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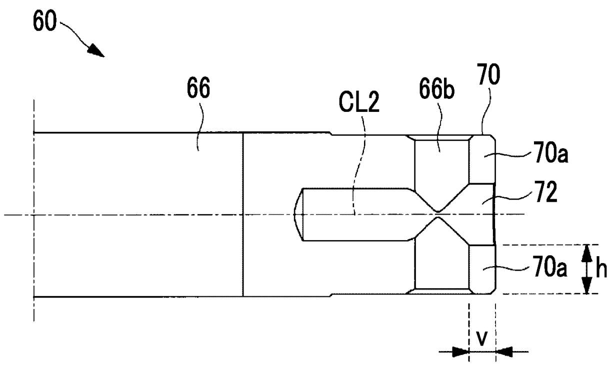
(54) ROTARY COMPRESSOR

(57) This rotary compressor is provided with a blade that abuts on an outer peripheral surface of a piston rotor and partitions the space of a compression room, and a pressing spring that presses a base end of the blade. A cylinder (60) is provided with a blade groove (66) for slidably holding the base end of the blade, a bridge part (70) that is provided on a rear end side of the blade groove (66) and forms an outer peripheral part of the cylinder (60), and a spring groove (72) that is formed in the bridge part (70) and accommodates the pressing spring. The spring groove (72) is formed to be oriented in a horizontal direction orthogonal to the axial direction of the cylinder (60). When cylinder (60) is viewed in a longitudinal section including a spring groove central axis (CL2) of the spring groove (72), the blade groove (66), and the bridge part (70), remaining portions (70a) of the bridge part (70) that are positioned on both sides in the axial direction of the spring groove (72) have a dimension v in the horizontal direction and a dimension h in the axial direction, where v < h.

FIG. 4



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Description

Technical Field

[0001] The present disclosure relates to a rotary compressor.

Background Art

[0002] A rotary compressor is known as one of compressors used for a refrigerating apparatus, an air conditioning device, or the like (refer to PTL 1).

Citation List

Patent Literature

[0003] [PTL 1] Japanese Unexamined Patent Application Publication No. 2018-76817

Summary of Invention

Technical Problem

[0004] Since spatial degrees of freedom can be provided in a design of a compressor component, it is desirable that a core diameter of a rotary compressor is large. However, in a case where the core diameter of the rotary compressor is large, there is a problem in that a weight and a material cost increase because a material amount increases.

[0005] Therefore, it is required to miniaturize the rotary compressor. However, in a case where the rotary compressor is miniaturized, the core diameter is reduced, and thus a refrigerant displacement amount of a compression portion may be reduced. In particular, in a case where a low-pressure refrigerant (for example, a refrigerant in which a combustion class is set to have mild-flammability (A2L) or high-flammability (A3)) is used as the refrigerant, the displacement amount is required to be about twice as much as that in a case of R32. Accordingly, it is desired to miniaturize the rotary compressor while securing the displacement amount.

[0006] The present disclosure has been made in view of such circumstances, and an object of the present disclosure is to provide a rotary compressor that can be miniaturized while securing a refrigerant displacement amount from a compression portion.

Solution to Problem

[0007] A rotary compressor according to an aspect of the present disclosure includes a cylinder (60) in which a compression chamber (60A) with a cylindrical shape inside is formed, a piston rotor (63) that compresses a refrigerant by eccentrically rotating inside the compression chamber, a blade (64) that partitions a space of the compression chamber by abutting on an outer peripheral surface of the piston rotor, and a pressing spring that presses a base end portion of the blade in a direction in which a tip portion of the blade abuts on the outer peripheral surface of the piston rotor, in which the cylinder includes a blade groove (66) for slidably holding the base end portion (64b) of the blade, a bridge portion (70) that is provided on a rear end side of the blade groove and forms an outer peripheral portion of the cylinder, and a spring groove (72) that is formed in the bridge portion and accommodates the pressing spring, the spring groove is formed to face in a horizontal direction orthogonal to an axial direction of the cylinder at a center position in the axial direction, and in a case where the cylinder is viewed in a longitudinal cross section, in a cross section including a central axis of the spring groove, the blade groove, and the bridge portion, and in a case where a dimension of a remaining portion (70a) of the bridge portion in the horizontal direction, which is located on each of both sides of the spring groove in the axial direction, is set as v and a dimension in the axial direction is set as h,

$v < h$ is satisfied.

Advantageous Effects of Invention

[0008] A rotary compressor can be miniaturized while securing a refrigerant displacement amount from a compression portion.

Brief Description of Drawings

[0009]

Fig. 1 is a longitudinal cross-sectional view showing a rotary compressor according to an embodiment of the present disclosure.

Fig. 2 is a side surface view showing a state in which the rotary compressor of Fig. 1 is provided on an installation surface.

Fig. 3 is a plan view of a cylinder in Fig. 1.

Fig. 4 is a cross-sectional view taken along arrow IV of Fig. 3.

Description of Embodiments

[0010] Hereinafter, an embodiment according to the present disclosure will be described with reference to the drawings.

[0011] As shown in Fig. 1, a rotary compressor (hereinafter, simply referred to as a "compressor") 1 according to the present embodiment is a sealed-type electric rotary compressor used for, for example, an air conditioner, a refrigerating apparatus, or the like. The compressor 1 includes a compressor main body 10 and an accumulator 12. The accumulator 12 is connected to the compressor main body 10 via a suction pipe 11.

[0012] The compressor main body 10 includes an approximately cylindrical housing 2, a rotary shaft body 3, an electric motor 5, and a rotary compression portion 6. A rotational axis CL of the rotary shaft body 3 coincides with a central axis of the housing 2. The rotary shaft body 3 is disposed such that an extending direction thereof is an up-down direction, and rotates around the rotational axis CL in the housing 2.

[0013] The housing 2 is a sealed-type and extends in the up-down direction. The housing 2 includes a main body portion 21 having a cylindrical shape, and an upper cover portion 22 and a lower cover portion 23 that close upper and lower openings of the main body portion 21.

[0014] A plurality of leg portions 7 are fixed below the main body portion 21. Each of the leg portions 7 is disposed in a circumferential direction of the main body portion 21 at a predetermined angle interval. As shown in Fig. 2, each of the leg portions 7 is fixed to an installation surface FL with an antivibration rubber 8 sandwiched therebetween.

[0015] The housing 2 is formed with an opening portion 24 at a position facing an outer peripheral surface of a cylinder 60 in a side wall lower portion. In the cylinder 60, a suction port 25 that communicates to a predetermined position in the cylinder is formed at a position facing the opening portion 24.

[0016] An oil reservoir for storing a lubricant is formed in a bottom portion of the housing 2. A liquid surface of the oil reservoir at a time of initial enclosure of oil is located above the rotary compression portion 6. As a result, the rotary compression portion 6 is driven in the oil reservoir.

[0017] A discharge pipe 13 and a terminal block 30 are provided in the upper cover portion 22. The discharge pipe 13 penetrates the upper cover portion 22 in a thickness direction, has a lower portion disposed in the housing 2, and has an upper portion disposed outside the housing 2. The discharge pipe 13 discharges the compressed refrigerant to the outside of the housing 2. The terminal block 30 is provided with three power supply terminals 31 that supply power to the electric motor 5. The power supply terminals 31 are supplied with three-phase power from an inverter device (not shown).

[0018] The accumulator 12 is used to gas-liquid-separate the refrigerant before supplying the refrigerant to the compressor main body 10. The accumulator 12 has an approximately cylindrical shape and is fixed to an outer peripheral surface of the housing 2 via a bracket 14. An inlet pipe 15 for introducing a refrigerant guided from an evaporator (not shown) is provided at an upper portion of the accumulator 12. The suction pipe 11 for sucking the refrigerant inside the accumulator 12 into the compressor main body 10 is connected to the accumulator 12. The suction pipe 11 is connected to the suction port 25 through the opening portion 24 of the housing 2. The accumulator 12 supplies the gas phase refrigerant to the rotary compression portion 6 via the suction pipe 11.

[0019] As the refrigerant, a low-pressure refrigerant is used, and for example, a refrigerant with mild-flammability (A2L) or a refrigerant with high-flammability (A3) such as propane is used. In addition, R410A, R32, R1234yf, and a natural refrigerant (R290, Iso-butane, or the like) can be used.

[0020] The electric motor 5 is accommodated in a central portion of the housing 2 in the up-down direction. The electric motor 5 includes a rotor 51 and a stator 52. The rotor 51 is fixed to an outer peripheral surface of the rotary shaft body 3 and is disposed above the rotary compression portion 6. The stator 52 is disposed to surround an outer peripheral surface of the rotor 51 and is fixed to an inner surface 21a of the main body portion 21 of the housing 2.

[0021] Power is supplied to the stator 52 from each of the power supply terminals 31 via wiring 32. The electric motor 5 rotates the rotary shaft body 3 by the power supplied from the power supply terminals 31.

[0022] The rotary compression portion 6 is disposed in a state of being sandwiched from above and below by an upper bearing 4A and a lower bearing 4B. Each of the upper bearing 4A and the lower bearing 4B is formed of a metallic material and is fixed to the cylinder 60 configuring the rotary compression portion 6 by bolts 61.

[0023] The rotary shaft body 3 is rotatably supported around the rotational axis CL by the upper bearing 4A and the lower bearing 4B.

[0024] The rotary compression portion 6 is disposed at the bottom portion in the housing 2 below the electric motor 5. The rotary compression portion 6 includes the cylinder 60, an eccentric shaft portion 62, and a piston rotor 63.

[0025] The cylinder 60 is formed with a compression chamber 60A, a suction hole 60B, and a discharge hole (not shown). The compression chamber 60A is formed inside the cylinder 60. The piston rotor 63 is accommodated in the compression chamber 60A.

[0026] The rotary compression portion 6 is fixed to the inner surface 21a of the main body portion 21 of the housing 2. Specifically, the upper bearing 4A sandwiching the cylinder 60 is fixed to the inner surface 21a of the main body portion 21 of the housing 2. The upper bearing 4A is fixed by performing plug welding at a plurality of locations in a circumferential direction of the housing 2. In addition, instead of the plug welding, shrink fitting, cold fitting, or the like may be used.

[0027] The eccentric shaft portions 62 are provided at a lower end portion of the rotary shaft body 3 and are provided inside the piston rotor 63 in a state of being offset from the central axis of the rotary shaft body 3 in a direction orthogonal to the central axis.

[0028] The piston rotor 63 has a cylindrical shape with an outer diameter smaller than an inner diameter of the cylinder 60, is disposed inside the cylinder 60, and is fixed in a state of being mounted to an outer periphery of the eccentric shaft portion 62. The piston rotor 63 rotates eccentrically with respect to the rotational axis CL as the rotary shaft body 3 rotates.

[0029] The suction hole 60B is a hole for guiding the refrigerant into the inside of the cylinder 60, and is formed in a direction orthogonal to the rotational axis CL.

[0030] A high-pressure refrigerant discharged from the discharge hole (not shown) formed in the cylinder 60 is guided into a space formed between a discharge cover 65 and the upper bearing 4A, and then is guided into an internal space of the housing 2.

[0031] Fig. 3 is a plan view of the cylinder 60. The cylinder 60 is provided with a blade 64 that divides the compression chamber 60A into two. A blade groove 66 formed to extend in a radial direction is formed in the cylinder 60. The blade 64 is slidably guided on an inner surface 66a of the blade groove 66 and is forward/backward movably held with respect to the piston rotor 63 in a direction of approaching and separating from the piston rotor 63. A base end portion 64b of the blade 64 on an outside in the radial direction is elastically pressed by a pressing spring (compression spring) (not shown), and a tip portion 64a is always in a state of being pressed against an outer peripheral surface 63a of the piston rotor 63.

[0032] The eccentric shaft portion 62 has an outer diameter slightly smaller than the inner diameter of the piston rotor 63. Accordingly, in a case where the rotary shaft body 3 rotates, the eccentric shaft portion 62 revolves around the rotary shaft body 3, and the piston rotor 63 eccentrically rotates in the cylinder 60. In this case, since the blade 64 is pressed by the pressing spring (not shown), the tip portion 64a moves forward and backward following a movement of the piston rotor 63 and is always pressed against the piston rotor 63.

[0033] An outer diameter D1 of the cylinder 60 is 90 mm or more and 105 mm or less.

[0034] An inner diameter D2 of the compression chamber 60A is 37 mm or more and 50 mm or less.

[0035] A through-hole 66b that penetrates the blade groove 66 in the axial direction (that is, the rotational axis CL direction) of the cylinder 60 at a rear end, that is, an outer peripheral side is formed. The through-hole 66b has a cylindrical shape. A bridge portion 70 is provided on a further rear end side, that is, an outer peripheral side of the through-hole 66b.

[0036] The bridge portion 70 forms an outer peripheral portion of the cylinder 60. As can be seen from Fig. 3, the bridge portion 70 is weak in terms of strength at a position in which a wall thickness is a thinnest in the cylinder 60. In addition, since the bridge portion 70 is formed with a spring groove 72 (refer to Fig. 4) that accommodates the pressing spring, the strength is further weakened.

[0037] Fig. 4 is a view showing a cross section in arrow IV of Fig. 3 and in which the cylinder 60 is viewed in a longitudinal cross section, in a cross section including a central axis of the spring groove 72, the blade groove 66, and the bridge portion 70.

[0038] As shown in Fig. 4, the spring groove 72 is formed to face in a horizontal direction orthogonal to the axial direction (that is, the rotational axis CL direction) of the cylinder 60 at a center position in the axial direction. That is, a spring groove central axis CL2 is provided to face horizontally. It is preferable that the spring groove central axis CL2 is provided to intersect with the rotational axis CL. A diameter of the spring groove 72 is set to, for example, $\Phi 6$ or more and $\varphi 10$ or less.

[0039] On each of both sides of the spring groove 72 in the axial direction, a remaining portion 70a of the bridge portion 70 is provided. In these remaining portions 70a, the strength of the bridge portion 70 is secured. In a case where a horizontal direction dimension of the remaining portion 70a is set as v and an axial direction dimension thereof is set as h, $v < h$ is satisfied. That is, the axial direction dimension h is larger than the horizontal direction dimension v of the remaining portion 70a, and the remaining portion 70a has a longitudinally long rectangular shape as viewed in Fig. 4.

[0040] A value of h/v is more preferably in the following range.

$$1.4 \leq h/v \leq 3.5$$

[0041] The horizontal direction dimension v is, for example, 2.0 mm or more and 7.5 mm or less.

[0042] The axial direction dimension h is, for example, 2.5 mm or more and 8.5 mm or less.

[0043] The above-described compressor 1 operates as follows.

[0044] The refrigerant guided from the evaporator (not shown) is taken into the accumulator 12 via the inlet pipe 15. The refrigerant is gas-liquid-separated in the accumulator 12, and the gas phase thereof is guided to the rotary compression portion 6 via the suction pipe 11. In the rotary compression portion 6, the refrigerant is guided to the compression chamber 60A via the suction hole 60B. Then, due to the eccentric rotation of the piston rotor 63, a volume of the compression chamber 60A gradually decreases, and the refrigerant is compressed. The refrigerant after being compressed is guided to the internal space of the housing 2 after passing through the space in the discharge cover 65 via the discharge hole. The refrigerant discharged into the internal space of the housing 2 is guided to a condenser (not shown) from the discharge pipe 13 provided in an upper portion of the housing 2.

[0045] The actions and effects of the present embodiment described above are as follows.

[0046] The bridge portion 70 that is provided on a rear end side of the blade groove 66 and forms the outer peripheral portion of the cylinder 60 is weak in terms of strength at a position in which the wall thickness is the thinnest in the cylinder 60. In addition, since the bridge portion 70 is formed with the spring groove 72 that accommodates the pressing spring, the strength is further weakened.

[0047] In a case of achieving a miniaturization of the compressor main body 10, it is necessary to reduce the outer diameter of the cylinder 60, but it is desired to avoid reducing the inner diameter D2 of the compression chamber 60A to secure the refrigerant displacement amount. In this case, a wall thickness of the bridge portion

70 has to be reduced.

[0048] The present inventors or the like have found a shape of the bridge portion 70 that secures the strength of the bridge portion 70 under such a restriction. That is, in a case where the cylinder 60 is viewed in a longitudinal cross section, in a cross section including the spring groove central axis CL2 of the spring groove 72, the blade groove 66, and the bridge portion 70 (refer to Fig. 4), in a case where a dimension of the remaining portion 70a of the bridge portion 70 in the horizontal direction, which is located on each of both sides of the spring groove 72 in the axial direction, is set as v, and a dimension in the axial direction is set as h, $v < h$ is satisfied. h is set to be larger than v, that is, the axial direction dimension h is set to be larger than the horizontal direction dimension v of the remaining portion 70a.

[0049] In a case where miniaturization is not required and there is no restriction in the outer diameter D1 of the cylinder 60, a desired strength of the bridge portion 70 can be obtained by increasing the horizontal direction dimension v to secure an area of the remaining portion 70a. However, in a case where the miniaturization is required, the outer diameter D1 of the cylinder 60 is reduced, and the horizontal direction dimension v cannot be increased to obtain the refrigerant displacement amount. Therefore, in the present embodiment, the axial direction dimension h is set to be larger than the horizontal direction dimension v to secure the area of the remaining portion 70a and to obtain the desired strength of the bridge portion 70.

[0050] Even in a case of the low-pressure refrigerant, for example, the refrigerant with mild-flammability (A2L) or the refrigerant with high-flammability (A3) such as propane, the desired refrigerant displacement amount can be obtained, and thus a compressor having a predetermined performance can be provided.

[0051] The rotary compressor described in the embodiment described above is understood as follows, for example.

[0052] A rotary compressor (1) according to a first aspect of the present disclosure includes a cylinder (60) in which a compression chamber (60A) with a cylindrical shape inside is formed, a piston rotor (63) that compresses a refrigerant by eccentrically rotating inside the compression chamber, a blade (64) that partitions a space of the compression chamber by abutting on an outer peripheral surface of the piston rotor, and a pressing spring that presses a base end portion of the blade in a direction in which a tip portion of the blade abuts on the outer peripheral surface of the piston rotor, in which the cylinder includes a blade groove (66) for slidably holding the base end portion (64b) of the blade, a bridge portion (70) that is provided on a rear end side of the blade groove and forms an outer peripheral portion of the cylinder, and a spring groove (72) that is formed in the bridge portion and accommodates the pressing spring, the spring groove is formed to face in a horizontal direction orthogonal to an axial direction of the cylinder at a center position in the axial direction, and in a case where the cylinder is viewed in a longitudinal cross section, in a cross section including a central axis of the spring groove, the blade groove, and the bridge portion, and in a case where a dimension of a remaining portion (70a) of the bridge portion in the horizontal direction, which is located on each of both sides of the spring groove in the axial direction, is set as v and a dimension in the axial direction is set as h,

$v < h$ is satisfied.

[0053] The bridge portion that is provided on a rear end side of the blade groove and forms the outer peripheral portion of the cylinder is weak in terms of strength at a position in which the wall thickness is the thinnest in the cylinder. In addition, since the bridge portion is formed with the spring groove that accommodates the pressing spring, the strength is further weakened.

[0054] In a case of achieving a miniaturization of the rotary compressor, it is necessary to reduce the outer diameter of the cylinder, but it is desired to avoid reducing an inner diameter of the compression chamber to secure the refrigerant displacement amount. In this case, a wall thickness of the bridge portion has to be reduced.

[0055] The present inventors or the like have found a shape of the bridge portion that secures the strength of the bridge portion under such a restriction. That is, in a case where the cylinder is viewed in a longitudinal cross section, in a cross section including the central axis of the spring groove, the blade groove, and the bridge portion, in a case where a dimension of the remaining portion of the bridge portion in the horizontal direction, which is located on each of both sides of the spring groove in the axial direction, is set as v, and a dimension in the axial direction is set as h, $v < h$ is satisfied. h is set to be larger than v, that is, the axial direction dimension h is set to be larger than the horizontal direction dimension v of the remaining portion.

[0056] In a case where miniaturization is not required and there is no restriction in the outer diameter of the cylinder, a desired strength of the bridge portion can be obtained by increasing the horizontal direction dimension v to secure an area of the remaining portion. However, in a case where the miniaturization is required, the outer diameter of the cylinder is reduced, and the horizontal direction dimension v cannot be increased to obtain the refrigerant displacement amount. Therefore, in the present disclosure, the axial direction dimension h is set to be larger than the horizontal direction dimension v to secure the area of the remaining portion and to obtain the desired strength of the bridge portion.

[0057] In the rotary compressor according to a second aspect of the present disclosure according to the first aspect, the v and the h satisfy the following relational expression, $1.4 \leq h/v \leq 3.5$.

[0058] By setting a range of $1.4 \leq h/v \leq 3.5$, the area of the remaining portion of the bridge portion can be secured, and the desired strength can be obtained.

[0059] In the rotary compressor according to a third aspect of the present disclosure according to the first aspect or the second aspect, a refrigerant with mild-flammability or a refrigerant with high-flammability is used as the refrigerant.

[0060] Even in a case of the low-pressure refrigerant, for example, the refrigerant with mild-flammability (A2L) or the refrigerant with high-flammability (A3) such as propane, the desired refrigerant displacement amount can be obtained, so that a compressor having a predetermined performance can be provided.

Reference Signs List

[0061]

1: compressor (rotary compressor)
2: housing
3: rotary shaft body
4A: upper bearing
4B: lower bearing
5: electric motor
6: rotary compression portion
7: leg portion
8: antivibration rubber
10: compressor main body
11: suction pipe
12: accumulator
13: discharge pipe
14: bracket
15: inlet pipe
21: main body portion
21a: inner surface
22: upper cover portion
23: lower cover portion
24: opening portion
25: suction port
30: terminal block
31: power supply terminal
32: wiring
51: rotor
52: stator
60: cylinder
60A: compression chamber
60B: suction hole
61: bolt
62: eccentric shaft portion
63: piston rotor
64: blade
64a: tip portion
64b: base end portion
65: discharge cover
66: blade groove
66a: inner surface
66b: through-hole
70: bridge portion
72: spring groove
CL: rotational axis
CL2: spring groove central axis
FL: installation surface
v: horizontal direction dimension
h: axial direction dimension

Claims

1. A rotary compressor comprising:

a cylinder in which a compression chamber with a cylindrical shape is formed;
a piston rotor that compresses a refrigerant by eccentrically rotating inside the compression chamber;
a blade that partitions a space of the compression chamber by abutting on an outer peripheral surface of the piston rotor; and
a pressing spring that presses a base end portion of the blade in a direction in which a tip portion of the blade abuts on the outer peripheral surface of the piston rotor,
wherein the cylinder includes a blade groove for slidably holding the base end portion of the blade, a bridge portion that is provided on a rear end side of the blade groove and forms an outer peripheral portion of the cylinder, and a spring groove that is formed in the bridge portion and accommodates the pressing spring,
the spring groove is formed to face in a horizontal direction orthogonal to an axial direction of the cylinder at a center position in the axial direction, and
wherein the cylinder , in a view in a longitudinal cross section, in a cross section including a central axis of the spring groove, the blade groove, and the bridge portion, and where a dimension of a remaining portion of the bridge portion in the horizontal direction, which is located on each of both sides of the spring groove in the axial direction, is set as v and a dimension in the axial direction is set as h,
$v < h$ is satisfied.

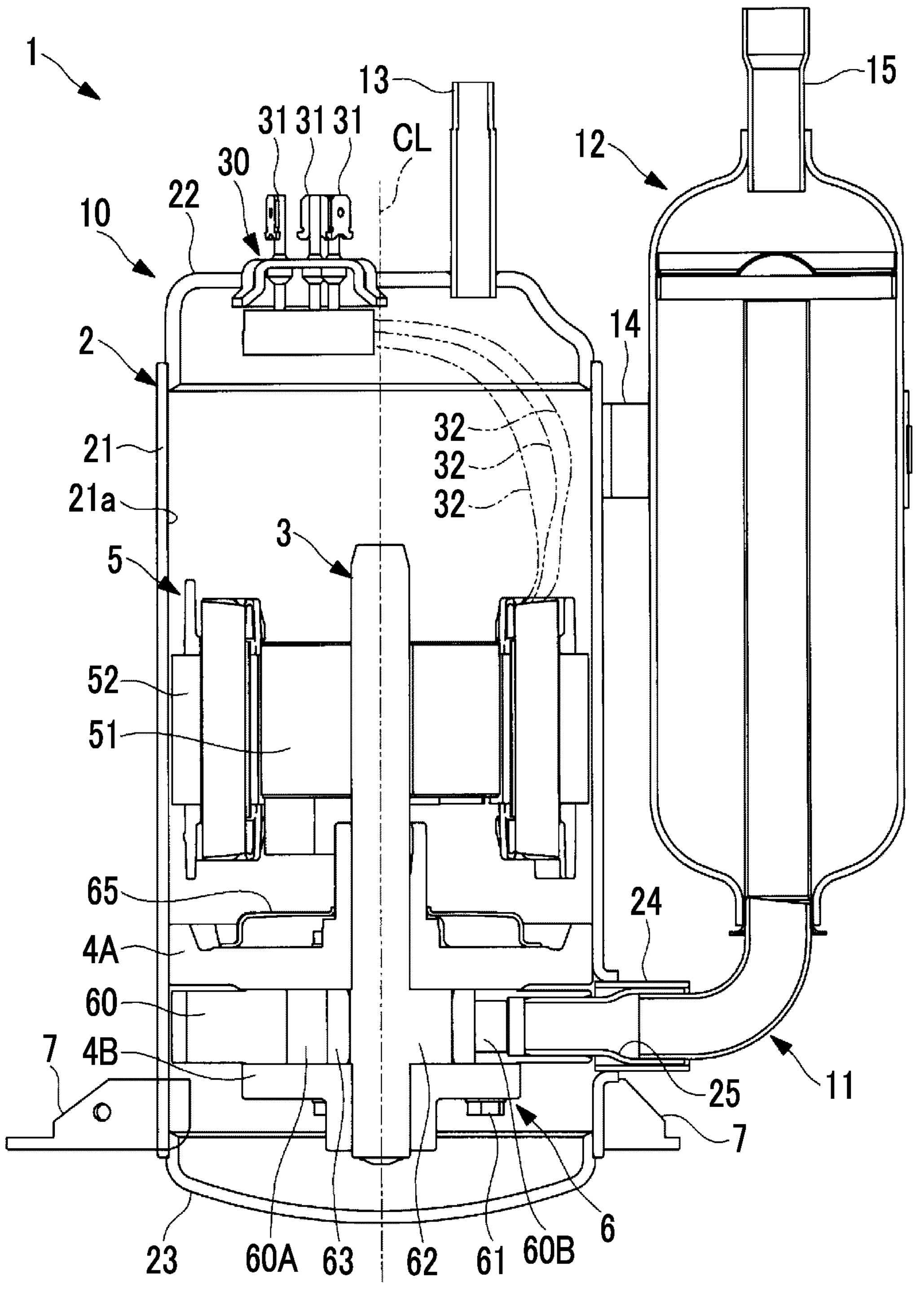
2.

The rotary compressor according to claim 1, wherein the v and the h satisfy the following relational expression,

$$1.4 \leq h/v \leq 3.5.$$

3. The rotary compressor according to claim 1 or 2, wherein a refrigerant with mild-flammability or a refrigerant with high-flammability is used as the refrigerant.

FIG. 1



1
13
15
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CL
12
30
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21a
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5
52
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4B
25
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23
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63
62
61
60B

FIG. 2

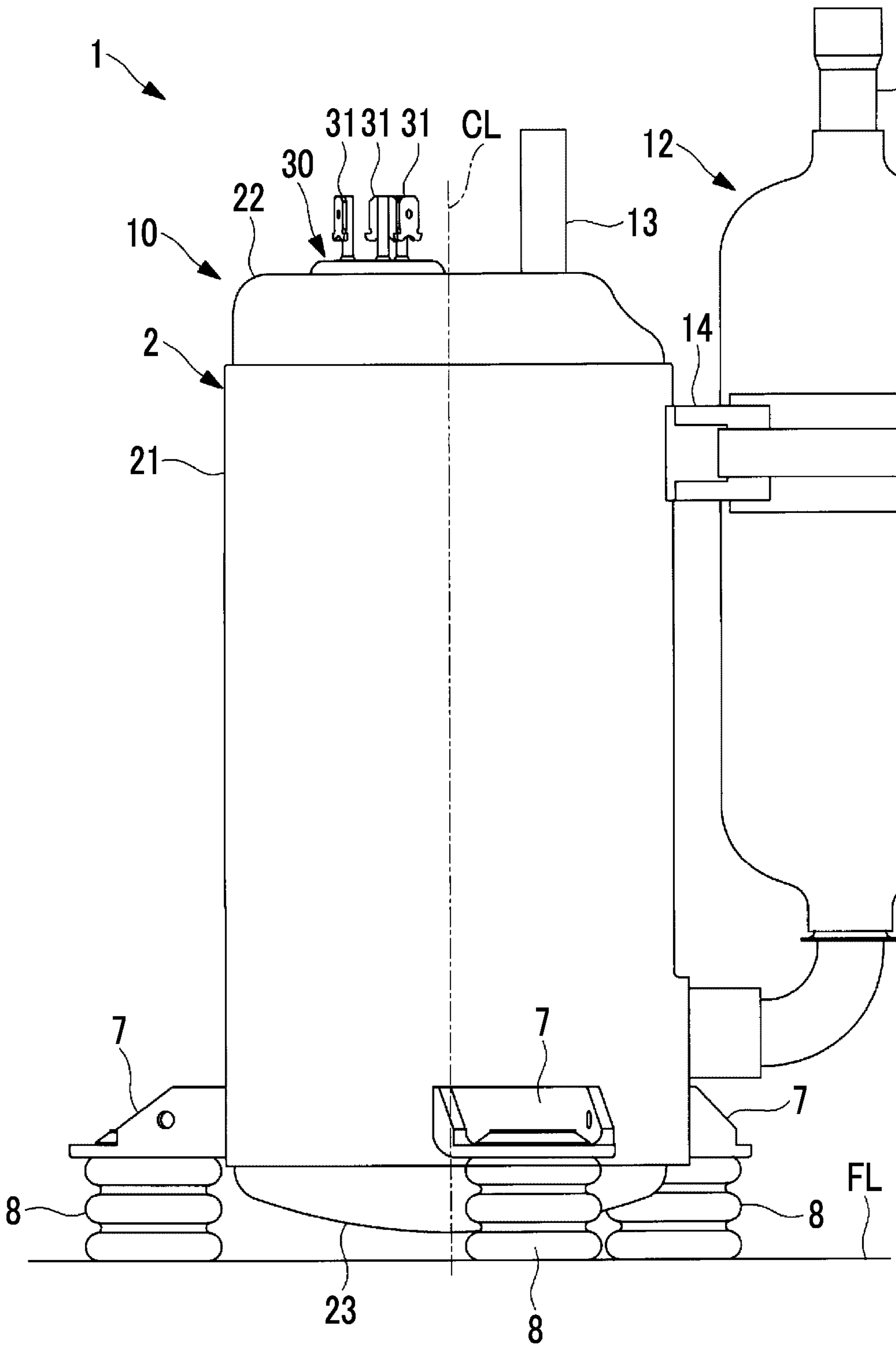
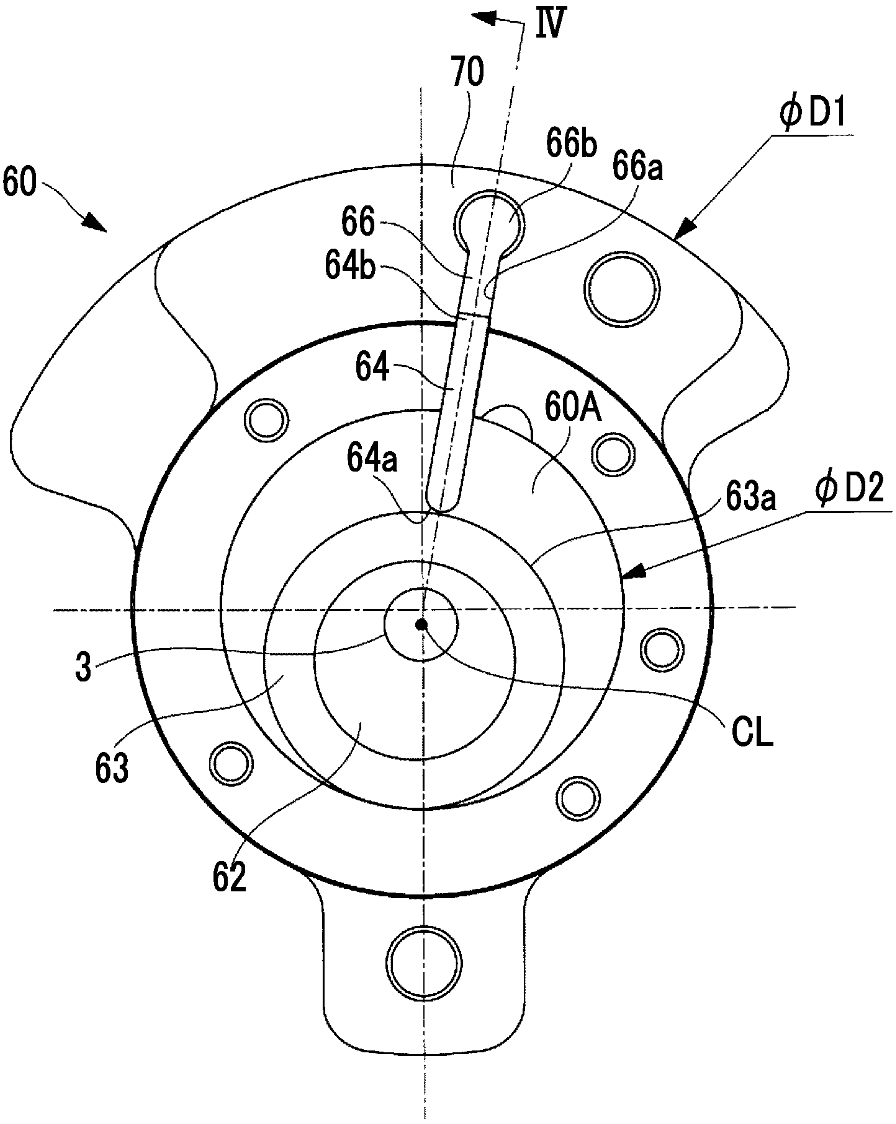


FIG. 3


IV
70
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66a
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66
64b
64
60A
64a
63a
φD2
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CL
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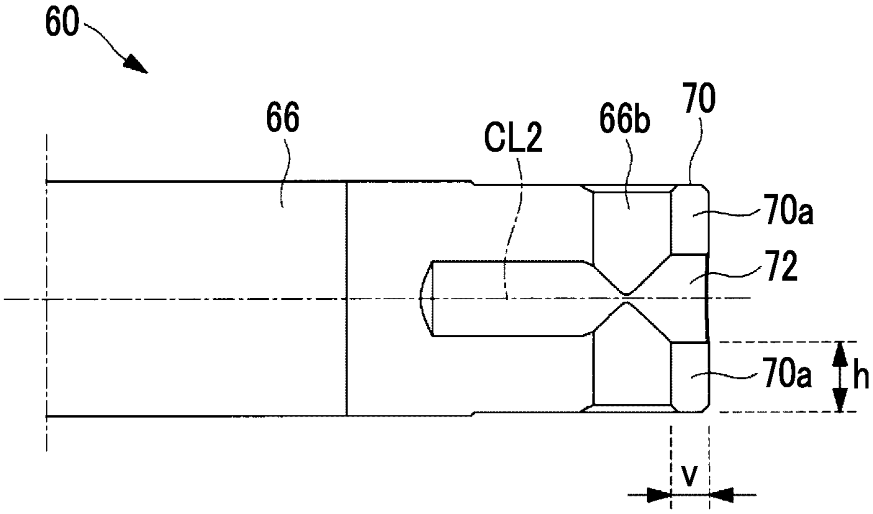
FIG. 4


60
66
CL2
66b
70
70a
72
70a
h
v

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/019929

A. CLASSIFICATION OF SUBJECT MATTER

F04C 18/356(2006.01)i; ***F04C 29/00***(2006.01)i
FI: F04C18/356 S; F04C18/356 H; F04C29/00 C; F04C18/356 K

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)

F04C18/356; F04C29/00

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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.
X Y	JP 2010-121546 A (HITACHI APPLIANCES, INC.) 03 June 2010 (2010-06-03) paragraphs [0015]-[0033], fig. 1-6	1-2 3
Y	JP 2000-283073 A (SANYO ELECTRIC CO., LTD.) 10 October 2000 (2000-10-10) paragraph [0014]	3

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 July 2023	**01 August 2023**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/019929

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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