction from the top plane of the orbiting scroll mirror plate so as to be disposed crisscross at an angle of 180 degrees with respect to the fixed scroll wrap; and
 - a back pressure hole formed through the orbiting scroll mirror plate in a vertical direction.

6. The lubrication system according to claim 5, wherein the lubrication system comprises a compression chamber for compressing the refrigerant and the oil flowing therein through the suction port, the compression chamber being defined by being surrounded by the fixed scroll mirror plate, the fixed scroll wrap, the orbiting scroll mirror plate and the orbiting scroll wrap.

7. The lubrication system according to claim 6, wherein the lubrication system comprises a back pressure chamber connected with the compression chamber via the back pressure hole, the back pressure chamber being defined by being surrounded by a bottom plane of the orbiting scroll mirror plate and the frame.

8. The lubrication system according to claim 7, wherein the lubrication system comprises a first oil injection hole formed to pierce the top plane of the fixed scroll mirror plate in a vertical direction to communicate fluidly with the oil groove and the compression chamber.

9. The lubrication system according to claim 4, wherein the lubrication system comprises a second oil injection hole formed to pierce the fixed scroll wrap in a vertical direction at the other end of the oil groove.

10. The lubrication system according to claim 7, wherein the lubrication system comprises an eccentric counterweight fastened to an upper end of the rotational shaft and disposed in the back pressure chamber.

11. The lubrication system according to claim 1, wherein the lubrication system comprises a thrust plate disposed between the frame and the orbiting scroll.

12. The lubrication system according to claim 11, wherein the lubrication system comprises an Oldham pin for fastening the frame and the thrust plate.

13. The lubrication system according to claim 1, wherein the lubrication system comprises a lip seal for sealing a space between the frame and the rotational shaft.

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