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(54) **VARIABLE DISPLACEMENT SWASH PLATE TYPE COMPRESSOR**

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(57) **ABSTRACT**

Provided is a compressor, in which the inclination angle of a swash plate is changed by an actuator, ensuring stability on a product-by-product basis while realizing reduction in size. In the compressor, when pressure in a control pressure chamber increases, a movable body moves toward a flange. At this time, the movable body pulls the opposite end side of a swash plate rearward in a swash plate chamber via first and second pulling arms. A link mechanism permits increase of the inclination angle of the swash plate until reaching a maximum value. When the pressure in the control pressure chamber reaches a required control pressure, a rear wall of the movable body which has moved rearward in the swash plate chamber abuts a front face of the flange. This makes it possible in this compressor to restrict the maximum value of the inclination angle of the swash plate.

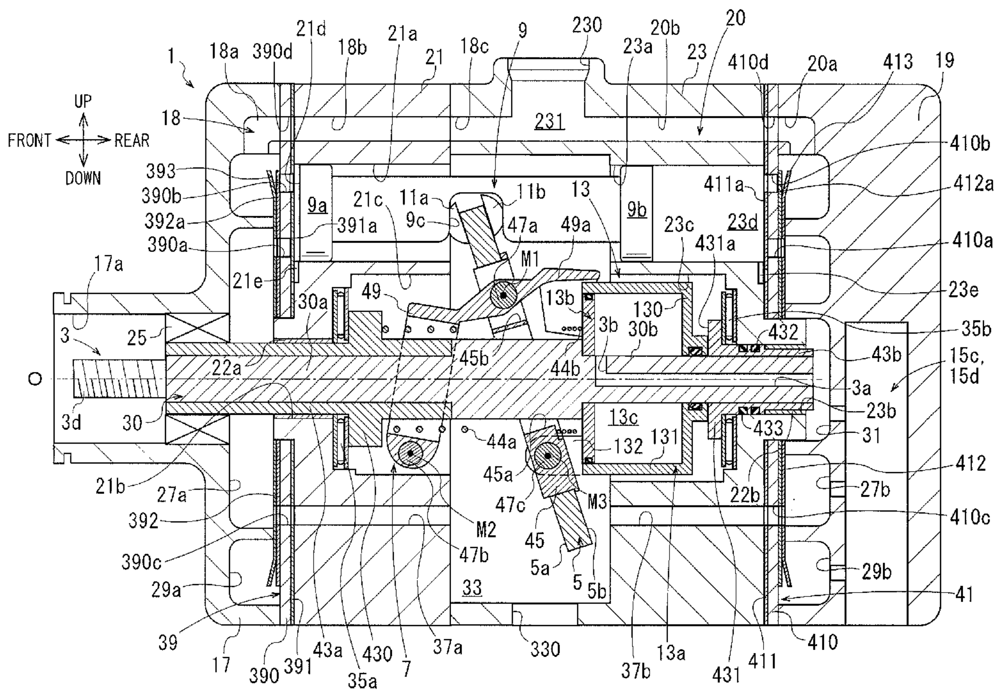
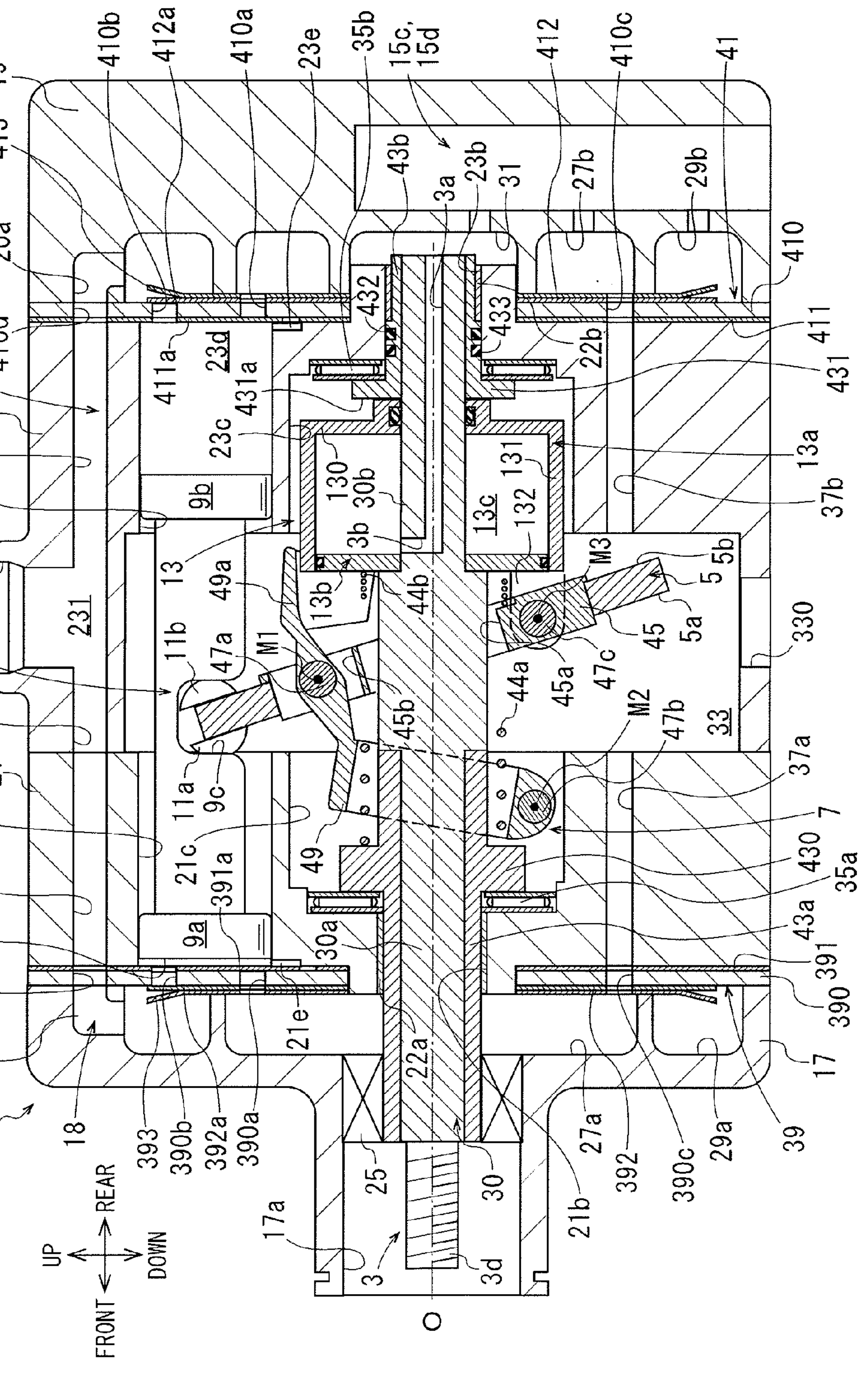


FIG. 1


UP
REAR
FRONT
DOWN
O
1
3
3a
3b
3d
5
5a
5b
7
9
9a
9b
9c
11a
11b
13
13a
13b
13c
15c, 15d
17
17a
18
18a
18b
18c
19
20
20a
20b
21
21a
21b
21c
21d
21e
22a
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23a
23b
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35a
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41
43a
43b
44a
44b
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45a
45b
47a
47b
47c
49
49a
130
131
132
230
231
330
390
390a
390b
390c
390d
391
391a
392
392a
393
410
410a
410b
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411a
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431a
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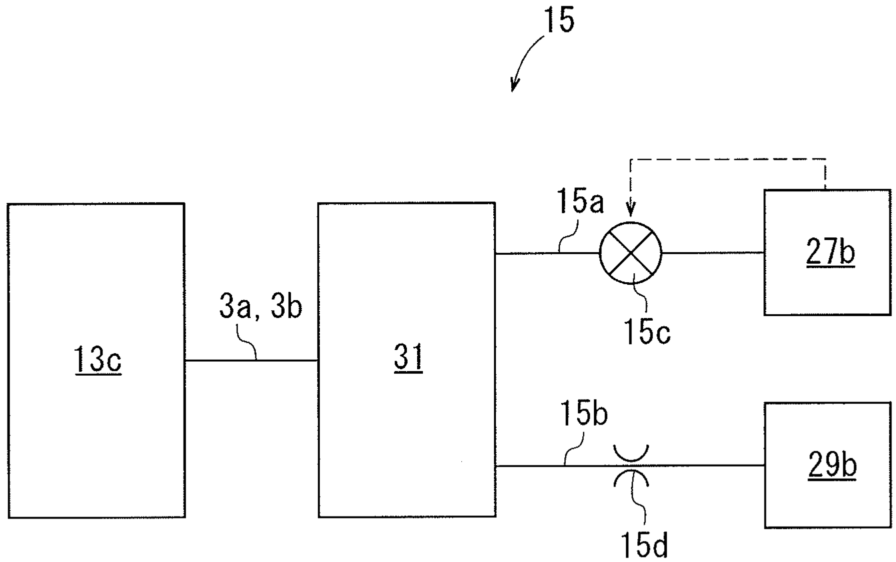
M1
M2
M3

FIG. 2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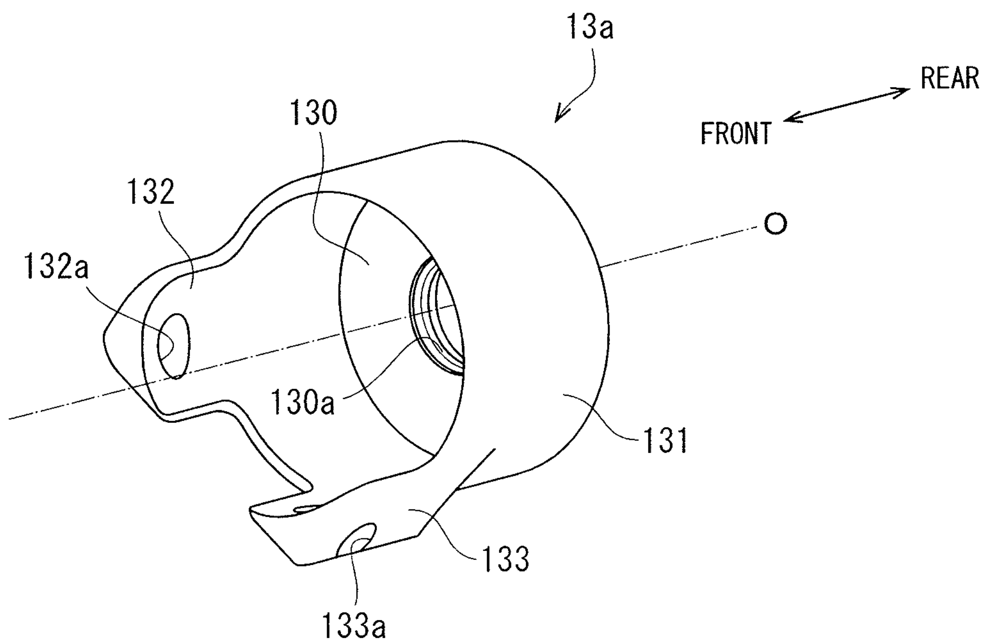
15a
27b
3a, 3b
13c
31
15c
15b
29b
15d

FIG. 3


13a
REAR
FRONT
130
132
132a
O
130a
131
133
133a

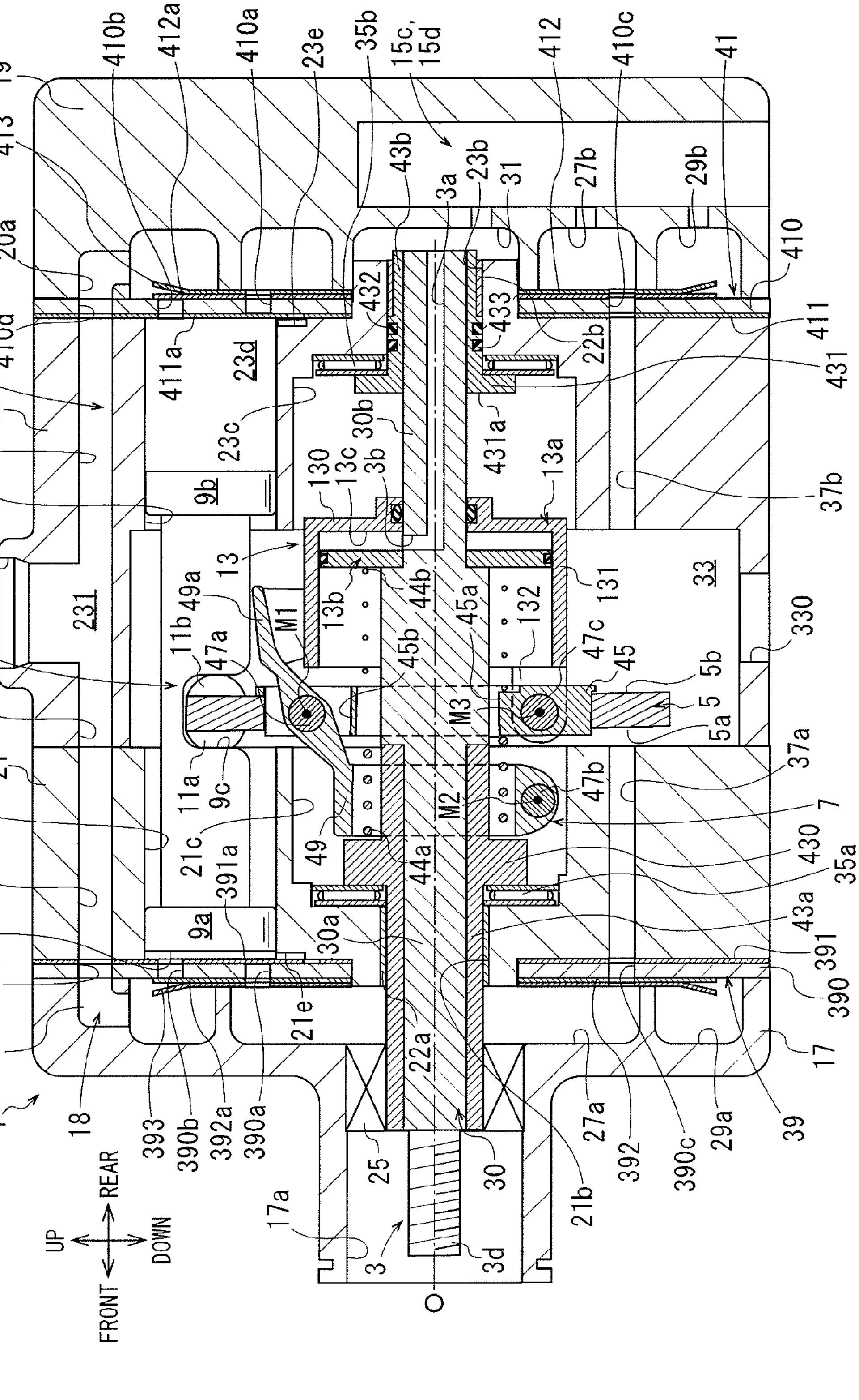
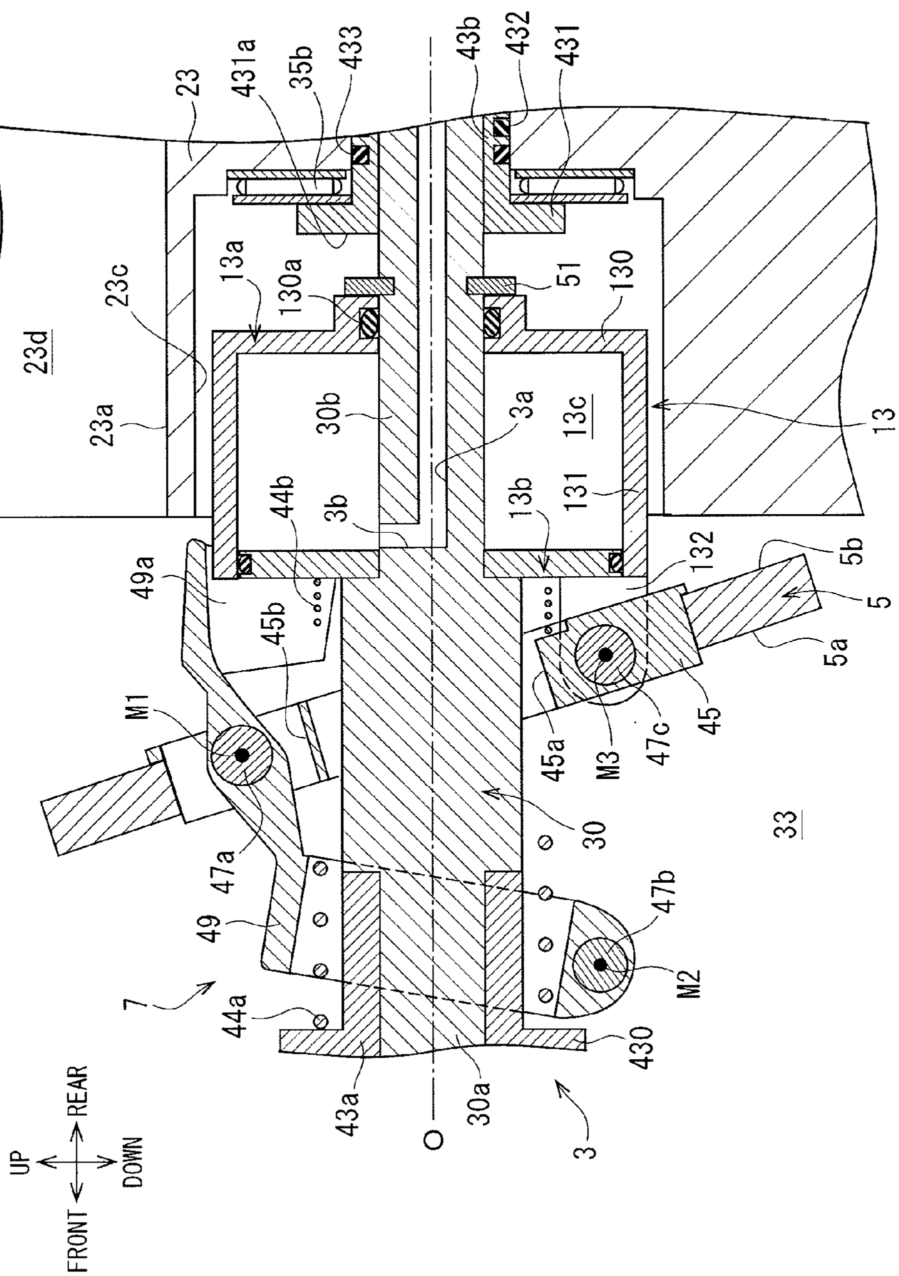


FIG. 4

FIG. 5


23
431a
35b
433
43b
432
431
23d
23c
13a
130a
51
130
23a
30b
3a
13c
13
44b
3b
13b
131
132
5b
49a
45b
5
5a
M1
45
45a
M3
47c
30
33
47a
49
47b
M2
7
44a
430
43a
30a
O
3
UP
REAR
FRONT
DOWN

VARIABLE DISPLACEMENT SWASH PLATE TYPE COMPRESSOR

TECHNICAL FIELD

[0001] The present invention relates to a variable displacement swash plate type compressor.

BACKGROUND ART

[0002] A conventional variable displacement swash plate type compressor (hereinafter referred to as a compressor) is disclosed in Patent Literature 1. This compressor includes a suction chamber, a discharge chamber, a swash plate chamber, and plural cylinder bores, which are formed in a housing. A drive shaft is rotatably supported in the housing. The swash plate chamber accommodates a swash plate, which is rotatable along with rotation of the drive shaft. A link mechanism is provided between the drive shaft and swash plate. The link mechanism permits change of the inclination angle of the swash plate. The inclination angle is defined as an angle of the swash plate with respect to a direction perpendicular to the drive axis of the drive shaft. A piston is reciprocally accommodated in each of the cylinder bores. A pair of shoes provided for each piston serves as a conversion mechanism and reciprocates the piston in each of the cylinder bores along with rotation of the swash plate at a stroke corresponding to the inclination angle. An actuator is capable of changing the inclination angle by changing the volume of a control pressure chamber. The actuator is controlled by a control mechanism.

[0003] In this compressor, the control mechanism raises the pressure in the control pressure chamber by using the pressure of refrigerant in the discharge chamber and thereby increases the inclination angle of the swash plate via the link mechanism. At this time, when the link mechanism is pushed by the swash plate due to the pressure in the control pressure chamber and when the length of the link mechanism in an axial direction of the drive shaft is minimized, the inclination angle cannot be increased any further. In other words, in this compressor, the maximum inclination angle is restricted by pushing the link mechanism by the swash plate. In this way, in this compressor, discharge capacity per rotation of the drive shaft can be increased to the maximum.

CITATION LIST

Patent Literature

[0004] Patent Literature 1: Japanese Patent Laid-Open No. 5-172052

SUMMARY OF INVENTION

Technical Problem

[0005] In a compressor in which the inclination angle of the swash plate is changed by an actuator as described above, a required control pressure, which is the pressure in the control pressure chamber required to increase the inclination angle of the swash plate to the maximum value, is preset. If the compressor is configured such that a discharge refrigerant pressure, i.e. the pressure of refrigerant in the discharge chamber, is introduced to the control pressure chamber, the required control pressure is set lower than an upper limit of the discharge refrigerant pressure.

[0006] In the conventional compressor described above, since the maximum value of the inclination angle is restricted by pushing the link mechanism by the swash plate, a pressure in excess of the required control pressure is applied to the swash plate and the link mechanism. This makes it necessary to secure strength of the swash plate and the link mechanism of the compressor sufficiently to endure this pressure, and, as a result, it is inevitable to increase the size of the swash plate chamber and thus the size of the compressor.

[0007] Furthermore, in the conventional compressor described above, since the maximum value of the inclination angle is restricted by the link mechanism, which is formed by assembling plural parts in the axial direction of the drive shaft, dispersion in the maximum value of the inclination angle is likely to occur due to dimensional tolerance and the like of the swash plate and the link mechanism in the axial direction of the drive shaft. Thus, it is difficult to maintain the quality of each individual compressor.

[0008] The present invention has been made in view of the conventional circumstances described above, and an object of the invention is to provide a compressor, in which the inclination angle of a swash plate is changed by an actuator, ensuring excellent quality stability on a product-by-product basis while realizing reduction in size.

Solution to Problem

[0009] A variable displacement swash plate type compressor according to the present invention comprises: a housing in which a suction chamber, a discharge chamber, a swash plate chamber, and a cylinder bore are formed; a drive shaft extending along a drive axis and rotatably supported in the housing; a swash plate rotatable in the swash plate chamber along with rotation of the drive shaft; a link mechanism that is provided between the drive shaft and the swash plate and permits change of an inclination angle of the swash plate in a direction perpendicular to the drive axis of the drive shaft; a piston reciprocally accommodated in the cylinder bore; a conversion mechanism that reciprocates the piston in the cylinder bore along with rotation of the swash plate at a stroke corresponding to the inclination angle; an actuator capable of changing the inclination angle; and a control mechanism that controls the actuator,

[0010] wherein the suction chamber and the swash plate chamber communicate with each other,

[0011] the actuator includes a partition body provided on the drive shaft, a movable body that is movable along the drive axis of the drive shaft in the swash plate chamber and provided with a coupling portion to be coupled to the swash plate, and a control pressure chamber that is defined by the partition body and the movable body and moves the movable body by introducing a refrigerant from the discharge chamber, and

[0012] a maximum inclination restriction member that rotates synchronously with the drive shaft and restricts a maximum value of the inclination angle by abutting the movable body is provided on the drive shaft.

[0013] In the compressor according to the present invention, the required control pressure is also set lower than the upper limit of the discharge refrigerant pressure. In this compressor, the movable body of the actuator moves when the refrigerant is introduced into the control pressure chamber from the discharge chamber. Thereby, the inclination angle of the swash plate changes in this compressor. In the compressor, the maximum value of the inclination angle of the swash plate is restricted as the movable body abuts the maximum inclination restriction member. That is, in this compressor, although the movable body and the swash plate are coupled to each other via the coupling portion, the swash plate does not push the link mechanism using the pressure in the control pressure chamber in order to restrict the maximum value of the inclination angle. Consequently, in this compressor, pressure in excess of the required control pressure does not act on the swash plate and the link mechanism, and therefore, it is not necessary to ensure the strength of the swash plate and the link mechanism more than required. Thus, the compressor eliminates the need to upsize the swash plate chamber.

[0014] Also, in the compressor, the maximum value of the inclination angle is restricted by having the movable body abut the maximum inclination restriction member rather than by use of the link mechanism. Consequently, even if the swash plate and the link mechanism have dimensional tolerance and the like in the axial direction of the drive shaft, such tolerance does not cause dispersion in the maximum value of the inclination angle.

[0015] Furthermore, since the maximum inclination restriction member rotates synchronously with the drive shaft, even when the movable body abuts the maximum inclination restriction member, rotation of the movable body and the swash plate is not restricted by the maximum inclination restriction member.

[0016] Thus, the compressor according to the present invention, in which the inclination angle of the swash plate is changed by the actuator, ensures excellent quality stability on a product-by-product basis while realizing reduction in size.

[0017] In the compressor according to the present invention, various members may be employed as the maximum inclination restriction member as long as the members have sufficient strength to endure pressure in excess of the required control pressure and are rotatable synchronously with the drive shaft. Furthermore, for example, a protrusion or the like may be formed on the movable body exclusively for the purpose of abutting the maximum inclination restriction member.

[0018] In the compressor according to the present invention, the drive shaft may include a drive shaft body and a cap that is press-fitted to the drive shaft body and located in the swash plate chamber. It is preferable that the cap is the maximum inclination restriction member. In this case, by having the movable body abut the cap, it is possible to restrict the maximum value of the inclination angle. Furthermore, when the cap is the maximum inclination restriction member, it is possible to adjust a position where the movable body abuts the cap depending on the shape of the cap and the position where the cap is press-fitted to the drive shaft body. Thus, the compressor is able to suitably restrict the maximum value of the inclination angle.

[0019] The compressor according to the present invention may comprise a circlip that is fitted to the drive shaft and located in the swash plate chamber. It is also preferable that the circlip is the maximum inclination restriction member. Also in this case, it is possible to adjust a position where the movable body abuts the circlip depending on the position where the circlip is fitted to the drive shaft body. Thus, this compressor is also able to suitably restrict the maximum value of the inclination angle.

Advantageous Effects of Invention

[0020] The compressor according to the present invention, in which the inclination angle of the swash plate is changed by the actuator, ensures excellent quality stability on a product-by-product basis while realizing reduction in size.

BRIEF DESCRIPTION OF DRAWINGS

[0021] FIG. **1** is a sectional view of a compressor according to Embodiment 1 at the time of maximum displacement.

[0022] FIG. **2** is a schematic diagram showing a control mechanism of the compressor according to Embodiment 1.

[0023] FIG. **3** is a perspective view showing a movable body of the compressor according to Embodiment 1 when viewed from the front.

[0024] FIG. **4** is a sectional view of the compressor according to Embodiment 1 at the time of minimum displacement.

[0025] FIG. **5** is an enlarged sectional view showing principal part of a compressor according to Embodiment 2 at the time of maximum displacement.

DESCRIPTION OF EMBODIMENTS

[0026] Embodiments 1 and 2, which embody the present invention, will be described below with reference to the drawings. The compressors according to Embodiments 1 and 2 are variable displacement double head swash plate type compressors. These compressors are both mounted on vehicles and constitute refrigeration circuits of vehicle air-conditioning apparatus.

Embodiment 1

[0027] As shown in FIG. **1**, a compressor according to Embodiment 1 comprises a housing **1**, a drive shaft **3**, a swash plate **5**, a link mechanism **7**, plural pistons **9**, a pair of shoes **11***a* and **11***b*, and an actuator **13** as well as a control mechanism **15** which is shown in FIG. **2**.

[0028] As shown in FIG. **1**, the housing **1** includes a front housing **17** located at a front position in the compressor, a rear housing **19** located at a rear position in the compressor, first and second cylinder blocks **21** and **23** located between the front housing **17** and the rear housing **19**, and first and second valve forming plates **39** and **41**.

[0029] A boss **17***a*, which protrudes frontward, is formed in the front housing **17**. A shaft seal device **25** is provided in the boss **17***a*. A first suction chamber **27***a* and a first discharge chamber **29***a* are formed in the front housing **17**. The first suction chamber **27***a* is located on an inner peripheral side in the front housing **17**. The first discharge chamber **29***a* is formed into an annular shape and located on an outer peripheral side of the first suction chamber **27***a* in the front housing **17**.

[0030] A first front-side communication passage **18***a* is formed in the front housing **17**. The front end of the first front-side communication passage **18***a* communicates with the first discharge chamber **29***a*, and the rear end thereof opens at the rear end of the front housing **17**.

[0031] The control mechanism **15** described above is provided in the rear housing **19**. Also, a second suction chamber **27***b*, a second discharge chamber **29***b*, and a pressure regulation chamber **31** are formed in the rear housing **19**. The pressure regulation chamber **31** is located in the central part of the rear housing **19**. The second suction chamber **27***b* is formed into an annular shape and located on an outer peripheral side of the pressure regulation chamber **31** in the rear housing **19**. The second discharge chamber **29***b* is also formed into an annular shape and located on an outer peripheral side of the second suction chamber **27***b* in the rear housing **19**.

[0032] A first rear-side communication passage **20***a* is formed in the rear housing **19**. The rear end of the first rear-side communication passage **20***a* communicates with the second discharge chamber **29***b*, and the front end thereof opens at the front end of the rear housing **19**.

[0033] A swash plate chamber **33** is formed between the first cylinder block **21** and the second cylinder block **23**. The swash plate chamber **33** is located at an approximate center in the front-rear direction of the housing **1**.

[0034] Plural first cylinder bores **21***a* are formed parallel to one another at equal angular intervals in a circumferential direction in the first cylinder block **21**. Also, a first shaft hole **21***b* is formed in the first cylinder block **21** to allow the drive shaft **3** to be inserted therethrough. A first sliding bearing **22***a* is provided on the first shaft hole **21***b*. A roller bearing may be provided instead of the first sliding bearing **22***a*.

[0035] The first cylinder block **21** has a first recess **21***c*, which communicates with the first shaft hole **21***b* and is coaxial with the first shaft hole **21***b*. The first recess **21***c* communicates with the swash plate chamber **33** and forms part of the swash plate chamber **33**. The first recess **21***c* is shaped such that its diameter becomes smaller toward the front end in a stepwise manner. A first thrust bearing **35***a* is provided on a front end of the first recess **21***c*. A first connecting passage **37***a* is formed in the first cylinder block **21** to allow the swash plate chamber **33** to communicate with the first suction chamber **27***a*. Also, a first retainer groove **21***e* is provided in the first cylinder block **21** to restrict a maximum opening degree of respective first suction reed valves **391***a* described later.

[0036] A second front-side communication passage **18***b* is formed in the first cylinder block **21**. The front end of the second front-side communication passage **18***b* opens at the front end of the first cylinder block **21**, and the rear end thereof opens at the rear end of the first cylinder block **21**.

[0037] Similarly to the first cylinder block **21**, plural second cylinder bores **23***a* are formed in the second cylinder block **23**. The second cylinder bores **23***a* are respectively paired with the first cylinder bores **21***a* in the front-rear direction. The first cylinder bores **21***a* and the second cylinder bores **23***a* are equal in diameter.

[0038] Also, a second shaft hole **23***b* is formed in the second cylinder block **23** to allow the drive shaft **3** to be inserted therethrough. The rear end of the second shaft hole **23***b* communicates with the pressure regulation chamber **31**. A second sliding bearing **22***b* is provided on the second shaft hole **23***b*. A roller bearing may be provided instead of the second sliding bearing **22***b*.

[0039] The second cylinder block **23** has a second recess **23***c*, which communicates with the second shaft hole **23***b* and is coaxial with the second shaft hole **23***b*. The second recess **23***c* also communicates with the swash plate chamber **33** and forms part of the swash plate chamber **33**. Accordingly, the front end of the second shaft hole **23***b* communicates with the swash plate chamber **33**. The second recess **23***c* is shaped such that its diameter becomes smaller toward the rear end in a stepwise manner. A second thrust bearing **35***b* is provided on the rear end of the second recess **23***c*. A second connecting passage **37***b* is formed in the second cylinder block **23** to allow the swash plate chamber **33** to communicate with the second suction chamber **27***b*. Also, a second retainer groove **23***e* is provided in the second cylinder block **23** to restrict a maximum opening degree of second suction reed valves **411***a* described later.

[0040] The second cylinder block **23** includes an outlet port **230**, a confluence discharge chamber **231**, a third front-side communication passage **18***c*, a second rear-side communication passage **20***b*, and an inlet port **330**. The outlet port **230** and the confluence discharge chamber **231** communicate with each other. Via the outlet port **230**, the confluence discharge chamber **231** is connected to a condenser (not shown) making up a refrigeration circuit.

[0041] The front end of the third front-side communication passage **18***c* opens to the front end of the second cylinder block **23**, and the rear end thereof communicates with the confluence discharge chamber **231**. The third front-side communication passage **18***c* communicates with the rear end of the second front-side communication passage **18***b* when the first cylinder block **21** and the second cylinder block **23** are joined together.

[0042] The front end of the second rear-side communication passage **20***b* communicates with the confluence discharge chamber **231**, and the rear end thereof opens to the rear end of the second cylinder block **23**.

[0043] The inlet port **330** is formed in the second cylinder block **23**. Via the inlet port **330**, the swash plate chamber **33** is connected to an evaporator (not shown) making up the refrigeration circuit.

[0044] The first valve forming plate **39** is provided between the front housing **17** and the first cylinder block **21**. Also, the second valve forming plate **41** is provided between the rear housing **19** and the second cylinder block **23**.

[0045] The first valve forming plate **39** includes a first valve plate **390**, a first suction valve plate **391**, a first discharge valve plate **392**, and a first retainer plate **393**. First suction ports **390***a*, the number of which is equal to the number of the first cylinder bores **21***a*, are formed in the first valve plate **390**, the first discharge valve plate **392**, and the first retainer plate **393**. First discharge ports **390***b*, the number of which is equal to the number of the first cylinder bores **21***a*, are formed in the first valve plate **390** and the first suction valve plate **391**. A first suction communication hole **390***c* is formed in the first valve plate **390**, the first suction valve plate **391**, the first discharge valve plate **392**, and the first retainer plate **393**. A first discharge communication hole **390***d* is formed in the first valve plate **390** and the first suction valve plate **391**.

[0046] The first cylinder bores **21***a* communicate with the first suction chamber **27***a* through the respective first suction ports **390***a*. Also, the first cylinder bores **21***a* communicate with the first discharge chamber **29***a* through the respective first discharge ports **390***b*. The first suction chamber **27***a* communicates with the first connecting passages **37***a* through the first suction communication hole **390***c*. The first front-side communication passage **18***a* communicates with the second front-side communication passage **18***b* through the first discharge communication hole **390***d*.

[0047] The first suction valve plate **391** is provided on the rear face of the first valve plate **390**. The first suction valve plate **391** has the plural first suction reed valves **391***a* which are capable of opening and closing the respective first suction ports **390***a* by elastic deformation. The first discharge valve plate **392** is provided on the front face of the first valve plate **390**. The first discharge valve plate **392** has plural first discharge reed valves **392***a* which are capable of opening and closing the respective first discharge ports **390***b* by elastic deformation. The first retainer plate **393** is provided on the front face of the first discharge valve plate **392**. The first retainer plate **393** restricts a maximum opening degree of the respective first discharge reed valves **392***a*.

[0048] The second valve forming plate **41** includes a second valve plate **410**, a second suction valve plate **411**, a second discharge valve plate **412**, and a second retainer plate **413**. Second suction ports **410***a*, the number of which is equal to the number of the second cylinder bores **23***a*, are formed in the second valve plate **410**, the second discharge valve plate **412**, and the second retainer plate **413**. Second discharge ports **410***b*, the number of which is equal to the number of the second cylinder bores **23***a*, are formed in the second valve plate **410** and the second suction valve plate **411**. A second suction communication hole **410***c* is formed in the second valve plate **410**, the second suction valve plate **411**, the second discharge valve plate **412**, and the second retainer plate **413**. A second discharge communication hole **410***d* is formed in the second valve plate **410** and the second suction valve plate **411**.

[0049] The second cylinder bores **23***a* communicate with the second suction chamber **27***b* through the respective second suction ports **410***a*. Also, the second cylinder bores **23***a* communicate with the second discharge chamber **29***b* through the respective second discharge ports **410***b*. The second suction chamber **27***b* communicates with the second connecting passages **37***b* through the second suction communication hole **410***c*. The first rear-side communication passage **20***a* communicates with the second rear-side communication passage **20***b* through the second discharge communication hole **410***d*.

[0050] The second suction valve plate **411** is provided on the front face of the second valve plate **410**. The second suction valve plate **411** is provided with the plural second suction reed valves **411***a* which are capable of opening and closing the respective second suction ports **410***a* by elastic deformation. Also, the second discharge valve plate **412** is provided on the rear face of the second valve plate **410**. The second discharge valve plate **412** is provided with plural second discharge reed valves **412***a* which are capable of opening and closing the respective second discharge ports **410***b* by elastic deformation. The second retainer plate **413** is provided on the rear face of the second discharge valve plate **412**. The second retainer plate **413** restricts a maximum opening degree of each of the second discharge reed valves **412***a*.

[0051] In the compressor, a first discharge communication passage **18** is formed by the first front-side communication passage **18***a*, the first discharge communication hole **390***d*, the second front-side communication passage **18***b*, and the third front-side communication passage **18***c*. Also, a second discharge communication passage **20** is formed by the first rear-side communication passage **20***a*, the second discharge communication hole **410***d*, and the second rear-side communication passage **20***b*.

[0052] Also, in the compressor, the first and second suction chambers **27***a* and **27***b* and the swash plate chamber **33** communicate with each other via the first and second connecting passages **37***a* and **37***b* and the first and second suction communication holes **390***c* and **410***c*. Consequently, the pressure in the first and second suction chambers **27***a* and **27***b* and the swash plate chamber **33** are substantially equal. Because a low-pressure refrigerant gas which has passed through an evaporator flows into the swash plate chamber **33** through the inlet port **330**, the pressure in the swash plate chamber **33** and the first and second suction chambers **27***a* and **27***b* is lower than the pressure in the first and second discharge chambers **29***a* and **29***b*.

[0053] The drive shaft **3** is made up of a drive shaft body **30** extending along a drive axis O, a first support member **43***a*, and a second support member **43***b*. A first small-diameter portion **30***a* is formed on the front end side of the drive shaft body **30**, and a second small-diameter portion **30***b* is formed on the rear end side of the drive shaft body **30**. The drive shaft body **30** extends rearward from the front side of the housing **1** by being inserted rearward from the boss **17***a* through the first and second sliding bearings **22***a* and **22***b*. Consequently, the drive shaft body **30** and thus the drive shaft **3** are supported by the housing **1** so as to be rotatable around [[a]] the drive axis O. The front end of the drive shaft body **30** is located in the boss **17***a* and the rear end thereof protrudes into the pressure regulation chamber **31**.

[0054] The swash plate **5**, the link mechanism **7**, and the actuator **13** are provided on the drive shaft body **30**. The swash plate **5**, the link mechanism **7**, and the actuator **13** are all disposed in the swash plate chamber **33**.

[0055] The first support member **43***a* is press-fitted to the first small-diameter portion **30***a* of the drive shaft body **30** and located inside of the first sliding bearing **22***a* in the first shaft hole **21***b*. Also, the first support member **43***a* includes a flange **430** configured to abut the first thrust bearing **35***a*, and a mounting portion (not shown) configured to allow a second pin **47***b*, which will be described later, to be inserted therethrough. A front end of a first return spring **44***a* is fixed to the first support member **43***a*. The first return spring **44***a* extends from the first support member **43***a* toward the swash plate chamber **33** along the drive axis O.

[0056] The second support member **43***b* is press-fitted to the rear end of the second small-diameter portion **30***b* of the drive shaft body **30**, and is located in the second shaft hole **23***b*. The second support member **43***b* corresponds to a cap according to the present invention. A flange **431** is formed on the front end of the second support member **43***b*. The flange **431** has a flat-shaped front face **431***a*. The flange **431** protrudes into the second recess **23***c* and abuts the second thrust bearing **35***b*. Also, the rear end of the second support member **43***b* protrudes into the pressure regulation chamber **31**. In the second support member **43***b*, a first slide member **432** and a second slide member **433** made of resin are provided in the rear of the flange **431**. The first and second slide members **432** and **433** are in contact with and slidable along an inner circumferential surface of the second shaft hole **23***b*.

[0057] The second sliding bearing **22***b* is press-fitted into the rear end of the second shaft hole **23***b*. Thereby, the second sliding bearing **22***b* is provided in the second shaft hole **23***b*.

[0058] The swash plate **5** has a flat annular shape and includes a front face **5***a* and a rear face **5***b*. The front face **5***a* faces frontward of the compressor in the swash plate chamber **33**. Also, the rear face **5***b* faces rearward of the compressor in the swash plate chamber **33**.

[0059] The swash plate **5** is fixed to a ring plate **45**. The ring plate **45** has a flat annular shape with an insertion hole **45***a* formed in the center. The swash plate **5** is attached to the drive shaft **3** by inserting the drive shaft body **30** through the insertion hole **45***a* in the swash plate chamber **33**.

[0060] The link mechanism **7** has a lug arm **49**. In the swash plate chamber **33**, the lug arm **49** is placed frontward relative to the swash plate **5** and located between the swash plate **5** and the first support member **43***a*. The lug arm **49** is formed so as to be substantially L-shaped from the front end toward the rear end. As shown in FIG. **4**, the lug arm **49** abuts the flange **430** of the first support member **43***a* when the inclination angle of the swash plate **5** with respect to a direction perpendicular to the drive axis O becomes a minimum. A weight **49***a* is formed at the rear end of the lug arm **49**. The weight **49***a* extends approximately half around a circumference of the actuator **13**. The shape of the weight **49***a* may be designed as appropriate.

[0061] As shown in FIG. **1**, the rear end side of the lug arm **49** is connected to one end side of the ring plate **45** with a first pin **47***a*. When the axis of the first pin **47***a* is defined as a first pivot axis M**1**, the rear end side of the lug arm **49** is supported around the first pivot axis M**1** so as to be pivotable with respect to the one end side of the ring plate **45**, i.e., the swash plate **5**. The first pivot axis M**1** extends in a direction perpendicular to the drive axis O of the drive shaft **3**.

[0062] The front end of the lug arm **49** is connected to the first support member **43***a* via the second pin **47***b*. When the axis of the second pin **47***b* is defined as a second pivot axis M**2**, the front end of the lug arm **49** is supported around the second pivot axis M**2** so as to be pivotable with respect to the first support member **43***a*, i.e., the drive shaft **3**. The second pivot axis M**2** extends parallel to the first pivot axis M**1**. The link mechanism **7** according to the present invention is made up of the lug arm **49**, the first and second pins **47***a* and **47***b*, and, in addition, first and second pulling arms **132** and **133** and a third pin **47***c*, which will be described later.

[0063] The weight **49***a* is provided so as to extend at the rear end of the lug arm **49**, i.e., on the opposite side of the second pivot axis M**2** with reference to the first pivot axis M**1**. As the lug arm **49** is supported by the ring plate **45** with the first pin **47***a*, the weight **49***a* passes through a groove **45***b* in the ring plate **45** and reaches the rear face side of the ring plate **45**, i.e., the side of the rear face **5***b* of the swash plate **5**. Therefore, a centrifugal force produced by rotation of the swash plate **5** around the drive axis O also acts on the weight **49***a* at the side of the rear face **5***b* of the swash plate **5**.

[0064] In this compressor, the swash plate **5** is able to rotate together with the drive shaft **3** as the swash plate **5** is connected to the drive shaft **3** by the link mechanism **7**. Also, the swash plate **5** is able to change its inclination angle due to the pivotal movement of both ends of the lug arm **49** around the first pivot axis M**1** and the second pivot axis M**2**, respectively.

[0065] The pistons **9** each has a first head **9***a* at its front end and a second head **9***b* at its rear end. The first head **9***a* is reciprocally accommodated in each of the first cylinder bores **21***a*. The first head **9***a* and the first valve forming plate **39** define a first compression chamber **21***d* in each of the first cylinder bores **21***a*. The second head **9***b* is reciprocally accommodated in each of the second cylinder bores **23***a*. The second head **9***b* and the second valve forming plate **41** define a second compression chamber **23***d* in each of the second cylinder bores **23***a*.

[0066] An engaging portion **9***c* is formed in the middle of each of the pistons **9**. Hemispherical shoes **11***a* and **11***b* are provided in each of the engaging portions **9***c*. The shoes **11***a* and **11***b* convert rotation of the swash plate **5** into reciprocating movement of the pistons **9**. The shoes **11***a* and **11***b* correspond to a conversion mechanism according to the present invention. Thereby, the first and second heads **9***a*, **9***b* are able to reciprocate in the first and second cylinder bores **21***a*, **23***a* at a stroke corresponding to the inclination angle of the swash plate **5**.

[0067] Here, in the compressor, when the stroke of the pistons **9** changes according to the change in the inclination angle of the swash plate **5**, respective top dead center positions of the first heads **9***a* and the second heads **9***b* move. Specifically, as the inclination angle of the swash plate **5** decreases, the top dead center positions of the first and second heads **9***a* and **9***b* move such that the volume of the second compression chamber **23***d* becomes larger than the volume of the first compression chamber **21***d*.

[0068] As shown in FIG. **1**, the actuator **13** is placed in the swash plate chamber **33**. The actuator **13** is located rearward of the swash plate **5** in the swash plate chamber **33** and capable of advancing into the second recess **23***c*. The actuator **13** includes a movable body **13***a*, a partition body **13***b*, and a control pressure chamber **13***c*. The control pressure chamber **13***c* is formed between the movable body **13***a* and the partition body **13***b*.

[0069] As shown in FIG. **3**, the movable body **13***a* includes a rear wall **130**, a circumferential wall **131**, a first pulling arm **132**, and a second pulling arm **133**. The rear wall **130** is located at a rear position in the movable body **13***a* and extends radially in a direction away from the drive axis O. The rear wall **130** has an insertion hole **130***a* through which the second small-diameter portion **30***b* of the drive shaft body **30** is inserted. The circumferential wall **131** continues from an outer circumferential edge of the rear wall **130** and extends frontward in the movable body **13***a*.

[0070] Both of the first pulling arm **132** and the second pulling arm **133** are formed at the front end of the circumferential wall **131**. The first pulling arm **132** and second pulling arm **133** of the circumferential wall **131** are placed so as to face each other across the drive axis O and protrude frontward in the movable body **13***a*. These first and second pulling arms **132** and **133** correspond to a coupling portion according to the present invention. A first pin hole **132***a* and a second pin hole **133***a* are bored through the first pulling arm **132** and the second pulling arm **133**, respectively. The movable body **13***a* is formed into a bottomed cylindrical shape by the rear wall **130**, the circumferential wall **131**, and the first and second pulling arms **132** and **133**.

[0071] As shown in FIG. **1**, the partition body **13***b* is formed into a disk shape having a diameter that is substantially equal to the inside diameter of the movable body **13***a*. A second return spring **44***b* is provided between the partition body **13***b* and the ring plate **45**. Specifically, the rear end of the second return spring **44***b* is fixed to the partition body **13***b* and the front end of the second return spring **44***b* is fixed to the opposite end side of the ring plate **45**.

[0072] The second small-diameter portion **30***b* of the drive shaft body **30** is inserted through the movable body **13***a* and the partition body **13***b*. The movable body **13***a* is accommodated in the second recess **23***c* and faces the link mechanism **7** across the swash plate **5**. The partition body **13***b* is placed in the movable body **13***a* at a position rearward of the swash plate **5**, and its periphery is surrounded by the circumferential wall **131**. Consequently, the control pressure chamber **13***c* is formed between the movable body **13***a* and the partition body **13***b*. The control pressure chamber **13***c* is separated from the swash plate chamber **33** by the rear wall **130** and the circumferential wall **131** of the movable body **13***a* and the partition body **13***b*.

[0073] In the compressor, a required control pressure, which is the pressure in the control pressure chamber **13***c* required to increase the inclination angle of the swash plate **5**

to a maximum value, is preset to the control pressure chamber **13***c*. The required control pressure is set lower than the upper limit of the discharge refrigerant pressure, i.e., the upper limit of the pressure of refrigerant gas in the first discharge chamber **29***a* and the second discharge chamber **29***b*.

[0074] In the compressor, due to the insertion of the second small-diameter portion **30***b*, the movable body **13***a* is able to rotate together with the drive shaft **3** and move along the drive axis O of the drive shaft **3** in the swash plate chamber **33**. On the other hand, the partition body **13***b* is fixed to the second small-diameter portion **30***b* in the state that the second small-diameter portion **30***b* has been inserted therethrough. The partition body **13***b* is thus only able to rotate together with the drive shaft **3**, and not able to move in the same manner as the movable body **13***a*. As a result, the movable body **13***a* moves along the drive axis O relative to the partition body **13***b*. The partition body **13***b* may be provided on the drive shaft body **30** so as to be movable along the drive axis O.

[0075] The first and second pulling arms **132** and **133** are connected with the opposite end side of the ring plate **45** by the third pin **47***c*. The third pin **47***c* extends from the first pin hole **132***a*, which is shown in FIG. **3**, to the second pin hole **133***a* through the opposite end side of the ring plate **45**. As shown in FIG. **1**, when the axis of the third pin **47***c* is defined as an action axis M**3**, the opposite end side of the ring plate **45**, i.e., the swash plate **5** is supported by the movable body **13***a* so as to be pivotable around the action axis M**3**. The action axis M**3** extends parallel to the first and second pivot axes M**1** and M**2**. The movable body **13***a* is thus coupled to the swash plate **5**.

[0076] The second small-diameter portion **30***b* has an axial path **3***a*, which extends frontward from the rear end along the drive axis O, and a radial path **3***b*, which extends in a radial direction from the front end of the axial path **3***a* and opens in an outer circumferential surface of the drive shaft body **30**. The rear end of the axial path **3***a* opens to the pressure regulation chamber **31**. The radial path **3***b* opens to the control pressure chamber **13***c*. The control pressure chamber **13***c* thus communicates with the pressure regulation chamber **31** through the radial path **3***b* and the axial path **3***a*.

[0077] A threaded portion **3***d* is formed on a tip end of the drive shaft body **30**. Via the threaded portion **3***d*, the drive shaft **3** is connected to a pulley or an electro-magnetic clutch (not shown).

[0078] As shown in FIG. **2**, the control mechanism **15** includes a low-pressure passage **15***a*, a high-pressure passage **15***b*, a control valve **15***c*, an orifice **15***d*, the axial path **3***a*, and the radial path **3***b*.

[0079] The low-pressure passage **15***a* is connected to the pressure regulation chamber **31** and the second suction chamber **27***b*. Through the low-pressure passage **15***a*, the axial path **3***a*, and the radial path **3***b*, the control pressure chamber **13***c*, the pressure regulation chamber **31**, and the second suction chamber **27***b* communicate with one another. The high-pressure passage **15***b* is connected to the pressure regulation chamber **31** and the second discharge chamber **29***b*. Through the high-pressure passage **15***b*, the axial path **3***a*, and the radial path **3***b*, the control pressure chamber **13***c*, the pressure regulation chamber **31**, and the second discharge chamber **29***b* communicate with one another. The orifice **15***d* is provided in the high-pressure passage **15***b*.

[0080] The control valve **15***c* is provided on the low-pressure passage **15***a*. The control valve **15***c* is able to adjust an opening degree of the low-pressure passage **15***a* based on the pressure in the second suction chamber **27***b*.

[0081] In the compressor, the inlet port **330** shown in FIG. **1** is connected with a pipe leading to the evaporator while the outlet port **230** is connected with a pipe leading to the condenser. The condenser is connected to the evaporator through a pipe and an expansion valve. The compressor, the evaporator, the expansion valve, the condenser, etc. make up the refrigeration circuit of vehicle air-conditioning apparatus. Illustration of the evaporator, the expansion valve, the condenser, and the pipes is omitted.

[0082] In the compressor configured as described above, by rotation of the drive shaft **3**, the swash plate **5** rotates and the pistons **9** reciprocate in the first and second cylinder bores **21***a* and **23***a*. Thereby, the first and second compression chambers **21***d* and **23***d* change their volumes according to the piston stroke. In the compressor, a suction phase for sucking refrigerant gas into the first and second compression chambers **21***d* and **23***d*, a compression phase for compressing the refrigerant gas in the first and second compression chambers **21***d* and **23***d*, and a discharge phase for discharging the compressed refrigerant gas into the first and second discharge chambers **29***a* and **29***b* take place repeatedly.

[0083] The refrigerant gas discharged into the first discharge chamber **29***a* passes through the first discharge communication passage **18** and reaches the confluence discharge chamber **231**. Similarly, the refrigerant gas discharged into the second discharge chamber **29***b* passes through the second discharge communication passage **20** and reaches the confluence discharge chamber **231**. After reaching the confluence discharge chamber **231**, the refrigerant gas is discharged to the condenser through the outlet port **230**.

[0084] While these suction phase and so forth take place, a piston compression force to reduce the inclination angle of the swash plate **5** is applied to a rotational body, which is made up of the swash plate **5**, the ring plate **45**, the lug arm **49**, and the first pin **47***a*. When the inclination angle of the swash plate **5** is changed, the stroke of the pistons **9** increases or decreases, and thereby, it is possible to control the displacement.

[0085] Specifically, when the control valve **15***c*, which is shown in FIG. **2**, of the control mechanism **15** increases the opening degree of the low-pressure passage **15***a*, the pressure in the pressure regulation chamber **31**, and thus the pressure in the control pressure chamber **13***c* become substantially equal to the pressure in the second suction chamber **27***b*. Due to the piston compression force acting on the swash plate **5**, the movable body **13***a* of actuator **13** moves frontward in the swash plate chamber **33** as shown in FIG. **4**.

[0086] Consequently, in the compressor, the movable body **13***a* pushes the swash plate **5** at the opposite end side frontward in the swash plate chamber **33** at the action axis M**3** via the first and second pulling arms **132** and **133**. Thus, in the compressor, the opposite end side of the ring plate **45**, in other words, the opposite end side of the swash plate **5**, pivots clockwise around the action axis M**3** against a biasing force of the second return spring **44***b*. Also, the rear end of the lug arm **49** pivots counterclockwise around the first pivot axis M**1** and the front end of the lug arm **49** pivots counterclockwise around the second pivot axis M**2**. The lug arm **49** comes close to the flange **430** of the first support member **43***a*. Thereby, the swash plate **5** pivots using the action axis M**3** as a point of action and using the first pivot axis M**1** as a fulcrum. This reduces the inclination angle of the swash plate **5** with respect to the direction perpendicular to the drive axis O of the drive shaft **3** and decreases the stroke of the pistons **9**. Therefore, discharge capacity of the compressor per rotation of the drive shaft **3** decreases. The inclination angle of the swash plate **5** shown in FIG. **4** is the minimum value in this compressor.

[0087] Here, in this compressor, the centrifugal force acting on the weight **49***a* is also applied to the swash plate **5**. Thus, the swash plate **5** of this compressor is easily displaced toward a direction of reducing the inclination angle.

[0088] When the inclination angle of the swash plate **5** decreases, the ring plate **45** abuts the rear end of the first return spring **44***a*. The first return spring **44***a* thus deforms elastically and the rear end of the first return spring **44***a* comes close to the first support member **43***a*.

[0089] In this compressor, as the inclination angle of the swash plate **5** becomes smaller and the stroke of the pistons **9** decreases, the top dead center position of the second heads **9***b* moves away from the second valve forming plate **41**. Thus, in the compressor, when the inclination angle of the swash plate **5** approaches 0 degrees, compression work is performed slightly in the first compression chamber **21***d*, whereas compression work is not performed in the second compression chamber **23***d*.

[0090] When the control valve **15***c* shown in FIG. **2** reduces the opening degree of the low-pressure passage **15***a*, the pressure in the pressure regulation chamber **31** increases due to the pressure of the refrigerant gas in the second discharge chamber **29***b*, and thereby the pressure in the control pressure chamber **13***c* increases. Thus, the movable body **13***a* of the actuator **13** moves in a rearward in the swash plate chamber **33**, i.e., toward the flange **431** of the second support member **43***b*, as shown in FIG. **1**, against the piston compression force acting on the swash plate **5**.

[0091] Consequently, in the compressor, the movable body **13***a* pulls the opposite end side of the swash plate **5** rearward in the swash plate chamber **33** at the action axis M3 via the first and second pulling arms **132** and **133**. Thus, in the compressor, the opposite end side of the swash plate **5** pivots counterclockwise around the action axis M3. Also, the rear side of the lug arm **49** pivots clockwise around the first pivot axis M1 and the front end of the lug arm **49** pivots clockwise around the second pivot axis M2. The lug arm **49** moves away from the flange **430** of the first support member **43***a*. Thereby, the swash plate **5** pivots in a direction opposite to the above-described direction in the case of reducing the inclination angle, using the action axis M3 as a point of action and using the first pivot axis M1 as a fulcrum. This increases the inclination angle of the swash plate **5** with respect to the direction perpendicular to the drive axis O of the drive shaft **3**.

[0092] Here, in the compressor, the movable body **13***a* moves towards the flange **431** and pulls the opposite end side of the swash plate **5** rearward in the swash plate chamber **33** via the first and second pulling arms **132** and **133** until the pressure in the control pressure chamber **13***c* reaches the required control pressure. Thus, the link mechanism **7** permits increase of the inclination angle of the swash plate **5** until it reaches the maximum value. The discharge capacity of the compressor per rotation of the drive shaft **3** increases as the stroke of the pistons **9** increases. When the pressure in the control pressure chamber **13***c* reaches the required control pressure, the inclination angle of the swash plate **5** reaches the maximum value as shown in FIG. **1**.

[0093] In the compressor, while the required control pressure of the control pressure chamber **13***c* is set lower than the upper limit of the discharge refrigerant pressure as described above, the refrigerant gas is introduced into the control pressure chamber **13***c* from the second discharge chamber **29***b* through the high-pressure passage **15***b* and the like. Therefore, in the compressor, even after the inclination angle of the swash plate **5** reaches the maximum value as described above, the pressure in the control pressure chamber **13***c* continues to increase beyond the required control pressure.

[0094] In this regard, in the compressor, when the pressure in the control pressure chamber **13***c* increases and reaches the required control pressure, the movable body **13***a* moves rearward in the swash plate chamber **33** and the rear wall **130** abuts the front face **431***a* of the flange **431**. This allows the compressor to restrict the maximum value of the inclination angle of the swash plate **5**. That is, in this compressor, although the movable body **13***a* and the swash plate **5** are coupled to each other via the first and second pulling arms **132** and **133**, for restricting the maximum value of the inclination angle, the swash plate **5** does not push the lug arm **49** of the link mechanism **7** due to the pressure in the control pressure chamber **13***c*. In this compressor, the pressure in excess of the required control pressure acts on the flange **431** and thus on the second support member **43***b*, but does not act on the swash plate **5** or the lug arm **49** of the link mechanism **7** via the first and second pulling arms **132** and **133**. Therefore, it is not necessary in this compressor to ensure the strength of the swash plate **5** and the lug arm **49** more than required. Thus, the compressor eliminates the need to upsize the swash plate chamber **33**.

[0095] In the compressor, the maximum value of the inclination angle is restricted by the rear wall **130** of the movable body **13***a* and the flange **431** abutting each other, not by the link mechanism **7**. Therefore, in the compressor, even if the swash plate **5** and the link mechanism **7** have dimensional tolerance and the like in the direction of the drive axis O, such tolerance does not cause dispersion in the maximum value of the inclination angle.

[0096] In the compressor, since the second support member **43***b* is press-fitted to the drive shaft body **30**, the second support member **43***b* including the flange **431** rotates synchronously with the drive shaft body **30**. Therefore, in the compressor, even when the rear wall **130** abuts the flange **431**, the rotation of the movable body **13***a* and even the swash plate **5** is not restricted by the flange **431**.

[0097] Therefore, the compressor according to Embodiment 1, in which the inclination angle of the swash plate **5** is changed by the actuator **13**, ensures excellent quality stability on a product-by-product basis while realizing reduction in size.

[0098] In particular, in this compressor, the maximum value of the inclination angle is restricted by having the flange **431** of the second support member **43***b* abut the rear wall **130** of the movable body **13***a*. Therefore, in this compressor, it is possible to adjust the position where the rear wall **130** abuts the flange **431** depending on the thickness of the flange **431** and the shape of the second support member **43***b* by itself. Furthermore, in this compressor, it is also possible to adjust the position where the rear wall **130** abuts the flange **431** depending on the position where the second support member **43***b* is press-fitted to the second small-diameter portion **30***b* of the drive shaft body **30**. Thus, the compressor is capable of suitably restricting the maximum value of the inclination angle.

Embodiment 2

[0099] In the compressor according to Embodiment 2, as shown in FIG. **5**, a circlip **51** is fitted to the second small-diameter portion **30***b* of the drive shaft body **30**. More specifically, the circlip **51** is fitted to the second small-diameter portion **30***b* at a position between the second support member **43***b* and the movable body **13***a*. Thereby, the circlip **51** is located in the second recess **23***c*, i.e., in the swash plate chamber **33**. The shape of the circlip **51** may be designed as appropriate. For ease of explanation, illustration of the pistons **9**, the shoes **11***a* and **11***b* and the like are omitted in this figure. The other components of the compressor are the same as those of the compressor according to Embodiment 1, and, with respect to the same components, same reference numerals are used and detailed description thereof is omitted.

[0100] In this compressor, when the pressure in the control pressure chamber **13***c* increases and reaches the required control pressure, the rear wall **130** of the movable body **13***a* which has moved rearward in the swash plate chamber **33** abuts the circlip **51**. This allows the compressor to restrict the maximum value of the inclination angle of the swash plate **5** without having the swash plate **5** push the link mechanism **7**.

[0101] Also, in the compressor, it is possible to adjust the position at which the rear wall **130** abuts the circlip **51** depending on the position where the circlip **51** is press-fitted to the second small-diameter portion **30***b*. Thus, the maximum value of the inclination angle can be suitably restricted in this compressor. The other operations of this compressor are the same as those of the compressor according to Embodiment 1.

[0102] Although present invention has been described above by referring to Embodiments 1 and 2, needless to say, the present invention is not limited to Embodiments 1 and 2 described above and may be modified and applied as appropriate without departing from the gist of the present invention.

[0103] For example, a protrusion may be provided on the rear wall **130** of the movable body **13***a* exclusively for the purpose of abutting the flange **431** or the circlip **51**. Also, the protrusion may be configured to be able to abut the second thrust bearing **35***b*. In this case, the second thrust bearing **35***b* corresponds to the maximum inclination restriction member according to the present invention.

[0104] Furthermore, the compressor may be configured as a variable displacement single head swash plate type compressor by forming cylinder bores only in either of the first cylinder block **21** and second the cylinder block **23**.

[0105] Also, the control mechanism **15** may be configured such that the control valve **15***c* is provided in the high-pressure passage **15***b* while the orifice **15***d* is provided in the low-pressure passage **15***a*. In this case, it is possible to adjust the opening degree of the high-pressure passage **15***b* using the control valve **15***c*. Thereby, the pressure in the control pressure chamber **13***c* can be increased quickly due to the pressure of refrigerant gas in the second discharge chamber **29***b*, and the discharge capacity can be increased quickly.

INDUSTRIAL APPLICABILITY

[0106] The present invention is applicable to air-conditioning apparatus and the like.

REFERENCE SIGNS LIST

[0107] **1** Housing

[0108] **3** Drive shaft

[0109] **5** Swash plate

[0110] **7** Link mechanism

[0111] **9** Piston

[0112] **11***a*, **11***b* Shoe (conversion mechanism)

[0113] **13** Actuator

[0114] **13***a* Movable body

[0115] **13***b* Partition body

[0116] **13***c* Control pressure chamber

[0117] **15** Control mechanism

[0118] **21***a* First cylinder bore

[0119] **21***d* First compression chamber

[0120] **23***a* Second cylinder bore

[0121] **23***d* Second compression chamber

[0122] **27***a* First suction chamber

[0123] **27***b* Second suction chamber

[0124] **29***a* First discharge chamber

[0125] **29***b* Second discharge chamber

[0126] **33** Swash elate chamber

[0127] **43***b* Second support member (maximum inclination restriction member, cap)

[0128] **51** Circlip (maximum inclination restriction member)

[0129] **130** Rear wall (movable body)

[0130] **131** Circumferential wall (movable body)

[0131] **132** First pulling arm (coupling portion)

[0132] **133** Second pulling arm (coupling portion)

[0133] O Drive axis

1. A variable displacement swash plate type compressor comprising:

a housing in which a suction chamber, a discharge chamber, a swash plate chamber, and a cylinder bore are formed;

a drive shaft extending along a drive axis and rotatably supported in the housing;

a swash plate rotatable in the swash plate chamber along with rotation of the drive shaft;

a link mechanism that is provided between the drive shaft and the swash plate and permits change of an inclination angle of the swash plate in a direction perpendicular to the drive axis of the drive shaft;

a piston reciprocally accommodated in the cylinder bore; a conversion mechanism that reciprocates the piston in the cylinder bore along with rotation of the swash plate at a stroke corresponding to the inclination angle; an actuator capable of changing the inclination angle; and

a control mechanism that controls the actuator, wherein

the suction chamber and the swash plate chamber communicate with each other,

the actuator includes a partition body provided on the drive shaft, a movable body that is movable along the drive axis of the drive shaft in the swash plate chamber and provided with a coupling portion to be coupled to the swash plate, and a control pressure chamber that is defined by the partition body and the movable body and moves the movable body by introducing a refrigerant from the discharge chamber, and

a maximum inclination restriction member that rotates synchronously with the drive shaft and restricts a maximum value of the inclination angle by abutting the movable body is provided on the drive shaft.

2. The variable displacement swash plate type compressor according to claim **1**, wherein:

the drive shaft includes a drive shaft body and a cap that is press-fitted to the drive shaft body and located in the swash plate chamber; and

the cap is the maximum inclination restriction member.

3. The variable displacement swash plate type compressor according to claim **1**, wherein:

the compressor further comprises a circlip that is fitted to the drive shaft and located in the swash plate chamber; and

the circlip is the maximum inclination restriction member.

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