

(11)

**EP 4 119 796 A1**

(12)

# EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**18.01.2023 Bulletin 2023/03**

(51) International Patent Classification (IPC):  
**F04C 29/00** <sup>(2006.01)</sup>      **F04B 39/00** <sup>(2006.01)</sup>

(21) Application number: **20924926.7**

(52) Cooperative Patent Classification (CPC):  
**F04B 39/00; F04C 29/00**

(22) Date of filing: **09.03.2020**

(86) International application number:  
**PCT/JP2020/010020**

(87) International publication number:  
**WO 2021/181463 (16.09.2021 Gazette 2021/37)**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
 PL PT RO RS SE SI SK SM TR**  
 Designated Extension States:  
**BA ME**  
 Designated Validation States:  
**KH MA MD TN**

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(54) COMPRESSOR AND REFRIGERATION CYCLE DEVICE

(57) A compressor (2) includes: an airtight container (11); a compression mechanism (13) accommodated in the airtight container (11); a motor (12) including a cylindrical stator (31) fixed to an inner surface of the airtight container (11) and a rotor (32) disposed inside the stator (31) to generate rotational driving force of the compression mechanism (13); and a pair of sealed terminals (18, 19) arranged in the airtight container (11). Three first plate-shaped terminals (75) of each sealed terminal (18,

19) are aligned with each side of a triangle (D) and faces each other on the front surface (75f) so as to form the triangle (D) across the three first plate-shaped terminals. One of corners (Co) of the triangle (D1) formed by the three first plate-shaped terminals (75) of one of the sealed terminals (18, 19) faces one of corners (Co) of the triangle (D1) formed by the three first plate-shaped terminals (75) of another of the sealed terminals (18, 19).

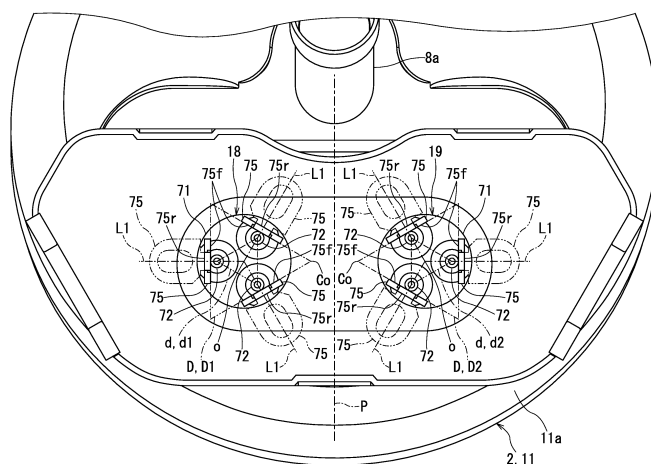


FIG. 2

## Description

### TECHNICAL FIELD

5   **[0001]** Embodiments of the present invention relates to a compressor and a refrigeration cycle apparatus.

### BACKGROUND

10   **[0002]** A known compressor includes a compression mechanism and an electric motor for driving the compression mechanism. The motor of such a conventional compressor is provided with a plurality of systems, for example, two systems of three-phase windings. Thus, the conventional compressor is provided with two systems of lead wires and two systems of sealed terminals. Each sealed terminal is electrically connected to the corresponding three-phase winding via its own lead wire.

15   **[0003]** These two systems of sealed terminals are connected to at least six power lines inside the compressor and are connected to at least six power lines outside the compressor. The wirings of these many power lines are complicated, and if excessive bending stress is applied to the power lines, the durability of the power lines may be reduced.

20   **[0004]** For this reason, the conventional compressor is provided with the first sealing terminal and the second sealing terminal. These sealed terminals are provided with three pins to be electrically connected to the motor, configured in the same shape, and arranged side by side in an airtight container. The three pins of the first sealed terminal and the three pins of the second sealed terminal are arranged asymmetrically with respect to the straight line that passes through the center of the discharge tube of the compressor and the midpoint between the first sealing terminal and the second sealing terminal.

### PRIOR ART Document

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### PATENT DOCUMENT

**[0005]** [Patent Document 1] JP 2012-082776 A

### SUMMARY

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### PROBLEMS TO BE SOLVED BY INVENTION

35   **[0006]** When the displacement volume is enlarged for improving the performance of the compressor, the compression load increases. In order to meet the increase in this compression load, the motor requires more electric current. Such an increase in current raises the temperature of the terminals connecting the power lines to the sealed terminals at the time of energization. It is difficult for the Faston terminals adopted in the conventional compressor to cope with such a temperature rise at the time of energization.

40   **[0007]** When terminals to be fastened with screws by bringing large plate-shaped terminals into surface contact are adopted instead of the Faston terminals, the temperature rise of the terminals connecting the power lines to the sealed terminals can be suppressed.

45   **[0008]** In order to connect the above-described plate-shaped terminals and the sealed terminals, a terminal block for fastening screws is required. When a plurality of sealed terminals are provided as in the conventional compressor, a terminal block is provided for each sealed terminal. In other words, a plurality of terminal blocks are arranged side by side in the same manner as the sealed terminals.

50   **[0009]** However, in the arrangement relationship of the pair of sealed terminals of the conventional compressor, it is difficult to arrange the pair of terminal blocks side by side without interfering with each other. Further, it is considered that workability at the time of fastening screws to the respective terminals is extremely low or the work of fastening screws to the respective terminals is difficult.

55   **[0010]** Accordingly, the present invention provides a compressor and a refrigeration cycle apparatus, each of which can securely screw sealed terminals and power-line terminals with a terminal block being installed, connect power lines to the sealed terminals without applying excessive bending stress to the power lines, and also efficiently connect the power lines at the time of manufacture.

### MEANS FOR SOLVING PROBLEM

**[0011]** In order to solve the above-mentioned problem, a compressor according to one embodiment of the present invention includes: an airtight container; a compression mechanism that is accommodated in the airtight container and

compresses a refrigerant introduced into the airtight container; a motor including a cylindrical stator fixed to an inner surface of the airtight container and a rotor disposed inside the stator to generate rotational driving force of the compression mechanism; and a pair of sealed terminals arranged in the airtight container. Each of the sealed terminals has three plate-shaped terminals that are disposed outside the airtight container and are electrically connected to the motor. One surface of each of the three plate-shaped terminals is aligned with each side of a triangle and faces each of other two plate-shaped terminal on the one surface in such a manner that three virtual planes each containing the one surface form the triangle across the three plate-shaped terminals. One of corners of the triangle formed by the three plate-shaped terminals of one of the sealed terminals faces one of corners of the triangle formed by the three plate-shaped terminals of another of the sealed terminals.

**[0012]** Furthermore, the compressor according to one embodiment of the present invention preferably includes a pair of terminal blocks provided for respective sealed terminals. One of the terminal blocks preferably holds three power lines connected to respective plate-shaped terminals of a corresponding sealed terminal in such a manner that the three power lines are wired to be separated away from another of the terminal block.

**[0013]** Each of the sealed terminals of the compressor according to one embodiment of the present invention preferably has three second plate-shaped terminals that are disposed inside the airtight container and are electrically connected to the motor. Preferably, in each of the sealed terminals, front and back surfaces of one of the three second plate-shaped terminals are aligned with a first virtual line that is one of three virtual lines substantially trisecting a circle centered on a center of gravity of the triangle in a fan shape, while front and back surfaces of other two of the three second plate-shaped terminals are substantially orthogonal to second virtual lines being other two of the three virtual lines, and first virtual lines of respective sealed terminals intersect each other at a position farther than a centerline of the airtight container when viewed from the pair of sealed terminals.

**[0014]** A refrigeration cycle apparatus according to another embodiment of the present invention includes: the compressor, a radiator, an expansion device, a heat absorber, and refrigerant piping that connects the compressor, the radiator, the expansion device, and the heat absorber and circulates the refrigerant.

#### Effects of Invention

**[0015]** According to embodiments of the present invention, a compressor and a refrigeration cycle apparatus can be provided, in which sealed terminals and power-line terminals can be securely screwed to each other with a terminal block being installed, power lines can be connected to the sealed terminals without applying excessive bending stress to the power lines, and the power lines can be efficiently connected at the time of manufacture.

#### BRIEF DESCRIPTION OF DRAWINGS

**[0016]**

Fig. 1 is a schematic diagram of a refrigerating cycle apparatus and a compressor according to one embodiment of the present invention.

Fig. 2 is a schematic view of sealed terminals of the compressor according to the embodiment of the present invention as viewed from above.

Fig. 3 is a schematic view of the sealed terminals of the compressor according to the embodiment of the present invention as viewed from below.

Fig. 4 is a schematic view of the sealed terminals and a terminal block of the compressor according to the embodiment of the present invention as viewed from above.

Fig. 5 is a longitudinal cross-sectional view of the sealed terminal and the terminal block of the compressor according to the embodiment of the present invention.

Fig. 6 is a plan view of the terminal block of the compressor according to the embodiment of the present invention.

#### DETAILED DESCRIPTION

**[0017]** A description will now be given of embodiments of a compressor and a refrigeration cycle apparatus according to the present invention by referring to Fig. 1 to Fig. 6. The same reference signs are given to identical or equivalent components in each figure.

**[0018]** Fig. 1 is a schematic diagram of a refrigerating cycle apparatus and a compressor according to one embodiment of the present invention.

**[0019]** As shown in Fig. 1, the refrigeration cycle apparatus 1 according to the present embodiment is, for example, an air conditioner. The refrigeration cycle apparatus 1 includes a sealed rotary compressor 2 (hereinafter, simply referred to as the compressor 2), a radiator 3, an expansion device 5, a heat absorber 6, an accumulator 7, and refrigerant piping

8. The refrigerant piping 8 connects the compressor 2, the radiator 3, the expansion device 5, the heat absorber 6, and the accumulator 7 in sequence so as to circulate a refrigerant. The radiator 3 is also called a condenser. The heat absorber 6 is also called an evaporator.

**[0020]** The compressor 2 sucks up the refrigerant having passes through the heat absorber 6 via the refrigerant piping 8, compresses the refrigerant, and discharges the high-temperature and high-pressure refrigerant to the radiator 3 through the refrigerant piping 8.

**[0021]** The compressor 2 includes: a cylindrical airtight container 11 disposed vertically; an open-winding type electric motor 12 (hereinafter, simply referred to as the motor 12) housed in the upper half of the airtight container 11; a compression mechanism 13 housed in the lower half of the airtight container 11; a rotating shaft 15 that transmits the rotational driving force of the motor 12 to the compression mechanism 13; a main bearing 16 that rotatably supports the rotating shaft 15; and an auxiliary bearing 17 that rotatably supports the rotating shaft 15 in cooperation with the main bearing 16.

**[0022]** The centerline of the vertically disposed airtight container 11 extends in the vertical (i.e., up-and-down) direction. The airtight container 11 includes: a cylindrical body 11a extending in the vertical direction; an end plate 11b that blocks the upper end portion of the body 11a; and an end plate 11c that blocks the lower end portion of the body 11a.

**[0023]** The end plate 11b on the upper side of the airtight container 11 is connected to a discharge pipe 8a for discharging the refrigerant to the outside of the airtight container 11. The discharge pipe 8a is connected to the refrigerant piping 8. The upper end plate 11b of the airtight container 11 is provided with: a pair of sealed terminals 18 and 19 that lead the power supplied to the motor 12 from the outside to the inside of the airtight container 11; and a pair of terminal blocks 22 and 23. The respective terminal blocks 22 and 23 are provided on the sealed terminals 18 and 19. A plurality of power lines 25, which are electrically connected to the respective sealed terminals 18 and 19 so as to supply power, are fixed to each of the terminal blocks 22 and 23. The power lines 25 are so-called lead wires.

**[0024]** The motor 12 generates the driving force that rotates the compression mechanism 13. The motor 12 is disposed above the compression mechanism 13. The motor 12 includes: a cylindrical stator 31 fixed to the inner surface of the airtight container 11; a rotor 32 that is disposed inside the stator 31 and generates the rotational driving force of the compression mechanism 13; and a plurality of lead wires 33 that are drawn from the stator 31 and electrically connected to the pair of sealed terminals 18 and 19.

**[0025]** The rotor 32 includes: a rotor iron core 35 having a magnet accommodating hole (not shown); and a permanent magnet (not shown) accommodated in the magnet accommodating hole. The rotor 32 is fixed to the rotating shaft 15. The rotation centerline C of the rotor 32 and the rotating shaft 15 substantially matches the centerline of the stator 31. In addition, the rotation centerline C of the rotor 32 and the rotating shaft 15 substantially matches the centerline of airtight container 11.

**[0026]** The plurality of lead wires 33 are power lines that supply power to the stator 31 through the sealed terminals 18 and 19. The plurality of lead wires 33 are wired depending on the type of the motor 12. In the present embodiment, six lead wires 33 are wired.

**[0027]** The motor 12 may be a motor having a plurality of systems, for example, three-phase windings of two systems like a motor of the conventional compressor, in addition to the mode of the open winding motor.

**[0028]** The rotating shaft 15 connects the motor 12 and the compression mechanism 13. The rotating shaft 15 transmits the rotational driving force generated by the motor 12 to the compression mechanism 13.

**[0029]** The intermediate portion 15a of the rotating shaft 15 connects the motor 12 and the compression mechanism 13, and is rotatably supported by the main bearing 16. The lower end portion 15b of the rotating shaft 15 is rotatably supported by the auxiliary bearing 17. The main bearing 16 and the auxiliary bearing 17 are also part of the compression mechanism 13. In other words, the rotating shaft 15 penetrates the compression mechanism 13.

**[0030]** Further, the rotating shaft 15 is provided with a plurality of, for example, three eccentric portions 36 between the intermediate portion 15a supported by the main bearing 16 and the lower end portion 15b supported by the auxiliary bearing 17. Each eccentric portions 36 is a disk or cylinder, center of which does not match the rotation centerlines of the rotating shaft 15.

**[0031]** The compression mechanism 13 compresses the refrigerant introduced into the airtight container 11. When the motor 12 rotationally drives the rotating shaft 15, the compression mechanism 13 sucks in the gaseous refrigerant from the refrigerant piping 8 so as to compress the refrigerant, and discharges the compressed high-temperature and high-pressure refrigerant into the airtight container 11.

**[0032]** The compression mechanism 13 is a rotary type with a plurality of cylinders, for example, three cylinders. The compression mechanism 13 includes: a plurality of cylinders 42, each of which has a circular cylinder chamber 41; and a plurality of annular rollers 43 that are disposed in the respective cylinder chambers 41. Note that the compression mechanism 13 may be a single-cylinder rotary type.

**[0033]** In the following, the cylinder 42 closest to the motor 12 is defined as the first cylinder 42A, the cylinder 42 farthest from the motor 12 is defined as the third cylinder 42C, and the cylinder 42 disposed between the first cylinder 42A and the third cylinder 42C is defined as the second cylinder 42B.

**[0034]** The compression mechanism 13 includes: the main bearing 16 that closes the top surface of the first cylinder

42A; a first partition plate 45A that closes the bottom surface of the first cylinder 42A and the top surface of the second cylinder 42B; a second partition plate 45B that closes the bottom surface of the second cylinder 42B and the top surface of the third cylinder 42C; and the auxiliary bearing 17 that closes the bottom surface of the third cylinder 42C.

**[0035]** In other words, the top surface of the first cylinder 42A is closed with the main bearing 16. The bottom surface of the first cylinder 42A is closed with the first partition plate 45A. The top surface of the second cylinder 42B is closed with the first partition plate 45A. The bottom surface of the second cylinder 42B is closed with the second partition plate 45B. The top surface of the third cylinder 42C is closed with the second partition plate 45B. The bottom surface of the third cylinder 42C is closed with the auxiliary bearing 17.

**[0036]** That is, the first cylinder 42A is sandwiched between the main bearing 16 and the first partition plate 45A. The second cylinder 42B is sandwiched between the first partition plate 45A and the second partition plate 45B. The third cylinder 42C is sandwiched between the second partition plate 45B and the auxiliary bearing 17.

**[0037]** The main bearing 16 and the first partition plate 45A are fixed in a lump to the second cylinder 42B with a fastening member 46 such as a bolt. That is, the main bearing 16 and the first partition plate 45A are fastened together to the second cylinder 42B with the fastening member 46. The main bearing 16 is provided with: a first discharge valve mechanism 51A that discharges the refrigerant compressed in the cylinder chamber 41 of the first cylinder 42A; and a first discharge muffler 52 that covers the first discharge valve mechanism 51A. When the pressure difference between the pressure in the cylinder chamber 41 of the first cylinder 42A and the pressure in the first discharge muffler 52 reaches a predetermined value due to the compression action of the compression mechanism 13, the first discharge valve mechanism 51A opens a discharge port (not shown) so as to discharge the compressed refrigerant into the first discharge muffler 52.

**[0038]** The second partition plate 45B is provided with: a second discharge valve mechanism 51B that discharges the refrigerant compressed in the cylinder chamber 41 of the second cylinder 42B; and a discharge chamber 53. The main bearing 16, the first cylinder 42A, the first partition plate 45A, and the second cylinder 42B forms a first hole (not shown) that spatially connects the discharge chamber 53 of the second partition plate 45B to the inside of the first discharge muffler 52. When the pressure difference between the pressure in the cylinder chamber 41 of the second cylinder 42B and the pressure in the discharge chamber 53 reaches a predetermined value due to the compression action of the compression mechanism 13, the second discharge valve mechanism 51B opens a discharge port (not shown) so as to discharge the compressed refrigerant into the discharge chamber 53. The refrigerant discharged into the discharge chamber 53 is discharged into the first discharge muffler 52 through the first hole. The refrigerant discharged into the first discharge muffler 52 through the first hole joins the refrigerant compressed by the first cylinder 42A.

**[0039]** The auxiliary bearing 17, the third cylinder 42C, and the second partition plate 45B are integrally fixed to the second cylinder 42B with a fastening member 55 such as a bolt. That is, the auxiliary bearing 17, the third cylinder 42C, and the second partition plate 45B are fastened together to the second cylinder 42B with the fastening member 55. The auxiliary bearing 17 is provided with: a third discharge valve mechanism 51C that discharges the refrigerant compressed in the cylinder chamber 41 of the third cylinder 42C; and a second discharge muffler 56 that covers the third discharge valve mechanism 51C. The main bearing 16, the first cylinder 42A, the first partition plate 45A, the second cylinder 42B, the second partition plate 45B, and the third cylinder 42C forms a second hole 57 that spatially connects the inside of the second discharge muffler 56 to the inside of the first discharge muffler 52. When the pressure difference between the pressure in the cylinder chamber 41 of the third cylinder 42C and the pressure in the second discharge muffler 56 reaches a predetermined value due to the compression action of the compression mechanism 13, third discharge valve mechanism 51C opens a discharge port (not shown) so as to discharge the compressed refrigerant into the second discharge muffler 56. The refrigerant discharged into the second discharge muffler 56 is discharged through the second hole 57 into the first discharge muffler 52. The refrigerant discharged into the first discharge muffler 52 joins the refrigerant compressed by the first cylinder 42A and the refrigerant compressed by the second cylinder 42B.

**[0040]** The first discharge muffler 52 has a discharge hole (not shown) that spatially connects the inside and outside of the first discharge muffler 52. The compressed refrigerant discharged into the first discharge muffler 52 is discharged into the airtight container 11 through the discharge hole.

**[0041]** Note that the first hole may be part of the second hole 57. Further, the discharge chamber 53 of the second partition plate 45B may be spatially connected to the second discharge muffler 56. That is, the first hole may be spatially connected to the second discharge muffler 56.

**[0042]** The first cylinder 42A is fixed to a frame 58 with a fastening member 59 such as a bolt, and this frame is fixed to the airtight container 11 by welding, for example, by spot welding at a plurality of points. In other words, the frame 58 supports the rotor 32, the compression mechanism 13, and the rotating shaft 15 of the motor 12 to the airtight container 11 via the first cylinder 42A. It is preferred that the center of gravity of the rotor 32, the compression mechanism 13, and the rotating shaft 15 of the motor 12 in the height direction of the airtight container 11 is located within the thickness of the frame 58 (i.e., dimension of the compressor 2 in the height direction).

**[0043]** A plurality of suction pipes 61 are connected to the cylinder chambers 41 of the respective cylinders 42 through the airtight container 11. Each cylinder 42 has a suction hole that is spatially connected to each suction pipe 61 and

reaches the cylinder chamber 41. The first suction pipe 61A is connected to the cylinder chamber 41 of the first cylinder 42A. The second suction pipe 61B is connected to the cylinder chamber 41 of the second cylinder 42B. The third suction pipe 61C is connected to the cylinder chamber 41 of the third cylinder 42C. The number of the plurality of suction pipes 61 may be the same as the number of the plurality of cylinders 42 as in the present embodiment or may be smaller than the number of the plurality of cylinders 42 by being shared by the two cylinders 42. For example, the second suction pipe 61B may be connected to the second partition plate 45B. The second partition plate 45B is provided with a refrigerant passage (not shown) that is connected to the second partition plate 45B and branches into the cylinder chamber 41 of the second cylinder 42B and the cylinder chamber 41 of the third cylinder 42C so as to be connected to both cylinder chambers 41.

**[0044]** The bottom portion of the airtight container 11 is filled with lubricant 62. Most of the compression mechanism 13 is in the lubricant 62 stored in the airtight container 11.

**[0045]** The accumulator 7 prevents the liquid refrigerant, which has not been completely gasified by the heat absorber 6, from being sucked into the compressor 2.

**[0046]** Next, the sealed terminals 18 and 19 will be described.

**[0047]** Fig. 2 is a schematic view of the sealed terminals of the compressor according to the embodiment of the present invention as viewed from above.

**[0048]** Fig. 3 is a schematic view of the sealed terminals of the compressor according to the embodiment of the present invention as viewed from below.

**[0049]** Fig. 4 is a schematic view of the sealed terminals and the terminal block of the compressor according to the embodiment of the present invention as viewed from above.

**[0050]** Fig. 5 is a longitudinal cross-sectional view of the sealed terminal and the terminal block of the compressor according to the embodiment of the present invention.

**[0051]** As shown in Fig. 2 to Fig. 5, the pair of sealed terminals 18 and 19 of the compressor 2 according to the present embodiment are arranged side by side on the dome-shaped end plate 11b of the airtight container 11.

**[0052]** First, the sealed terminal 18 will be described. The other sealed terminal 19 has substantially the same structure and shape as the sealed terminal 18. Accordingly, the description of the other sealed terminal 19 is omitted. For the sake of simplicity, the sealed terminal 18 is hereinafter referred to as the first sealed terminal 18, and the other sealed terminal 19 is hereinafter referred to as the second sealed terminal 19.

**[0053]** The first sealed terminal 18 includes: a substantially disk-shaped main body 71; three pins 72 that penetrate the front and back of the main body 71; three first plate-shaped terminals 75 that are provided on the respective pins 72 and are located outside the airtight container 11; and three second plate-shaped terminals 76 that are provided on the respective pins 72 and are disposed inside the airtight container 11.

**[0054]** Fig. 2 and Fig. 3 are diagrams of the sealed terminals 18 and 19 when viewed from the extending direction of the pins 72 of the pair of sealed terminals 18 and 19. Fig. 2 and Fig. 3 show the sealed terminals 18 and 19 from the direction tilted with respect to the planar view of the compressor 2.

**[0055]** The main body 71 holds the three pins 72 and the three first plate-shaped terminals 75 such that they are isolated from each other. The three pins 72 and the three first plate-shaped terminals 75 are electrically connected to the motor 12.

**[0056]** The three pins 72 are arranged at the respective vertexes of the equilateral triangle d, center of gravity of which is the center point O of the disk-shaped main body 71. In other words, the three pins 72 are arranged around the center point O at every 120 degree of the center angle. Each virtual line passing through each pin 72 from the center point O are defined as a line segment L1. That is, the three line segments L1 substantially trisect the circle in a fan shape.

**[0057]** The respective first plate-shaped terminals 75 are connected to the power lines 25. Each of the first plate-shaped terminals 75 has a front surface 75f as one surface and a back surface 75r as the other surface. The front surface 75f and the back surface 75r are in a front-to-back relationship of the first plate-shaped terminal 75. The front surface 75f of each first plate-shaped terminal 75 is joined to the corresponding pin 72.

**[0058]** As shown in Fig. 2, the front surface 75f of each first plate-shaped terminal 75 is aligned with each side of a triangle D and faces the respective front surfaces 75f of the other two first plate-shaped terminals 75 such that virtual planes containing the respective front surfaces 75f form the triangle D across the three first plate-shaped terminals 75. In other words, the three first plate-shaped terminals 75 are arranged in the respective sides of the triangle D such that the front surfaces 75f of the respective three first plate-shaped terminals 75 face each other.

**[0059]** The front surface 75f and back surface 75r of each first plate-shaped terminal 75 are substantially orthogonal to the corresponding line segment L1. The "corresponding line segment L1" is the line segment L1 passing through the pin 72 to which each first plate-shaped terminal 75 is joined, and is the line segment L1 that penetrates the front and back of each first plate-shaped terminal 75. That is, each first plate-shaped terminal 75 is arranged at the center of the corresponding side of the triangle D.

**[0060]** The triangle D contains the second triangle d formed by the three pins 72. Each vertex of the second triangle d touches the midpoint of the corresponding side of the triangle D or is in closest contact with the midpoint of the

corresponding side of the triangle D.

**[0061]** The three first plate-shaped terminals 75 are arranged so as to form a hexagon as a whole when the ends of the adjacent first plate-shaped terminals 75 are connected by a virtual straight line. In this hexagon, the opposite side of one first plate-shaped terminal 75 is the virtual straight line connecting the ends of the other two first plate-shaped terminals 75.

**[0062]** The second plate-shaped terminals 76 are connected to the respective lead wires 33. Each second plate-shaped terminal 76 has a front surface 76f as one surface and a back surface 76r as the other surface. The front surface 76f and the back surface 76r are in a front-and-back relationship of the second plate-shaped terminal 76. The front surface 76f of each second plate-shaped terminals 76 is joined to the corresponding pin 72.

**[0063]** As shown in Fig. 3, the front surface 76f and the back surface 76r of one second plate-shaped terminal 76a extend along the first virtual line L1a, which is one of the line segments L1. The front surface 76f and the back surface 76r of the second plate-shaped terminal 76b are substantially orthogonal to the second virtual line L1b as the corresponding line segment L1, and the front surface 76f and the back surface 76r of the second plate-shaped terminal 76c are substantially orthogonal to the second virtual line L1c as the corresponding line segment L1. In other words, the second plate-shaped terminal 76a extends along the virtual plane VP2a that bisects the acute angle formed by the virtual plane VP2b containing the second plate-shaped terminal 76b and the virtual plane VP2c containing the second plate-shaped terminals 76c.

**[0064]** Next, the relationship between the pair of sealed terminals 18 and 19 will be described.

**[0065]** The pair of sealed terminals 18 and 19 face each other so as to interpose a plane P that contains the midpoint of the pair of sealed terminals 18 and 19 and the centerline of the airtight container 11.

**[0066]** One corner Co of the triangle (D1 or D2) formed by the three first plate-shaped terminals 75 of one of the sealed terminals 18 and 19 faces one corner Co of the triangle (D1 or D2) formed by the three first plate-shaped terminals 75 of the other of the sealed terminals 18 or 19. That is, one corner Co of the triangle D1 formed by the three first plate-shaped terminals 75 of the first sealed terminal 18 faces one corner Co of the triangle D2 formed by the three first plate-shaped terminals 75 of the second sealed terminal 19. Namely, one corner Co of the triangle D2 formed by the three first plate-shaped terminals 75 of the second sealed terminal 19 faces one corner Co of the triangle D1 formed by the three first plate-shaped terminals 75 of the first sealed terminal 18.

**[0067]** The pair of corners Co facing each other in the pair of triangles D1 and D2 may be separated from each other without overlapping as shown in Fig. 2 or may be at the same position.

**[0068]** Thus, one side of the second triangle d formed by the three pins 72 of one of the sealed terminals 18 and 19 faces one side of the second triangle d formed by the three pins 72 of the other of the sealed terminals 18 or 19. That is, one side of the second triangle d formed by the three pins 72 of the first sealed terminal 18 faces one side of the second triangle d formed by the three pins 72 of the second sealed terminal 19. Namely, one side of the second triangle d formed by the three pins 72 of the second sealed terminal 19 faces one side of the second triangle d formed by the three pins 72 of the first sealed terminal 18.

**[0069]** The respective first virtual lines L1a of the pair of sealed terminals 18 and 19 intersect each other at the point farther than the centerline of the airtight container 11 when viewed from the pair of sealed terminals 18 and 19. In other words, the second plate-shaped terminal 76a that has the front surface 76f and the back surface 76r extending along the first virtual line L1a is provided on the pin 72a that is closest to the centerline of the airtight container 11 among the pins 72 of each of the sealed terminals 18 and 19.

**[0070]** It is preferred that the pair of sealed terminals 18 and 19 are plane-symmetric with respect to the plane P as the plane of symmetry. The pair of sealed terminals 18 and 19 may be asymmetric as long as one corner Co of the triangle D1 and one corner Co of the triangle D2 are disposed so as to face each other. In this case, the pair of sealed terminals 18 and 19 are desirably disposed in such a manner that the opposite sides of the respective corners Co of the sealed terminals 18 and 19 are parallel to each other.

**[0071]** Next, the pair of terminal blocks 22 and 23 provided in the respective sealed terminals 18 and 19 will be described.

**[0072]** Fig. 6 is a plan view of the terminal block of the compressor according to the embodiment of the present invention.

**[0073]** First, the terminal block 22 will be described. The other terminal block 23 has substantially the same structure and shape as the terminal block 22. Thus, the description of the other terminal block 23 is omitted. For the sake of simplicity, the terminal block 22 is hereinafter referred to as the first terminal block 22, and the other terminal block 23 is hereinafter referred to as the second terminal block 23. The first terminal block 22 is provided in the first sealed terminal 18, and the second terminal block 23 is provided in the second sealed terminal 19.

**[0074]** The first terminal block 22 has a T-shape when viewed from the extending direction of the three pins 72 of the first sealed terminal 18, and has thickness in the extending direction of the three pins 72. The first terminal block 22 includes: three terminal disposition holes 81; three plate-shaped terminal receivers 82; and three wiring holders 83.

**[0075]** Two terminal disposition holes 81, two plate-shaped terminal receivers 82, and two wiring holders 83 are disposed on the horizontal bar 85 of the T-shaped first terminal block 22. The remaining one terminal disposition hole 81, the remaining one plate-shaped terminal receiver 82, and the remaining one wiring holder 83 are disposed on the

vertical bar 86 of the T-shaped first terminal block 22.

**[0076]** Each terminal disposition hole 81 has a shape through which each first plate-shaped terminal 75 and each pin 72 of the first sealed terminal 18 can be inserted. The respective terminal disposition holes 81 are a series of holes through which the pin 72 and the first plate-shaped terminal 75 can be integrally inserted.

**[0077]** The two terminal disposition holes 81 on the horizontal bar 85 of the first terminal block 22 are disposed at the respective ends of the horizontal bar 85, and the one terminal disposition hole 81 on the vertical bar 86 of the first terminal block 22 is disposed at the boundary portion between the horizontal bar 85 and the vertical bar 86. The boundary portion between the horizontal bar 85 and the vertical bar 86 is the connection portion between the horizontal bar 85 and the vertical bar 86, and is the root of the vertical bar 86. These three terminal disposition holes 81 are arranged so as to form the shape of the triangle D corresponding to the three pins 72 and the three first plate-shaped terminals 75 of the first sealed terminal 18. In addition, these three terminal disposition holes 81 are arranged so as to form a hexagon as a whole when the ends of adjacent terminal disposition holes 81 are connected by virtual straight lines.

**[0078]** The respective plate-shaped terminal receivers 82 are disposed side by side to the terminal disposition holes 81. The respective plate-shaped terminal receivers 82 are disposed outside the virtual triangle D, where the three terminal disposition holes 81 are disposed, or are disposed outside the virtual hexagon formed by the three terminal disposition holes 81.

**[0079]** Each plate-shaped terminal receivers 82 is a concave recess having a shape by which the first plate-shaped terminal 75 inserted into the terminal disposition hole 81 can be bent toward the outside of the triangle D. Each plate-shaped terminal receivers 82 has a seating surface that is inserted into the terminal disposition hole 81 and seats the first plate-shaped terminal 75 bent towards the outside of the triangle D. Nuts 91 are embedded in the plate-shaped terminal receivers 82. A fastening member 92, for example a screw, is fastened to each nut 91. This fastening member 92 electrically connects a plate-shaped terminal 93 provided at the end of the power line 25 to the first plate-shaped terminal 75, and fastens the first plate-shaped terminal 75 bent by the plate-shaped terminal receiver 82 and the terminal 93 of the power line 25 together so as to fix them to the first terminal block 22.

**[0080]** Each first plate-shaped terminal 75 before being bent protrudes from the tip of the corresponding pin 72 in the extending direction of the pin 72. Each first plate-shaped terminal 75 has an elongated hole 95 in this protruding portion. The seating position of each first plate-shaped terminal 75 to be bent by the plate-shaped terminal receiver 82 and seated on the seat surface is not always constant. Thus, the elongated hole 95 of each first plate-shaped terminal 75 absorbs the variation in seating position of the first plate-shaped terminal 75 such that the fastening member 92 is smoothly fastened to the nut 91.

**[0081]** Each wiring holder 83 is a groove extending in the extending direction of the vertical bar 86 of the T-shaped first terminal block 22. That is, each wiring holder 83 is a groove extending downward in the T-shape formed by the first terminal block 22. The respective wiring holders 83 is connected in series to the plate-shaped terminal receivers 82. Each wiring holder 83 holds the power line 25, which is connected to the first plate-shaped terminal 75 by each plate-shaped terminal receiver 82, such that the power line 25 is wired in the extending direction of the vertical bar 86 of the T-shaped first terminal block 22. That is, the wiring holder 83 of the vertical bar 86 of the first terminal block 22 extends in the bending direction of the first plate-shaped terminal 75 bent on the corresponding plate-shaped terminal receiver 82. The wiring holders 83 of the horizontal bar 85 of the first terminal block 22 intersect with the bending direction of the first plate-shaped terminal 75 bent on the corresponding plate-shaped terminal receivers 82, and extend in parallel to the extending direction of the wiring holder 83 of the vertical bar 86 of the first terminal block 22.

**[0082]** Next, the relationship between the pair of terminal blocks 22 and 23 will be described.

**[0083]** The pair of terminal blocks 22 and 23 face each other so as to interpose the plane P that contains the midpoint of the pair of sealed terminals 18 and 19 and the centerline of the airtight container 11.

**[0084]** One of the terminal blocks 22 and 23 holds the three power lines 25 connected to the respective first plate-shaped terminals 75 of the corresponding sealed terminals (18 or 19) such that these three power lines 25 are wired to be separated away from the other of the terminal blocks 22 and 23. That is, the first terminal block 22 holds the three power lines 25 connected to the respective first plate-shaped terminals 75 of the first sealed terminal 18 such that these three power lines 25 are wired to be separated away from the second terminal block 23. Similarly, the second terminal block 23 holds the three power lines 25 connected to the respective first plate-shaped terminals 75 of the second sealed terminal 19 such that these three power lines 25 are wired to be separated away from the first terminal block 22.

**[0085]** In other words, the pair of T-shaped terminal blocks 22 and 23 are provided on the pair of sealed terminals 18 and 19 such that the respective horizontal bars 85 of the terminal blocks 22 and 23 face each other. That is, the respective vertical bars 86 of the pair of terminal blocks 22 and 23 extend in the direction away from each other. Since the wiring holders 83 of each of the terminal blocks 22 and 23 extend in parallel to the extending direction of the vertical bar 86 of the corresponding terminal block, one of the terminal blocks 22 and 23 holds the three power lines 25 connected to the respective first plate-shaped terminals 75 of the corresponding sealed terminals (18 or 19) in the direction away from the other of the terminal blocks 22 or 23.

**[0086]** As described above, the compressor 2 and the refrigeration cycle apparatus 1 according to the present em-



bodiment is configured such that one of the corners of the triangle D formed by the three first plate-shaped terminals 75 of one of the sealed terminals 18 and 19 faces one of the corners of the triangles D formed by the three first plate-shaped terminals 75 of the other of the sealed terminals 18 and 19.

**[0087]** Thus, the compressor 2 and the refrigeration cycle apparatus 1 enable the three first plate-shaped terminals 75 to be bent toward the outside of the triangle D in one of the sealed terminals 18 and 19 without interference. In other words, the compressor 2 and the refrigeration cycle apparatus 1 enable the three first plate-shaped terminals 75 to be bent toward the outside of the triangle D without interference and to readily connect the power lines 25 having the plate-shaped terminals 93.

**[0088]** In the compressor 2 and the refrigeration cycle apparatus 1, the three bent first plate-shaped terminals 75 of one of the sealed terminals 18 and 19 and the three bent first plate-shaped terminals 75 of the other of the sealed terminals 18 and 19 can be arranged as close to each other as possible without interfering with each other. These three first plate-shaped terminals 75 are radially arranged at every 120 degrees in a bent state. Under this state, in view of the pair of sealed terminals 18 and 19 adjacent to each other, the arrangement relationship of the pair of sealed terminals 18 and 19 according to the present embodiment is an excellent mounting form in which the pair of sealed terminals 18 and 19 are closest to each other and the power lines 25 can be readily wired.

**[0089]** Thus, the compressor 2 and the refrigeration cycle apparatus 1 can readily connect the power lines 25 having the larger plate-shaped terminals 93 to the pair of sealed terminals 18 and 19. In other words, the compressor 2 and refrigeration cycle apparatus 1 can readily adopt a larger terminal having a large contact area for each terminal 93 that connects the power line 25 to the pair of sealed terminals 18 and 19, and can readily supply a large current to the motor 12 while avoiding temperature rise of each terminal 93.

**[0090]** In addition, the compressor 2 and the refrigeration cycle apparatus 1 enable bending of the first plate-shaped terminals 75 of the sealed terminals 18 and 19, and can provide the terminal blocks 22 and 23 so as to securely screw the sealed terminals 18 and 19 and the terminals 93 of the power lines 25.

**[0091]** Further, the compressor 2 and the refrigeration cycle apparatus 1 enable bending of the first plate-shaped terminals 75 of the sealed terminals 18 and 19, and can provide the terminal blocks 22 and 23 so as to readily fasten the screws, which fasten the sealed terminals 18 and 19 and the terminals 93 of the power lines 25 together, from the same direction. This increases the degree of freedom of the wiring paths of the power lines 25 and enables connection of the power lines 25 to the sealed terminals 18 and 19 without applying excessive bending stress to the power line 25.

**[0092]** Moreover, the compressor 2 and the refrigeration cycle apparatus 1 according to the present embodiment include the pair of terminal blocks 22 and 23 provided in the respective sealed terminals 18 and 19. One of the terminal blocks 22 and 23 holds the three power lines 25 connected to the respective first plate-shaped terminals 75 of the corresponding sealed terminals 18 and 19 such that these three power lines 25 are wired to be separated away from the other of the terminal blocks 22 and 23. Hence, the compressor 2 and the refrigeration cycle apparatus 1 enables connection of the power lines 25 to the sealed terminals 18 and 19 without applying excessive bending stress to the power lines 25, and can wire the power lines 25 without exerting excessive stress on the power lines 25 and avoid mutual interference between the power lines 25.

**[0093]** Furthermore, the compressor 2 and the refrigeration cycle apparatus 1 according to the present embodiment includes the second plate-shaped terminals 76 arranged in such a manner that the first virtual lines L1a intersect each other at a position farther than the centerline of the airtight container 11 when viewed from the pair of sealed terminals 18 and 19. Thus, the compressor 2 and the refrigeration cycle apparatus 1 can wire the lead wires 33 of the motor 12 in the space inside the airtight container 11 under the state where excessive stress does not act on the lead wires 33. Additionally, the compressor 2 and the refrigeration cycle apparatus 1 can connect the lead wires 33 of the motor 12 to the second plate-shaped terminals 76 without making the lead wires 33 touch the inner wall surface of the airtight container 11. This protects the lead wires 33 from the thermal effects at the time of welding the end plate 11b of the airtight container 11 to the body 11a and reduces the risk of disconnection.

**[0094]** The terminals provided at the ends of the lead wires 33 are exposed to the refrigerant flowing in the compressor 2. Hence, the temperature of the terminals depends on the temperature of the refrigerant in the compressor 2. That is, the temperature of the terminals provided at the ends of the lead wires 33 does not rise abnormally at the time of energization even when a larger current is supplied to the motor as the compression load increases. Thus, the terminals provided at the ends of the lead wires 33 of the motor 12 may be plate-shaped terminals similar to the terminals 93 provided at the ends of the power lines 25 or may be the Faston terminals used in the conventional compressor.

**[0095]** According to the refrigeration cycle apparatus 1 and the compressor 2 of the present embodiment, the sealed terminals 18 and 19 and the terminals 93 of the power lines 25 can be securely screwed to each other by installing the terminal blocks 22 and 23, the power lines 25 can be connected to the sealed terminals 18 and 19 without applying excessive bending stress to the power lines 25, and the power lines 25 can be efficiently connected at the time of manufacture.

**[0096]** While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be

embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

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# Reference Signs List

## [0097]

10	1	refrigeration cycle apparatus
	2	compressor
	3	radiator
	5	expansion device
	6	heat absorber
15	7	accumulator
	8	refrigerant piping
	8a	discharge pipe
	11	airtight container
	11a	body
20	11b, 11c	end plate
	12	motor
	13	compression mechanism
	15	rotating shaft
	15a	intermediate portion
25	15b	lower end portion
	16	main bearing
	17	auxiliary bearing
	18	sealed terminal(first sealed terminal)
	19	sealed terminal(second sealed terminal)
30	22	terminal block (first terminal block)
	23	terminal block (second terminal block)
	25	power line
	31	stator
	32	rotor
35	33	lead wire
	35	rotor iron core
	36	eccentric portion
	41	cylinder chamber
	42	cylinder
40	42A	first cylinder
	42B	second cylinder
	42C	third cylinder
	43	roller
	45A	first partition plate
45	45B	second partition plate
	46	fastening member
	51A	first discharge valve mechanism
	51B	second discharge valve mechanism
	51C	third discharge valve mechanism
50	52	first discharge muffler
	53	discharge chamber
	55	fastening member
	56	second discharge muffler
	57	second hole
55	58	frame
	59	fastening member
	61	suction pipe
	61A	first suction pipe

	61B	second suction pipe
	61C	third suction pipe
	62	lubricant
	71	main body
5	72	pin
	75	first plate-shaped terminal
	75f	front surface
	75r	back surface
	76, 76a, 76b, 76c	second plate-shaped terminal
10	76f	front surface
	76r	back surface
	81	terminal disposition hole
	82	plate-shaped terminal receiver
	83	wiring holder
15	85	horizontal bar
	86	vertical bar
	91	nut
	92	fastening member
	93	terminal
20	95	elongated hole

## Claims

25 1. A compressor comprising:

an airtight container;

a compression mechanism that is accommodated in the airtight container and compresses a refrigerant introduced into the airtight container;

30 a motor including a cylindrical stator and a rotor that is disposed inside the stator and generates rotational driving force of the compression mechanism, the stator being fixed to an inner surface of the airtight container; and  
a pair of sealed terminals arranged in the airtight container, wherein:

35 each of the sealed terminals has three plate-shaped terminals that are disposed outside the airtight container and are electrically connected to the motor;

one surface of each of the three plate-shaped terminals is aligned with each side of a triangle and faces each of other two plate-shaped terminal on the one surface in such a manner that three virtual planes each containing the one surface form the triangle across the three plate-shaped terminals; and

40 one of corners of the triangle formed by the three plate-shaped terminals of one of the sealed terminals faces one of corners of the triangle formed by the three plate-shaped terminals of another of the sealed terminals.

2. The compressor according to claim 1, further comprising a pair of terminal blocks provided for respective sealed terminals,

45 wherein one of the terminal blocks holds three power lines connected to respective plate-shaped terminals of a corresponding sealed terminal in such a manner that the three power lines are wired to be separated away from another of the terminal block.

3. The compressor according to claim 1 or claim 2, wherein:

50 each of the sealed terminals has three second plate-shaped terminals that are disposed inside the airtight container and are electrically connected to the motor;

in each of the sealed terminals, front and back surfaces of one of the three second plate-shaped terminals extend along a first virtual line that is one of three virtual lines substantially trisecting a circle centered on a center of gravity of the triangle in a fan shape, while front and back surfaces of other two of the three second plate-shaped terminals are substantially orthogonal to second virtual lines, which are other two of the three virtual lines; and

55 first virtual lines of respective sealed terminals intersect each other at a position farther than a centerline of the

airtight container when viewed from the pair of sealed terminals.

4. A refrigeration cycle apparatus comprising:

5           the compressor according to any one of claim 1 to claim 3;  
          a radiator;  
          an expansion device;  
          a heat absorber; and  
10          refrigerant piping that connects the compressor, the radiator, the expansion device, and the heat absorber and  
          circulates the refrigerant.

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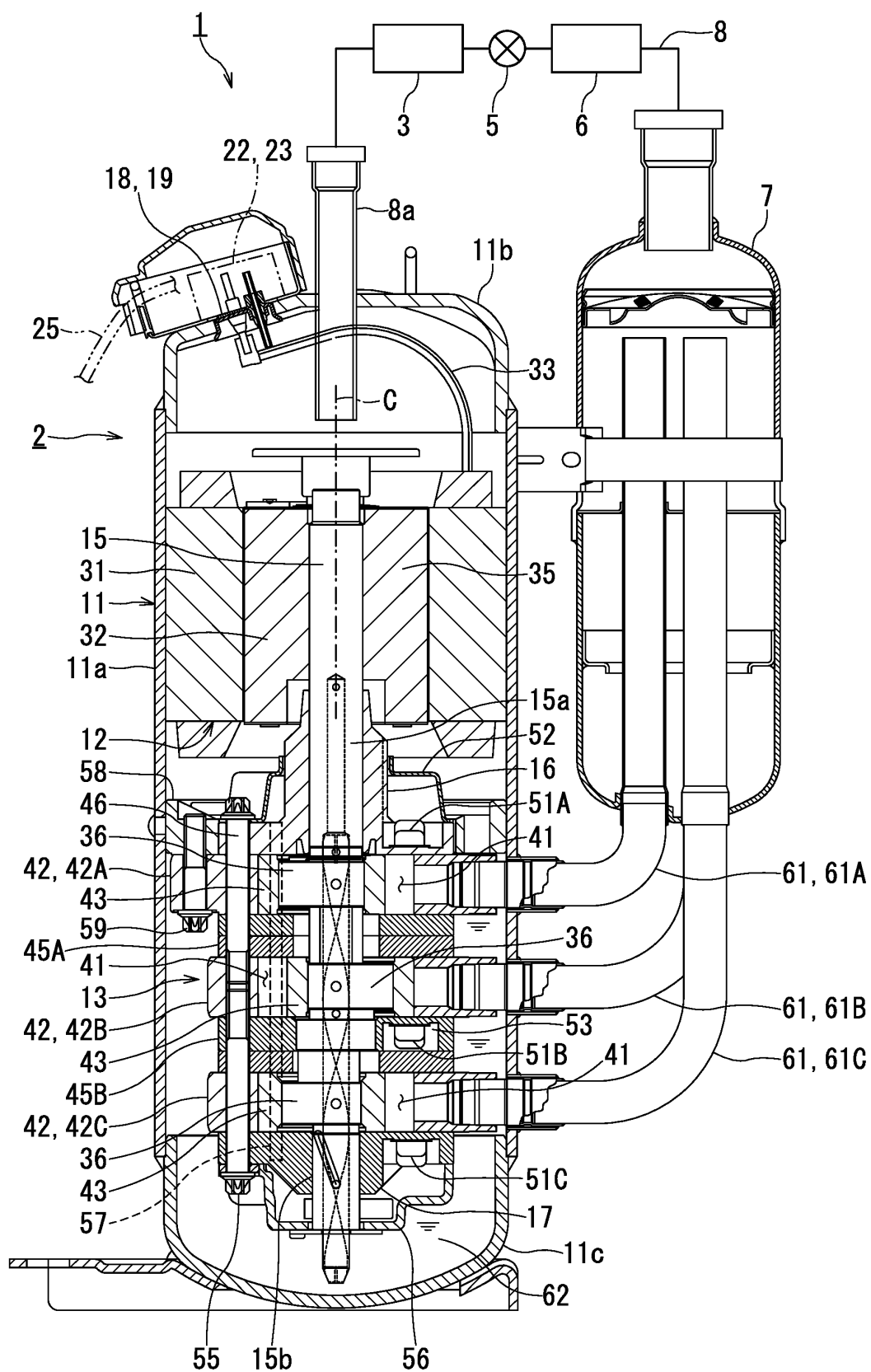
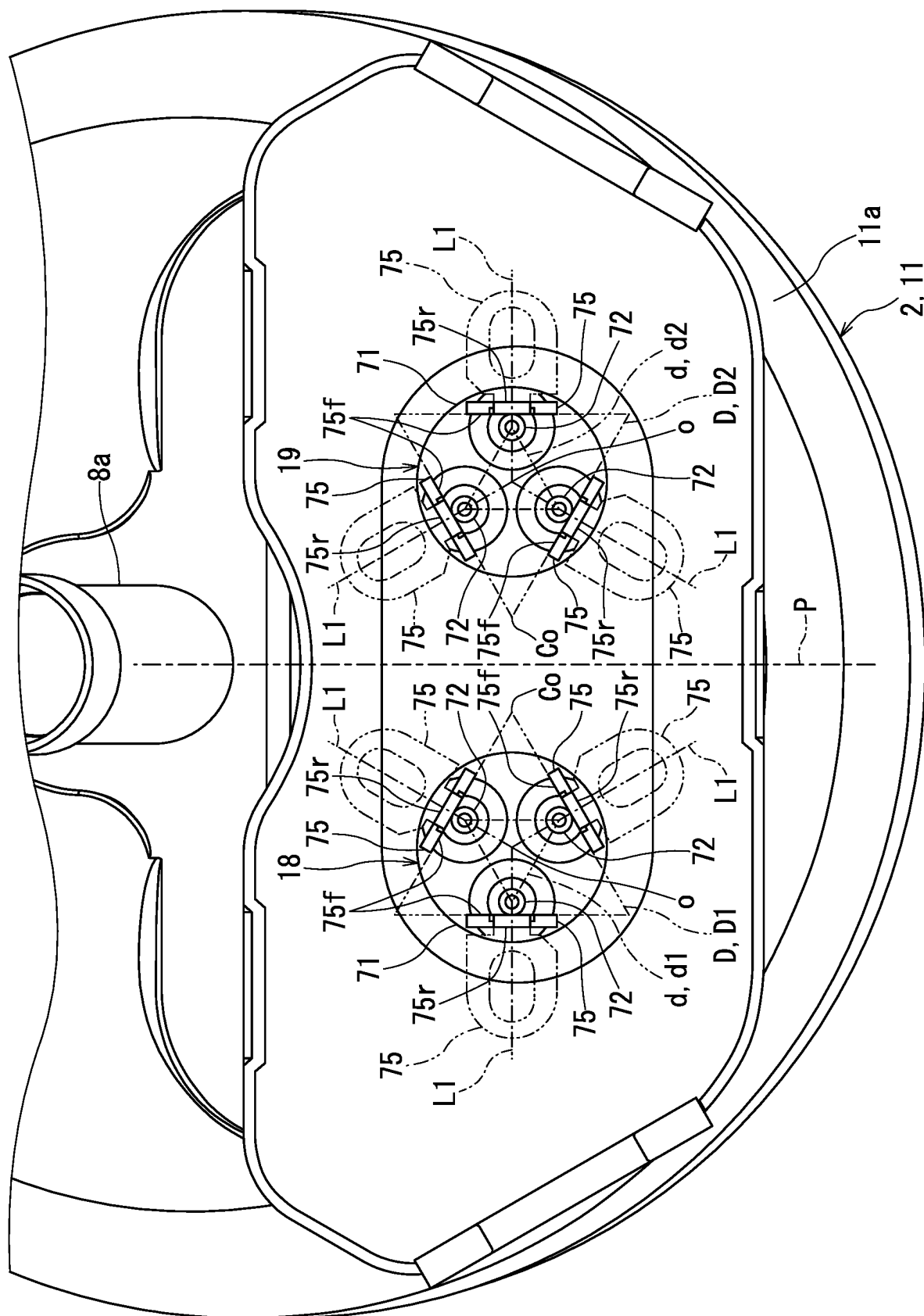


FIG. 1



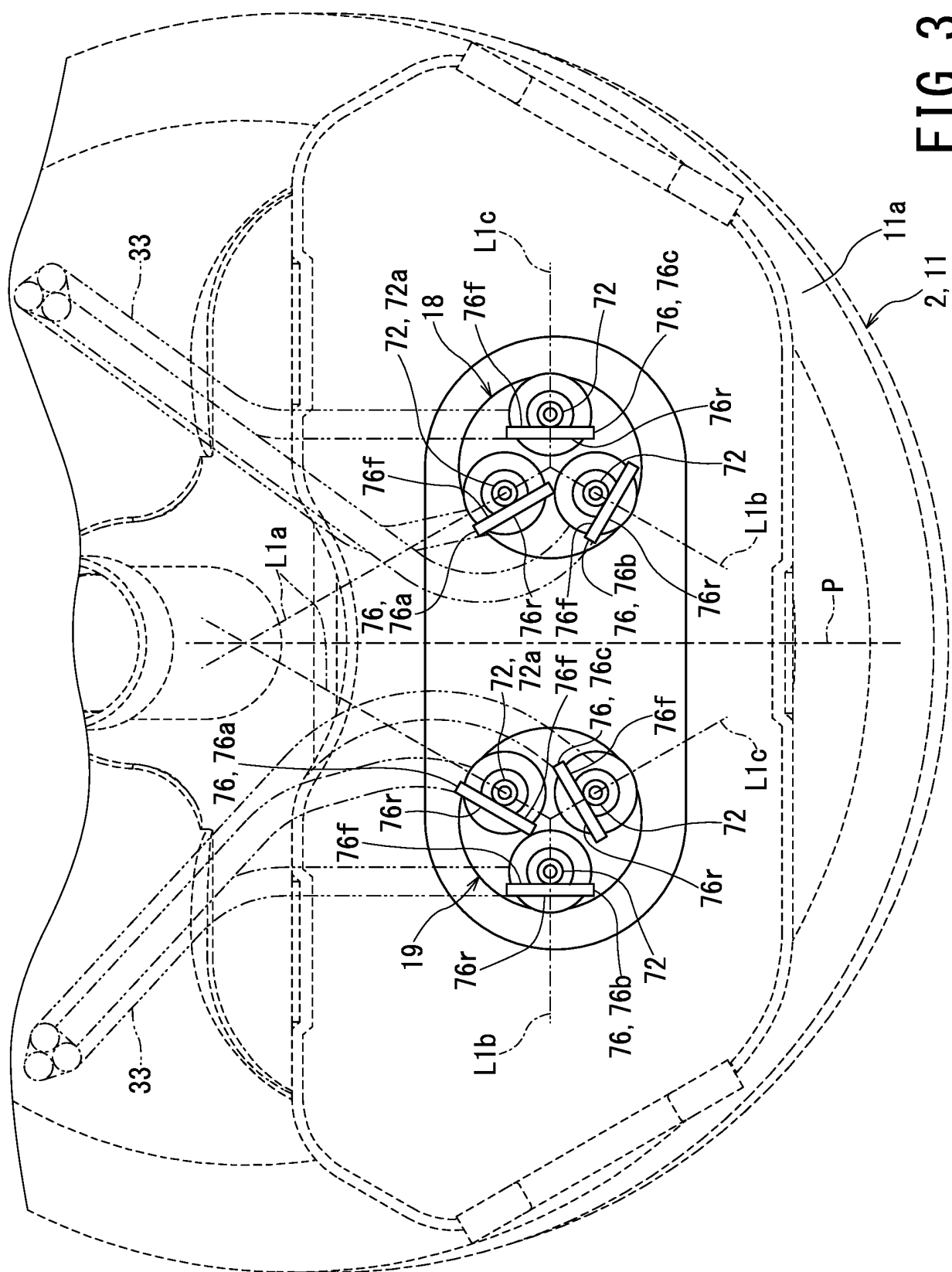
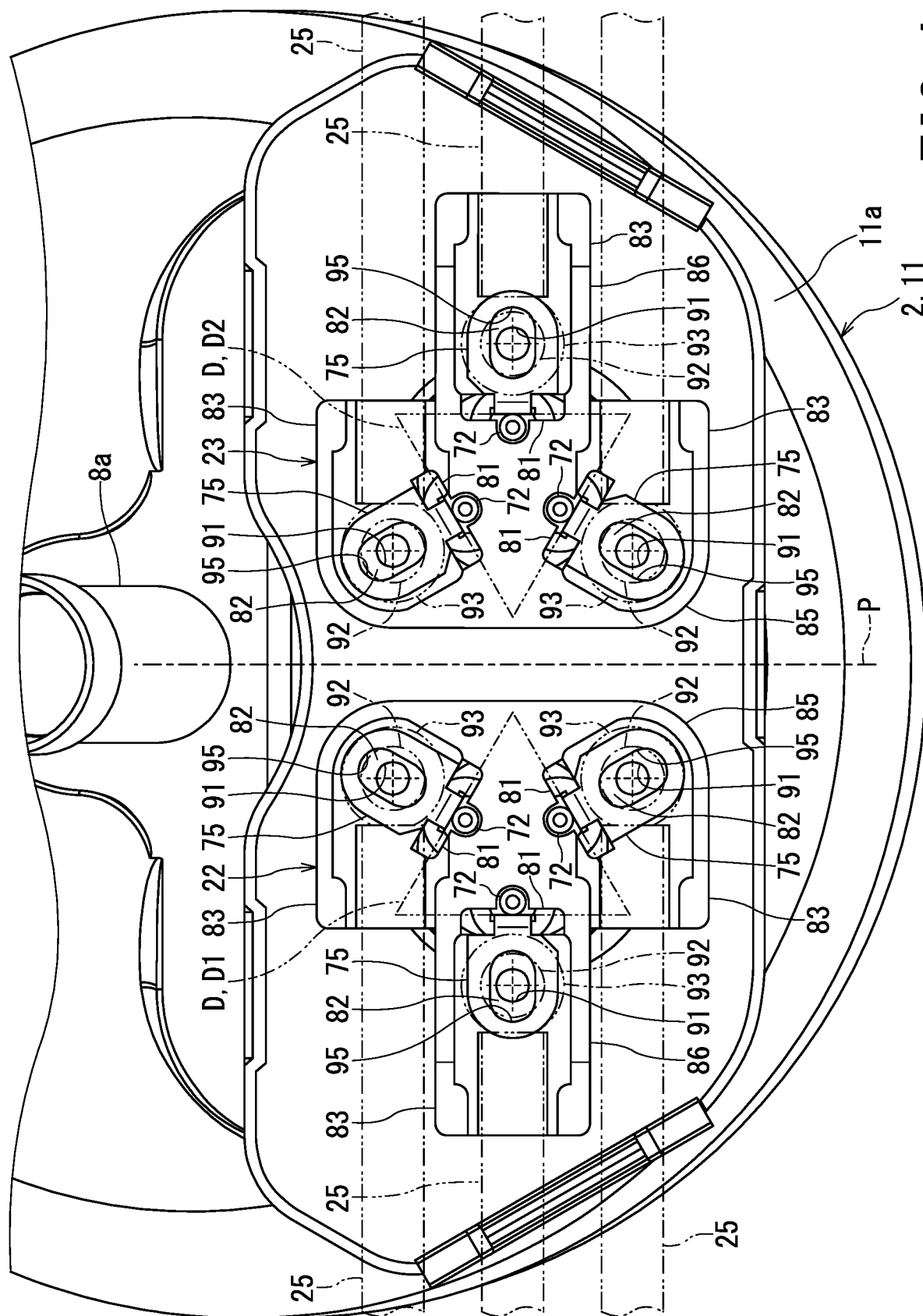


FIG. 3





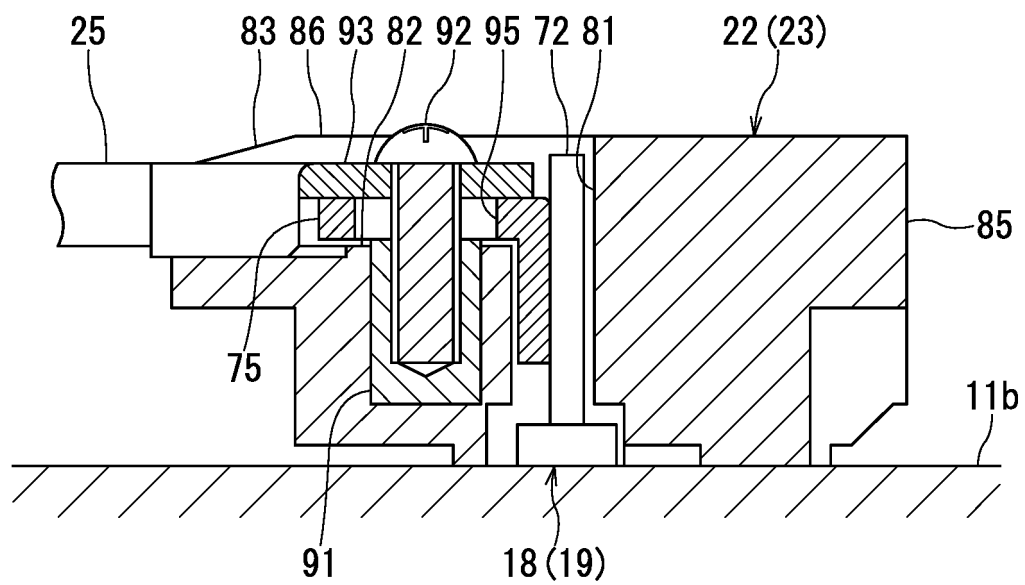


FIG. 5

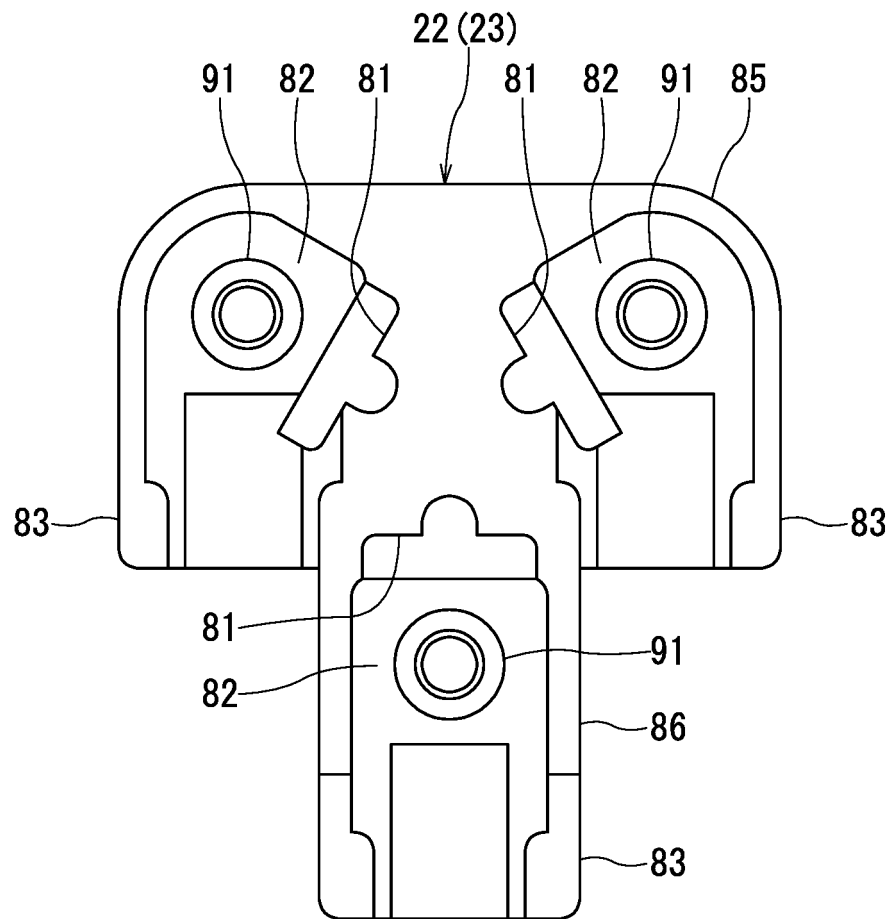


FIG. 6

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/010020

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F04C29/00 (2006.01) i, F04B39/00 (2006.01) i  
 FI: F04C29/00 C, F04B39/00 106A

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)

Int. Cl. F04C29/00, F04B39/00

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 1971-2020  
 Registered utility model specifications of Japan 1996-2020  
 Published registered utility model applications of Japan 1994-2020

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	WO 2019/030841 A1 (MITSUBISHI ELECTRIC CORP.) 14 February 2019, paragraphs [0011]-[0117], fig. 1-14	1-4
Y	JP 2013-24050 A (DAIKIN INDUSTRIES, LTD.) 04 February 2013, paragraphs [0028]-[0035], fig. 1-5	1-4

☐ 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

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"&" document member of the same patent family

Date of the actual completion of the international search  
11.05.2020

Date of mailing of the international search report  
26.05.2020

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Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/JP2020/010020

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
WO 2019/030841 A1	14.02.2019	(Family: none)	
JP 2013-24050 A	04.02.2013	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2012082776 A [0005]