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(54) **COMPRESSOR**

(57) To reduce a size of an oil separator by improving oil separation performance of the oil separator of a compressor in the compressor having a centrifugal separation type oil separator. To further improve the oil separation performance by forming a processing drill so as not to interfere with a separation pipe at the time of drilling a refrigerant introduction path and by connecting the refrigerant introduction path to an inner peripheral surface of a separation chamber smoothly even when the oil separator is reduced in size. To further secure a clearance at a portion where an opening of the refrigerant introduction path faces. In a compressor having an oil separator 14 including a separation chamber 22, a separation pipe 23 housed in the separation chamber 22 and a refrigerant introduction path 21 allowing a discharge chamber 11 to communicate with the separation chamber 22, an axial center 0 of the separation chamber 22 and an axial center 0' of the separation pipe are shifted from each other.

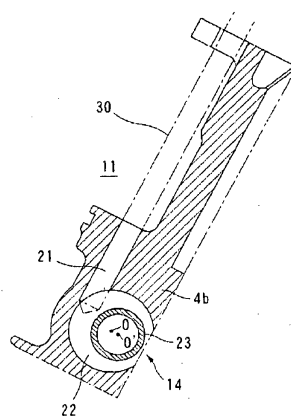


Fig.3A

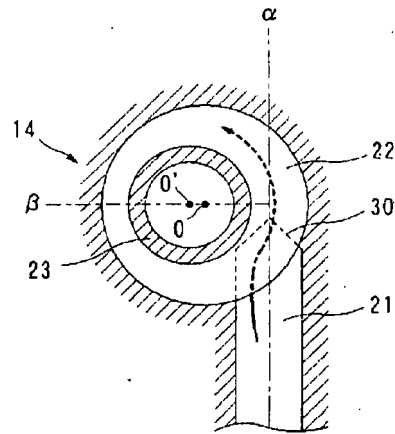


Fig.3B

Description

Technical Field

[0001] The present invention relates to a compressor including a centrifugal separation-type oil separator, and particularly relates to a compressor including an oil separator having high oil separation performance.

Background Art

[0002] As compressors having a centrifugal separation-type oil separator which separates oil from working fluid compressed by a compression mechanism in related art, for example, compressors disclosed in Patent Literature 1 and Patent Literature 2 are well known.

[0003] In the above compressors, the compressor shown in Patent Literature 1 is provided with a movable member capable of moving in accordance with the rotation of a shaft and a fixed member forming a compression chamber together with the movable member. An oil separator which introduces the working fluid compressed in the compression chamber and separates oil is integrally formed with the fixed member. The oil separator has a separation chamber to which working fluid compressed in the compression chamber is introduced and a separation pipe housed in the separation chamber for swirling the introduced working fluid, in which the separation chamber and the separation pipe are integrally formed with the fixed member in a coaxial manner.

[0004] In the compressor disclosed in Patent Literature 2, a cyclone block (oil separator) for separating a refrigerant oil from a refrigerant gas is provided in a rear side block which forms a housing of the compressor. The oil separator is configured by including a centrifugal separation body part having a cylindrical inner peripheral surface in which the compressed refrigerant gas is swirled and a bottom surface blocking one end side of the cylindrical inner peripheral surface, and an inner cylindrical gas exhaust part arranged inside a columnar space surrounded by the cylindrical inner peripheral surface along an axis of the columnar space, which introduces the refrigerant gas swirled inside to the outside of the centrifugal separation body part from an end surface opposite to the bottom surface. Also in the compressor, the gas exhaust part and the centrifugal separation body part are formed of different members from each other.

[0005] As described above, in the related-art oil separators, the separation chamber formed in the approximately columnar space and the cylindrical separation pipe housed inside the separation chamber are formed in the centrifugal separation main part provided in the housing so that axial centers thereof coincide to each other, and working fluid including oil is swirled in the approximately cylindrical space demarcated by an inner peripheral surface of the separation chamber and an outer peripheral surface of the separation pipe, thereby performing centrifugal separation of the oil in the working

fluid.

Citation List

5 Patent Literature

[0006]

Patent Literature 1: W2011-080865 Republication
Patent Literature 2: JP-A-2007-327340

Summary of Invention

Technical Problem

[0007] However, in the related-art oil separator in which the separation chamber and the separation pipe are coaxially formed, it is necessary to secure the separation chamber having a certain degree of size for securing required separation ability, therefore, the size of the oil separator is not easily reduced and it is difficult to reduce the size of the compressor.

[0008] Accordingly, it is required that the oil separation performance of the oil separator is increased and the size of the oil separator is reduced.

[0009] Furthermore, in the structure disclosed in Patent Literature 1 in which the centrifugal separation body part and the separation pipe which demarcate the separating chamber are integrally formed, the following inconveniences may occur in a work of processing a refrigerant introduction path for introducing a high-pressure gas of the oil separator by using a processing drill, if a sufficient clearance between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation chamber is not secured. That is, at the time of drilling the refrigerant introduction path by moving the processing drill from a side direction of the separation body part to a tangential direction of the inner peripheral surface of the separation chamber, there exists an inconvenience that a processing drill 30 interferes with a separation pipe 23 and makes a hole in the separation pipe 23 as shown in Fig. 5A when the processing drill is inserted deeply into the separation chamber. Conversely, when the insertion of the processing drill 30 is shallow for avoiding the interference with the separation pipe 23, there exists an inconvenience that a refrigerant introduction path 21 is not connected to the inner peripheral surface of a separation chamber 22 in the tangential direction and working fluid is not introduced to the separation chamber 22 smoothly, therefore, the swirling of working fluid is not performed smoothly and the oil separation ability may deteriorate as shown in Fig. 5B.

[0010] In order to avoid such inconveniences, it is desirable to increase the clearance between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation chamber sufficiently to thereby prevent the interference with the separation pipe even when the processing drill is inserted deeply. How-

ever, when the clearance is secured large in the above related-art structure, the oil separator itself becomes large in size and it is difficult to reduce the size of the compressor.

[0011] Also in the structure disclosed in Patent Literature 2 in which the separation pipe is formed separately from the centrifugal separation body part demarcating the separation chamber, when the clearance between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation chamber is insufficient, there exists an inconvenience that an opening portion of the refrigerant introduction path becomes too close to the separation pipe and working fluid introduced to the separation chamber collides with the separation pipe to make the working fluid difficult to swirl inside the separation chamber smoothly.

[0012] In order to avoid such inconvenience, it is necessary to increase the clearance between the outer peripheral surface of the pipe portion and the inner peripheral surface of the separation chamber. However, when the clearance is secured large in the above related-art structures, the oil separator becomes large in size and it is difficult to reduce the size of the compressor.

[0013] The present invention has been made in view of the above circumstances, and an object thereof is to reduce the size of the oil separator by avoiding the above inconveniences caused by the structure in which the separation chamber and the separation pipe are coaxially formed to improve oil separation performance of the oil separator in the compressor. Another object is to provide a compressor including an oil separator capable of avoiding the inconvenience that the processing drill interferes with the separation pipe at the time of drilling the refrigerant introduction path, capable of further improving oil separation performance by connecting the refrigerant introduction path to the inner peripheral surface of the separation chamber smoothly and further capable of avoiding the inconvenience that the opening of the refrigerant introduction path becomes too close to the separation pipe even when the oil separator is reduced in size.

Solution to Problem

[0014] According to an embodiment of the present invention, there is disclosed a compressor including a housing, a compression mechanism housed in the housing, a discharge chamber formed in the housing, to which working fluid compressed in the compression mechanism is discharged and an oil separator housed in the housing and separating oil from the working fluid compressed in the compression mechanism, in which the oil separator is formed by including a cylindrical separation chamber, a separation pipe housed in the separation chamber and a refrigerant introduction path allowing the discharge chamber to communicate with the separation chamber, and an axial center of the separation chamber and an axial center of the separation pipe are shifted from each other.

[0015] Accordingly, a passage cross section of a passage where the compressed working fluid swirls can be changed by shifting the axial center of the separation chamber and the axial center of the separation pipe, therefore, the oil separation performance can be increased. As a result, the oil separation ability can be increased, and the oil separator can be reduced in size accordingly.

[0016] When the oil separator is reduced in size, a clearance between an inner peripheral surface of the separation chamber and an outer peripheral surface of the separation pipe can be partially increased as the axial center of the separation chamber and the axial center of the separation pipe are shifted from each other. Accordingly, the refrigerant introduction path is drilled so as to face that portion, thereby avoiding interference between a processing drill inserted when drilling the refrigerant introduction path and the separation pipe. It is also possible to eliminate an inconvenience that the insertion of the processing drill becomes shallow for avoiding interference with the separation pipe and smooth connection between the refrigerant introduction path and the inner peripheral surface of the separation chamber is hindered. Furthermore, an inconvenience that an opening of the refrigerant introduction path becomes too close to the separation pipe can be eliminated.

[0017] Here, the axial center of the separation pipe may be shifted from the axial center of the separation chamber in an arbitrary direction for increasing the oil separation performance, however, it is preferable that these axial centers are shifted from each other so that a distance between the axial center of the separation pipe and an opening portion of the refrigerant introduction path which opens to the separation chamber is longer than a distance between the axial center of the separation chamber and the opening portion from a viewpoint of processing the refrigerant introduction path.

[0018] According to the above structure, the refrigerant introduction path can be opened so as to face an area where the cross section of the passage between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation chamber becomes relatively large, therefore, it is possible to avoid interference with the separation pipe easily at the time of inserting the processing drill and to introduce the working fluid smoothly. Moreover, the introduced working fluid flows toward an area where the clearance between the separation pipe and the separation chamber is narrow, thereby increasing a flow velocity of the working fluid and performing oil separation efficiently.

[0019] In particular, the axial center of the separation pipe is shifted from the axial center of the separation chamber in a direction approximately perpendicular to an axial line of the refrigerant introduction path, thereby allowing the opening portion of the refrigerant introduction path to face an area where the passage cross section between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation

chamber becomes the largest. As a result, processing of the refrigerant introduction path can be performed easily and the working fluid can be introduced to the separation chamber smoothly. Additionally, the size of the oil separator can be reduced easily even when the processing of the refrigerant introduction path is anticipated.

[0020] It is preferable that the separation chamber is integrally formed with the housing, and the separation pipe is integrally formed with a portion of the housing which demarcates the separation chamber.

[0021] According to the adoption of the above structure, adjustment of an axial center position of the separation pipe is not required, which can eliminate variation in effects of oil separation.

Advantageous Effects of Invention

[0022] As described above, the axial center of the separation chamber is shifted from the axial center of the separation pipe in the oil separator in the compressor having the centrifugal separation type oil separator according to the present invention, therefore, the oil separation performance of the oil separator can be improved and the oil separator can be reduced in size accordingly, which can eventually reduce the size of the compressor.

[0023] Furthermore, the refrigerant introduction path can be formed so as to face the portion where the clearance between the outer peripheral surface of the separation pipe and the inner peripheral surface of the separation chamber becomes large even when the oil separator is reduced in size, therefore, the following advantages can be obtained.

- The processing drill does not interfere with the separation pipe at the time of drilling the refrigerant introduction path.
- The refrigerant introduction path can be connected to the inner peripheral surface of the separation chamber smoothly and the inconvenience that the opening of the refrigerant introduction path becomes too close to the separation pipe can be eliminated.
- The working fluid is introduced to the separation chamber smoothly to thereby perform the oil separation efficiently.

Brief Description of Drawings

[0024]

[Fig. 1A, Fig. 1B] Figs. 1A and Fig. 1B are sectional side views showing a structure example of a compressor according to the present invention, Fig. 1A is a cross-sectional view obtained by cutting the compressor so as to present an oil separator and a discharge port, and Fig. 1B is a cross sectional view by cutting the compressor so as to present a suction port.

[Fig. 2A, Fig. 2B] Fig. 2A shows a cross-sectional

view cut along A-A line of Fig. 1A and Fig. 2B is a cross-sectional view cut along B-B line of Fig. 1A.

[Fig. 3A, Fig. 3B] Figs. 3A and Fig. 3B are views showing a state where a refrigerant induction path communicating with a separation chamber of the oil separator is processed by a processing drill, Fig. 3A is a view for explaining a work of drilling the refrigerant introduction path by inserting the processing drill from the outside of a housing and Fig. 3B is an enlarged view obtained by enlarging a portion of the oil separator of Fig. 3A.

[Fig. 4A, Fig. 4B] Figs. 4A and Fig. 4B are views for explaining behavior of working fluid when the working fluid is introduced in to the separation chamber in the compressor adopting the oil separator according to the present invention, Fig. 4A is a view for explaining behavior of the working fluid at the time of a low flow rate, and Fig. 4B is a view for explaining behavior of the working fluid at the time of a high flow rate.

[Fig. 5A, Fig. 5B] Figs. 5A and Fig. 5B are views for explaining inconveniences in the case where the refrigerant introduction path is formed with respect to a related-art oil separator, Fig. 5A is a view showing a state where the processing drill is inserted deeply and Fig. 5B is a view showing a state where the processing drill is inserted in a shallow manner.

Description of Embodiments

[0025] Hereinafter, an embodiment of a compressor according to the present invention will be explained with reference to the attached drawings.

[0026] In Fig. 1A, Fig. 1B, Fig. 2A and Fig. 2B, a vane-type compressor suitable for a refrigeration cycle using working fluid as a refrigerant is shown. The vane-type compressor includes a movable member 2 which moves with the rotation of a shaft 1, a fixed member 4 forming a compression chamber 3 with the movable member 2, and a shell member 5 housing the movable member 2 and the fixed member 4, forming a housing together with the fixed member 4.

[0027] The fixed member 4 is formed by including a cylinder part 4a housing the movable member 2 and a rear side block part 4b integrally formed continuously from a rear side of the cylinder part 4a.

[0028] The movable member 2 is configured by including a rotor 2a rotatably housed in the cylinder part 4a of the fixed member 4 and fixed to the shaft 1 and a vane 2b inserted into a vane groove 6 formed in the rotor 2a.

[0029] The shell member 5 is configured by including a front side block part 5a abutting on a front side end surface of the cylinder part 4a and a cylinder part 5b formed so as to surround outer peripheral surfaces of the cylinder part 4a and the rear side block part 4b.

[0030] The shaft 1 is rotatably supported by the front side block part 5a of the shell member 5 and the rear side block part 4b of the fixed member 4 through a plain

bearing. In the shell member 5, a suction port 7 and a discharge port 8 for working fluid (refrigerant gas) and a suction space (low-pressure space) 10 communicating with the suction port 7 and formed with a concave part 9 which is formed in the cylinder part 4a of the fixed member 4 are formed. Moreover, a later-described discharge chamber (high-pressure space) 11 is demarcated by the cylinder part 4a of the fixed member 4 and the cylinder part 5b of the shell member 5. The discharge chamber 11 communicates with the discharge port 8 through an oil separator 14 formed in the rear side block part 4b of the fixed member 4.

[0031] The space surrounded by the cylinder part 4a and a cross section of the rotor 2a are formed in a perfect circle. An axial center of the cylinder part 4a and an axial center of the rotor 2a are provided so as to be shifted from each other so that an outer peripheral surface of the rotor 2a abuts on an inner peripheral surface of the cylinder part 4a at one place in a circumferential direction (provided so as to be shifted by 1/2 of a difference between an inner diameter of the cylinder part and an outer diameter of the rotor 2a), and a compression space 13 is demarcated between the inner peripheral surface of the cylinder part 4a and the outer peripheral surface of the rotor 2a. The compression space 13 is sectioned by the vane 2b and divided into plural compression chambers 3, and the volume of each compression chamber 3 varies by the rotation of the rotor 2a.

[0032] The shell member 5 is configured so that a pulley 15 for transmitting rotational power to the shaft 1 is rotatably fitted to the outside of a boss section 5c integrally formed with the front side block part 5a, and the rotational power is transmitted from the pulley 15 to the shaft 1 through an electromagnetic clutch 16.

[0033] The cylinder part 4a of the fixed member 4 is provided with flange parts 4c, 4d protruding in a radial direction at both ends thereof. The flange part 4c on the front side is formed in a shape corresponding to an inner peripheral shape of the shell member 5 and is fitted to the inside of the shell member 5 to abut on an end surface of the front side block part 5a. The flange part 4d on the rear side is also formed in a shape corresponding to the inner peripheral shape of the shell member 5. The flange part 4d on the rear side is inserted into the inside of the shell member 5 to seal the shell member 5 with a sealing member such as an O-ring with high airtightness.

[0034] A suction port 17 communicating with the suction space 10 and a discharge port 18 communicating with the discharge chamber 11 are provided on a peripheral surface of the cylinder part 4a. Therefore, when the cylinder part 4a is fitted into the shell member 5, the suction space 10 communicates with the compression chamber 3 through the suction port 17, the discharge chamber 11 is formed between an outer peripheral surface of the cylinder part 4a and an inner peripheral surface of the cylinder part 5b, which is demarcated by the flange parts 4c, 4d at both sides thereof. The discharge chamber 11 can communicate with the compression chamber 3

through the discharge port 18. The discharge port 18 is opened and closed by a discharge valve 19 housed in the discharge chamber 11.

[0035] The discharge chamber 11 is provided over almost the entire circumference of the cylinder part 4a from the portion where the discharge valve 19 is formed, which is demarcated by a partition wall 20 provided in the vicinity of the discharge port 18 of the cylinder part 4a. A portion on the side opposite to the side where the discharge port 18 is provided with respect to the partition wall 20 communicates with the oil separator 14 which is described below through a refrigerant introduction path 21 formed in the flange part 4d (rear side block part 4b).

[0036] The oil separator 14 is integrally formed with the rear side block part 4b of the fixed member 4, having a separation chamber 22 formed in a cylindrical space with which the refrigerant introduction path 21 formed in the flange part 4d communicates. The oil separator 14 is formed by housing an approximately cylindrical separation pipe 23 which is integrally formed with the fixed member 4 (rear side block part 4b) in the separation chamber 22.

[0037] The refrigerant introduction path 21 is formed so as to connect to an inner peripheral surface of an upper end part of the separation chamber 22 in a tangential direction and drilled from the discharge chamber's side by a processing drill 30 as shown in Fig. 3A and Fig. 3B.

[0038] The separation chamber 22 is extended in a direction approximately orthogonal to an axial direction of the shaft 1 and formed so that an axis line thereof is obliquely inclined to a vertical line. The upper end part of the separation chamber 22 communicates with the discharge port 8 of the shell member 5 through the separation pipe 23, and a lower end part opens to a side surface of the rear side block 4b. The opening at the lower end part of the separation chamber 22 is covered with the cylindrical part 5b of the shell member 5.

[0039] In this example, the cylindrical part 5b is extended in an axial direction in such a degree that the entire rear side block part 4b is housed. The separation chamber 22 is sealed in an airtight manner with respect to the cylinder 5b of the shell member 5 by sealing members such as O-rings provided in a circumferential direction of the rear side block part 4b in front and rear portions of the compressor in the axial direction.

[0040] In the above oil separator 14, the separation pipe 23 is provided so that an axial center 0' thereof is shifted from an axial center 0 of the separation chamber 22. A direction in which the axial center 0' of the separation pipe 23 is shifted from the axial center 0 of the separation chamber 22 may be arbitrarily set. However, the direction is determined so that a distance between the axial center 0' of the separation pipe 23 and the opening portion of the refrigerant introduction path 21 which opens to the separation chamber 22 becomes longer than a distance between the axial center 0 of the separation chamber 22 and the opening portion for forming

the refrigerant introduction path 21. In particular, the axial center 0' of the separation pipe 23 is shifted from the axial center 0 of the separation chamber 22 in a direction (β direction) approximately perpendicular to an axial line α of the refrigerant introduction path 21.

[0041] The above separation chamber 22 and the separation pipe 23 forming the oil separator 14 are molded at the same time when the fixed member 4 is molded by casting. Therefore, the separation chamber 22 is formed in a tapered shape in which a diameter is gradually increased toward the opening at the lower end and the separation pipe 23 is formed in a tapered shape in which a diameter of the outer peripheral surface is gradually reduced toward a tip end so as to be removed from molds easily.

[0042] Accordingly, the working fluid flowing into the separation chamber 22 swirls around the separation pipe 23 housed inside the separation chamber 22 and mixed oil is separated in the process. The working fluid from which the oil is separated is discharged from the discharge port 8 through the separation pipe 23. The separated oil is reserved in an oil reservoir chamber 25 formed in a bottom part of the fixed member 4 through an oil drain hole 24 formed in the fixed member 4 so as to communicate with the lower end part of the separation chamber 22, then, supplied through an oil supply passage 26 to respective portions to be lubricated due to a pressure difference between the oil reservoir chamber 25 and the respective portions to be lubricated.

[0043] In the above structure, the rotational power from a not-shown power source is transmitted to the shaft 1 through the pulley 15 and the electromagnetic clutch 16. When the rotor 2a rotates, the working fluid flowing into the suction space 10 from the suction port 7 is sucked into the compression space 13 through the suction port 17. As the volume of each compression chamber 3 sectioned by the vane 2b inside the compression space varies according to the rotation of the rotor 2a, the working fluid confined inside the vane 2b is compressed and discharged from the discharge port 18 to the discharge chamber 11 through the discharge valve 19. The working fluid discharged to the discharge chamber 11 moves in the circumference direction along the outer peripheral surface of the cylinder part 4a (along the inner peripheral surface of the cylinder part 5b of the shell member 5), travelling around almost the entire circumference of the cylinder part 4a and being introduced into the separation chamber 22 of the oil separator 14 which is integrally formed with the rear side block 4b through the refrigerant introduction path 21 formed in the flange part 4d (rear side block part 4b). After that, the working fluid is processed so that oil is separated in the process of swirling inside the separation chamber, being discharged from the discharge port 8 to an outer circuit through the separation pipe 23. The separated oil is introduced to the oil reservoir chamber 25 through the oil drain hole 24 formed in the lower end of the separation chamber 22.

[0044] At that time, the axial center 0 of the separation

chamber 22 is shifted from the axial center 0' of the separation pipe 23 in the oil separator 14, therefore, a cross section of a passage between the outer peripheral surface of the separation chamber 22 and the inner peripheral surface of the separation pipe 23 (cross section of the passage where the compressed working fluid swirls) varies. The oil separation performance can be increased by the variation in the cross section of the passage.

[0045] In particular, when the refrigerant introduction path 21 is formed so as to face a relatively large area in the cross section of the passage as in the above structure, the flow velocity of the working fluid can be increased in an area where the cross section of the passage between the outer peripheral surface of the separation chamber 22 and the inner peripheral surface of the separation pipe 23 is relatively small at the time of a low flow rate when the discharge capacity is low, therefore, oil can be separated efficiently.

[0046] At the time of a high flow rate when the discharge capacity is high, the working fluid swirls while being diffused in the axial direction of the separation pipe 23 in an area where the cross section of the passage is small, therefore, the occurrence of pressure loss is inhibited while keeping the flow velocity of the working fluid, and oil separation can be sufficiently performed.

[0047] As the oil separation ability can be increased by the above structure, the oil separator 14 can be reduced in size accordingly, which can contribute to size reduction of the compressor.

[0048] In the case where the oil separator 14 is reduced in size, the axial center 0 of the separation chamber 22 is shifted from the axial center 0' of the separation pipe 23, therefore, the refrigerant introduction path 21 is drilled so as to face a portion where the clearance between the inner peripheral surface of the separation chamber 22 and the outer peripheral surface of the separation pipe 23 is large, thereby preventing the processing drill 30 from interfering with the separation pipe 23 at the time of drilling the refrigerant introduction path 21. It is also possible to eliminate the inconvenience that the insertion of the processing drill 30 becomes shallow for avoiding interference with the separation pipe 23 and smooth connection between the refrigerant introduction path 21 and the wall surface of the separation chamber 22 is hindered. Furthermore, the inconvenience that the opening of the refrigerant introduction path 21 becomes too close to the separation pipe 23 can be eliminated, and efficient oil separation can be secured.

[0049] Particularly in the above structure, the axial center 0' of the separation pipe 23 is shifted from the axial center 0 of the separation chamber 22 in the direction (β direction) approximately perpendicular to the axial line α of the refrigerant introduction path 21, therefore, it is possible to allow the opening portion of the refrigerant introduction path 21 to face the area where the cross section of the passage between the outer peripheral surface of the separation pipe 23 and the inner peripheral surface of the separation chamber 22 becomes the larg-

est. Therefore, the processing of the refrigerant introduction path 21 can be easily performed, and the working fluid can be smoothly introduced to the separation chamber 22. Additionally, the size reduction of the oil separator can be easily realized even when the processing of the refrigerant introduction path 21 by the processing drill is anticipated.

[0050] As the separation pipe 23 is integrally formed with the housing (rear side block part 4b) together with the separation chamber 22 in the above structure, adjustment of an axial center position of the separation pipe 23 is not necessary, which can eliminate variation in effects of oil separation. However, it is not always necessary to form the separation pipe 23 integrally with the housing (rear side block part 4b) for improving separation performance and reducing the size of the oil separator 14, and the separation pipe 23 may be formed of a member different from the member (rear side block part 4b) demarcating the separation chamber 22.

[0051] The example in which the above structure is applied to the vane-type compressor has been explained, however, it is also possible to adopt the above structure in the case where the centrifugal separation-type oil separator is provided in a fixed member of a scroll-type compressor which includes a fixed scroll (fixed member) fixed to a housing and a movable scroll (movable member) capable of moving (turning) with respect to the fixed scroll, in which the movable scroll is driven to be turned by a shaft rotatably arranged in the housing and the volume of a compression chamber formed by both scrolls is expanded/contracted with the turning of the movable scroll to thereby suck and compress a refrigerant.

[0052] The example in which the oil separator 14 is provided in the rear side block 4b integrally formed with the cylinder part 4a and is housed in the shell member 5 has been explained in the above structure, however, it is also possible to adopt the same structure as the above in a structure in which the oil separator is provided in the front side block part integrally formed with the cylinder part and is housed in the shell member.

Reference Signs List

[0053]

- 1 shaft
- 2 movable part
- 3 compression chamber
- 4 fixed part
- 4a cylinder part
- 4b rear side block part
- 5 shell member
- 5a front side block part
- 5b cylindrical part
- 11 discharge chamber
- 14 oil separator
- 21 refrigerant introduction path
- 22 separation chamber

- 23 separation pipe
- O axial center of separation chamber
- O' axial center of separation pipe
- α axial line of refrigerant introduction path

Claims

1. A compressor comprising:

a housing (4, 5);
 a compression mechanism housed in the housing (4, 5);
 a discharge chamber (11) formed in the housing (4, 5), to which working fluid compressed in the compression mechanism is discharged; and
 an oil separator (14) housed in the housing (4, 5) and separating oil from the working fluid compressed in the compression mechanism,
 wherein the oil separator (14) belonging to a centrifugal separation type, is formed by including a cylindrical separation chamber (22), a separation pipe (23) housed in the separation chamber (22) and a refrigerant introduction path (21) allowing the discharge chamber (11) to communicate with the separation chamber (22), and
 an axial center (O) of the separation chamber (22) and an axial center (O') of the separation pipe (23) are shifted from each other.

2. The compressor according to claim 1,
 wherein a distance between the axial center (O') of the separation pipe (23) and an opening portion of the refrigerant introduction path (21) which opens to the separation chamber (22) is longer than a distance between the axial center (O) of the separation chamber (22) and the opening portion.

3. The compressor according to claim 2,
 wherein the axial center (O') of the separation pipe (23) is shifted from the axial center (O) of the separation chamber (22) in a direction approximately perpendicular to an axial line of the refrigerant introduction path (21).

4. The compressor according to any one of claims 1 to 3,
 wherein the separation chamber (22) is integrally formed with the housing (4), and
 the separation pipe (23) is integrally formed with a portion of the housing (4) which demarcates the separation chamber (22).

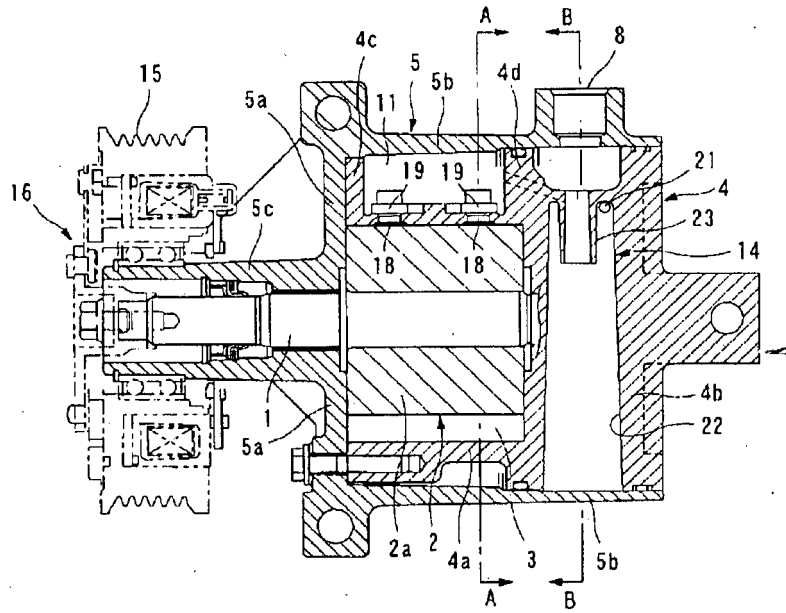


Fig.1A

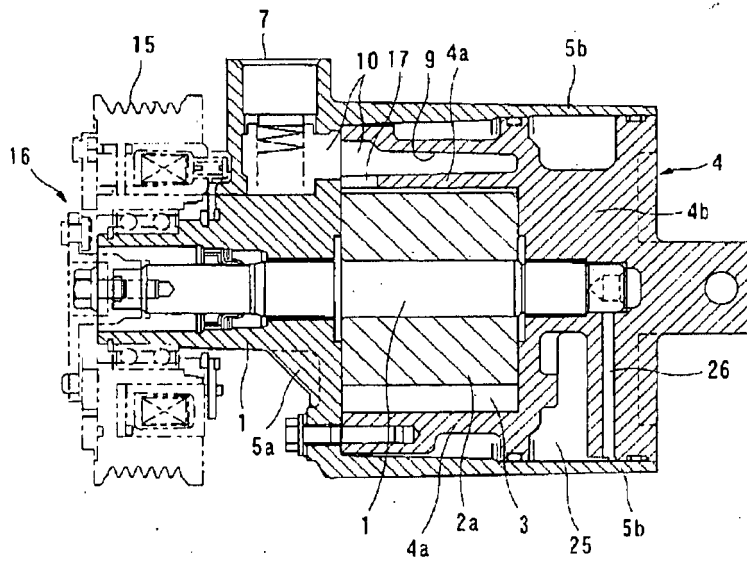


Fig.1B

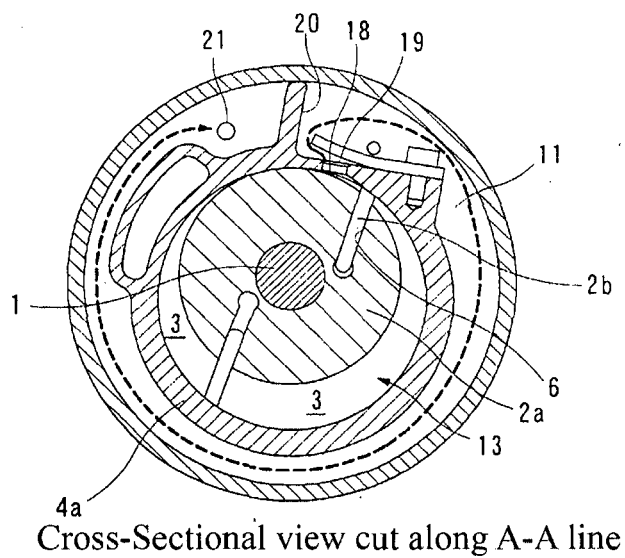


Fig.2A

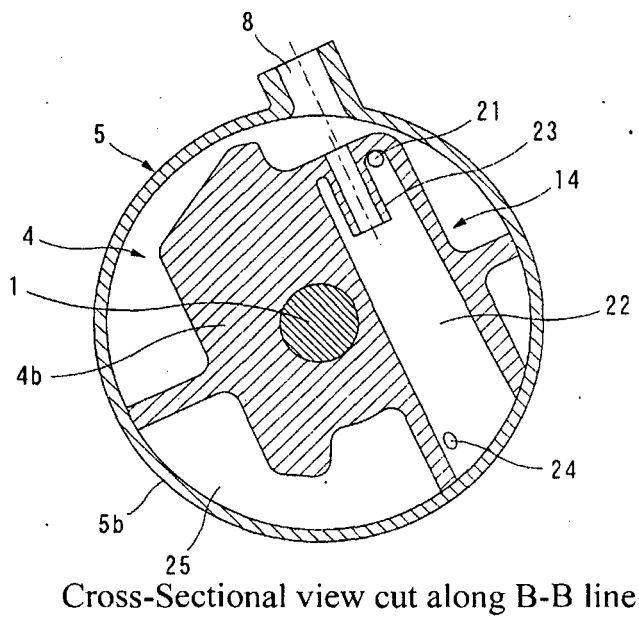


Fig.2B

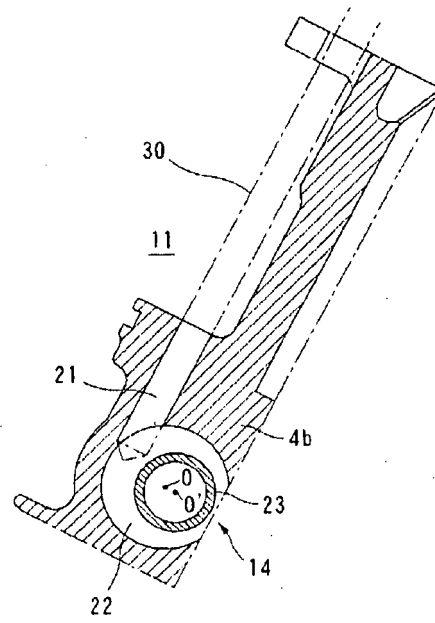


Fig.3A

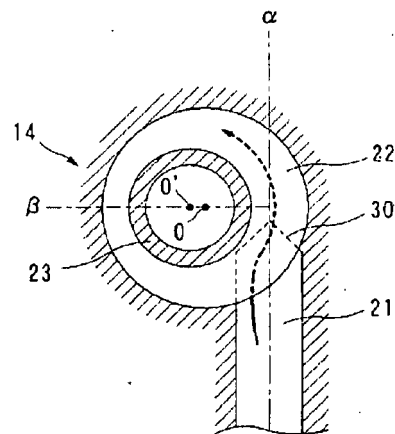


Fig.3B

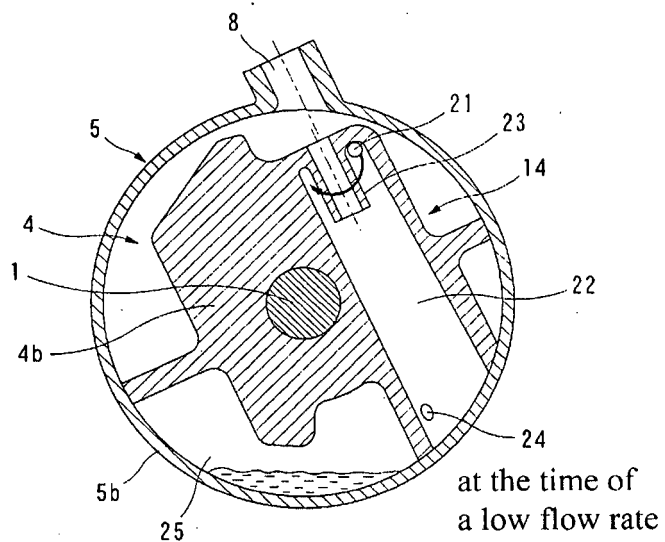


Fig.4A

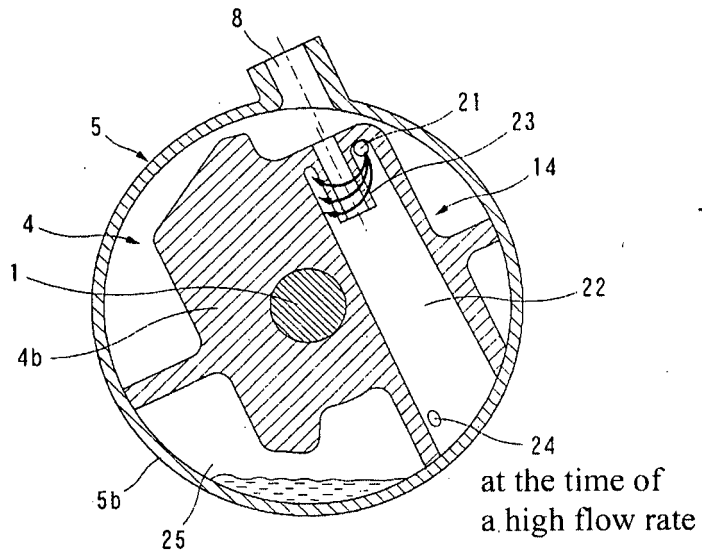


Fig.4B

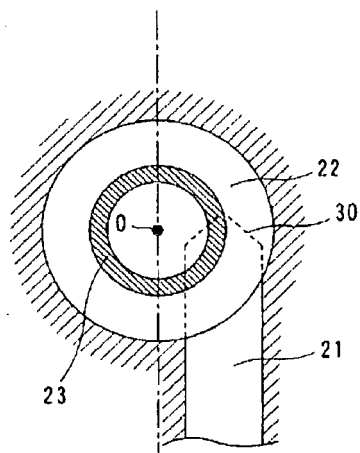


Fig.5A

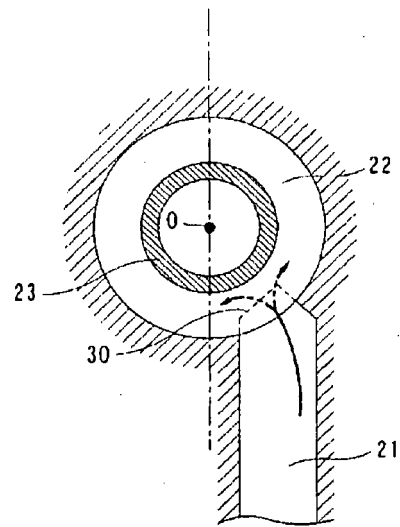


Fig.5B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/083336

A. CLASSIFICATION OF SUBJECT MATTER

F04B39/04(2006.01)i, F04C18/344(2006.01)i, F04C29/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F04B39/04, F04C18/344, F04C29/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	WO 2011/080865 A1 (Valeo Japan Co., Ltd.), 07 July 2011 (07.07.2011), paragraphs [0035] to [0038]; fig. 1 to 4 & EP 2520803 A1	1, 4 2-3
Y A	JP 2013-164008 A (Panasonic Corp.), 22 August 2013 (22.08.2013), paragraphs [0109] to [0110]; fig. 11 (Family: none)	1, 4 2-3
A	JP 2011-247575 A (Nichirei Industries Co., Ltd.), 08 December 2011 (08.12.2011), paragraph [0085]; fig. 32 (Family: none)	1-4

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search
25 February 2015 (25.02.15)Date of mailing of the international search report
24 March 2015 (24.03.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/083336

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-227890 A (Calsonic Kansei Corp.), 07 November 2013 (07.11.2013), entire text; all drawings (Family: none)	1-4
A	US 2009/0191081 A1 (Geonho LEE), 30 July 2009 (30.07.2009), entire text; all drawings & WO 2007/145465 A1	1-4
A	US 2003/0074870 A1 (Mietto VIRGILIO), 24 April 2003 (24.04.2003), entire text; all drawings & EP 1304483 A2	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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