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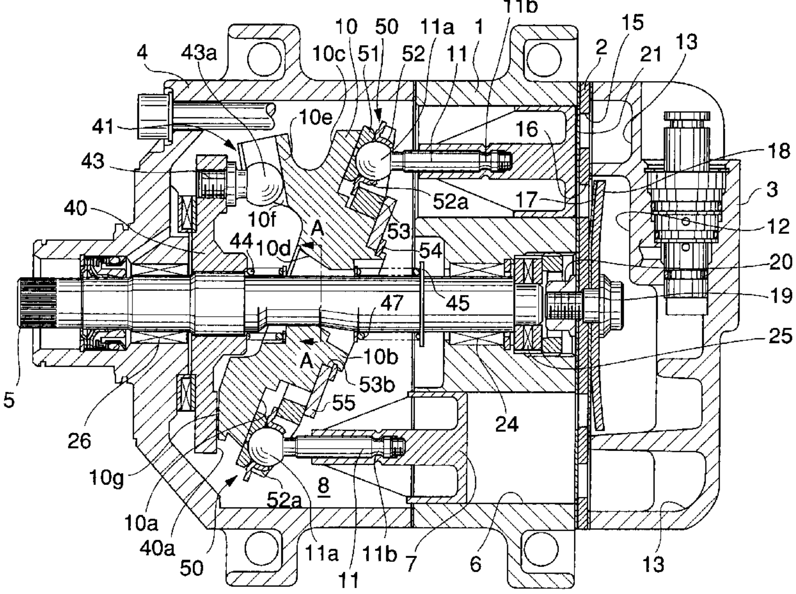
(54) **Variable capacity swash plate compressor**

(57) A swash plate (10) of a variable capacity swash plate is formed with a central through hole (10d) and is axially movably mounted on a drive shaft (5) via an inner peripheral surface of the central through hole (10d). The swash plate (10) is tiltably connected to a rotatable member (40) rigidly fitted on the drive shaft (5) for rotation in unison therewith, such that the swash plate (10) can rotate in unison with the drive shaft (5) as the latter rotates. A plurality of pistons (7) are slidably received in respective cylinder bores (6) axially formed through a cylinder block (1). A plurality of shoes (50) are connected to respective pistons (7) and are relatively rotatable on a sliding surface (10a) of the swash plate (10) with respect thereto as the drive shaft (5) rotates, to convert rotation of the swash plate (10) about the drive shaft (5) into axial reciprocating motion of each piston (7). The amount of stroke of each piston (7) changes according to an inclination of the swash plate (10). The drive shaft (5) is formed with a recess (70) for shifting the rotational axis of the swash plate (10) toward a top dead centre position side when the amount of stroke of each piston (7) becomes a maximum.

FIG.3



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a variable capacity swash plate compressor, and more particularly to a variable capacity swash plate compressor having a construction which is capable of reducing pressure acting on a shoe corresponding to a piston at its top dead center position when the compressor is in a maximum piston-stroke condition.

Description of the Prior Art

FIGS. 1 and 2 show the whole arrangement of a conventional variable capacity swash plate compressor. FIG. 1 shows the compressor in a maximum piston-stroke condition, while FIG. 2. shows the compressor in a minimum piston-stroke condition.

The conventional variable capacity swash plate compressor includes a drive shaft 105, a thrust flange 140 rigidly fitted on the drive shaft 105, for rotation in unison with the drive shaft 105, a swash plate 110 which is axially movably mounted on the drive shaft 105 and connected to the thrust flange 140 via a linkage 141, for rotation in unison with the thrust flange 140, a plurality of pistons 107 slidably received in a plurality of cylinder bores 106 respectively, a plurality of shoes 150 arranged on a sliding surface 110a of the swash plate 110, for relative rotation with respect to the swash plate 110 according to the rotation of the drive shaft 105, a retainer 153 retaining the shoes 150, and a plurality of connecting rods 111.

Each connecting rod 111 has one end portion, spherical in shape, slidably held in a corresponding one of the shoes 150, for relative rotation with respect to a corresponding one of the shoes 150, and the other end portion secured to the piston 107.

Torque of an engine, not shown, installed on an automotive vehicle, not shown, is transmitted to the drive shaft 105 to rotate the same. The torque of the drive shaft 105 is transmitted from the thrust flange 140 to the swash plate 110 via the linkage 141 to cause rotation of the swash plate 110.

The rotation of the swash plate 110 causes relative rotation of the shoe 150 on the sliding surface 110a of the swash plate 110 with respect to the swash plate 110, whereby the torque transmitted from the swash plate 110 is converted into reciprocating motion of the piston 107. As the piston 107 reciprocates within the cylinder bore 106, the volume of a compression chamber within the cylinder bore 106 changes, whereby suction, compression and delivery of refrigerant gas are carried out sequentially.

The inclination (angle with respect to an imaginary plane perpendicular to the drive shaft 105) of the swash plate 110 varies with pressure within a crankcase 108 in which the swash plate 110 is received, so that high-pressure refrigerant gas is delivered in an amount or volume corresponding to an inclination of the swash plate 110. More specifically, as the pressure within the crankcase 108 decreases, the inclination of the swash plate 110 becomes larger, and when a portion 110g of the swash plate 110 abuts on the thrust flange 140 as shown in FIG. 1, the amount of stroke of each piston 107 becomes maximum, whereby the capacity or delivery quantity of the compressor becomes maximum.

On the other hand, as the pressure within the crankcase 108 increases, the inclination of the swash plate 110 becomes smaller, and when the portion 110g of the swash plate 110 moves to a position most distant from the thrust flange 140 as shown in FIG. 2, the amount of stroke of each piston 107 becomes minimum, whereby the capacity or delivery quantity or the compressor becomes minimum.

In the conventional variable capacity swash plate compressor, however, since an outermost peripheral end of the swash plate 110 becomes closer to the drive shaft 105 as the inclination of the swash plate 110 increases according to changes in the pressure within the crankcase 108, a shoe 150 at a top dead center position portion of the swash plate 110 (i.e. a shoe 150 corresponding to a piston 107 at its top dead center position) relatively shifts radially outward on the swash plate 110 with respect to the swash plate 110 in accordance with the increase of the inclination of the swash plate 110. As a result, when the inclination of the swash plate 110 becomes maximum, a contact area between the swash plate 110 and the shoe 150 becomes minimum, whereby pressure or force acting on a portion of the shoe 150 (during a compression stroke of the piston 107) in contact with the swash plate 110 is increased, which causes sliding contact portions of the shoe 150 and the swash plate 110 (particularly, the sliding contact portion of the latter) to wear in an accelerated manner.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a variable capacity swash plate compressor having a construction which is capable of reducing pressure acting on each shoe when the compressor is in a maximum piston-stroke condition, to thereby reduce abrasion of sliding contact portions of a swash plate and the shoe.

To attain the above object, the present invention provides a variable capacity swash plate compressor including a drive shaft, a rotating member rigidly fitted on the drive shaft, for rotation in unison with the drive shaft, a swash plate having a central through hole formed therethrough, the swash plate being axially movably mounted on the drive shaft via an inner peripheral surface of the central through hole and tiltably connected to the rotating member, the swash plate having a sliding surface and rotating in unison with the rotating member as the rotating member rotates, a cylinder block, a plurality of cylinder bores axially formed through the cylinder block, a plurality of pistons slidably received in the cylinder bores, respectively, and a plurality of shoes connected to the pistons, respectively, and each arranged on the sliding surface of the swash plate for relative rotation with respect to the swash plate as the drive shaft rotates, to convert rotation of the swash plate about the drive shaft into axial reciprocating motion of each of the pistons, wherein an amount of stroke of the each of the pistons changes according to an inclination of the swash plate.

The variable capacity swash plate compressor is characterized in that the drive shaft is formed with a recess for shifting a rotation axis of the swash plate toward a top dead center position side when the amount of stroke of the each of the pistons becomes maximum.

According to the variable capacity swash plate compressor of the invention, when the compressor enters the maximum piston-stroke condition, the rotation axis of the swash plate is shifted toward the top dead center position side. Therefore, it is possible to maintain a large contact area between the shoe corresponding to each piston at its top dead center position and the sliding surface of the swash plate, which makes it possible to prevent pressure acting on a unit area of a portion of each shoe in sliding contact with the swash plate from increasing, and reduce abrasion of the sliding contact portion of each shoe and a portion of the swash plate in sliding contact therewith.

Preferably, the recess is formed in a bottom dead center-side half portion of an intermediate portion of the drive shaft in an axially extending manner.

According to this preferred embodiment, it is possible to positively shift the rotation axis of the swash plate toward the top dead center position side when the compressor enters the maximum piston-stroke condition.

Preferably, the recess of the drive shaft has a curved bottom surface having a predetermined radius of curvature, the inner peripheral surface of the central through hole of the swash plate having a portion having a curved surface engageable with the recess.

According to this preferred embodiment, the swash plate and the drive shaft are in stable engagement with each other.

Further preferably, the drive shaft is formed with a sloped guide surface which continues from the recess to a uniform radius portion of the drive shaft, for guiding the curved surface of the portion of the inner peripheral surface of the central through hole of the swash plate.

According to this preferred embodiment, it is possible to smoothly shift the central portion of the swash plate from the recess corresponding to maximum piston stroke (top dead center side position) to a uniform radius portion of the swash plate corresponding to minimum piston stroke (bottom dead center side position), or vice versa.

Alternatively, the recess of the drive shaft has a flat bottom surface, the inner peripheral surface of the central through hole of the swash plate having a portion having a flat surface for being brought into surface contact with the flat bottom surface of the recess.

According to this preferred embodiment, similarly to one of the above-mentioned preferred embodiments, the swash plate and the drive shaft are in stable engagement with each other.

Further preferably, the drive shaft is formed with a sloped guide surface which continues from the recess to a uniform radius portion of the drive shaft, for guiding the flat surface of the portion of the inner peripheral surface of the central through hole of the swash plate.

According to this preferred embodiment, similarly to one of the above-mentioned preferred embodiments, it is possible to smoothly shift the central portion of the swash plate from the recess corresponding to maximum piston stroke (top dead center side position) to a uniform radius portion of the swash plate corresponding to minimum piston stroke (bottom dead center side position), or vice versa.

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description taken in conjunction with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view showing the whole arrangement of a conventional variable capacity swash plate compressor in a maximum piston-stroke condition;

FIG. 2 is a longitudinal cross-sectional view showing the whole arrangement of the FIG. 1 variable capacity swash plate compressor in a minimum piston-stroke condition;

FIG. 3 is a longitudinal cross-sectional view showing the whole arrangement of a variable capacity swash plate compressor according to a first embodiment of the invention, in a maximum piston-stroke condition;

FIG. 4 is a longitudinal cross-sectional view showing the whole arrangement of the FIG. 3 variable capacity swash plate compressor in a minimum piston-stroke condition;

FIG. 5A is a sectional view taken on line A-A of FIG. 3;

FIG. 5B is a sectional view taken on line B-B of FIG. 4; and

FIGS 6A and 6B are sectional views which are useful in explaining a variable capacity swash plate compressor according to a second embodiment of the invention, in which:

FIG. 6A shows the relationship between a drive shaft and an inner peripheral surface of a central hole formed through a swash plate, in a maximum piston-stroke condition of the compressor; and

FIG. 6B shows the relationship between the drive shaft and the inner peripheral surface of the central hole formed through the swash plate, in a minimum piston-stroke condition of the compressor.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be described in detail with reference to drawings showing preferred embodiments thereof.

Referring first to FIG. 3, there is shown the whole arrangement of a variable capacity swash plate compressor according to a first embodiment of the invention.

The variable capacity swash plate compressor has a cylinder block 1 having one end thereof secured to a rear head 3 via a valve plate 2 and the other end thereof secured to a front head 4. The cylinder block 1 has a plurality of cylinder bores 6 axially formed therethrough at predetermined circumferential intervals about a drive shaft 5. Each cylinder bore 6 has a piston 7 slidably received therein.

Within the front head 4, there is formed a crankcase 8. The crankcase 8 has a swash plate 10 received therein, which rotates in unison with the drive shaft 5. A plurality of shoes 50 are each retained on a sliding surface 10a of the swash plate 10 by a retainer 53. Connecting rods 11 each have one end 11a, spherical in shape, relatively rotatably connected to a corresponding one of the shoes 50 and the other end 11b thereof secured to the piston 7 corresponding thereto.

As the swash plate 10 rotates, each piston 7 reciprocates within the cylinder bore 6. The inclination of the swash plate 10 varies with pressure within the crankcase 8.

Each shoe 50 is comprised of a first support member 51 for slidably supporting a front-side surface of the one end lla, spherical in shape, of the connecting rod 11 such that the one end 11a of the connecting rod 11 is relatively rotatable with respect to the first support member 51, and a second support member 52 for slidably supporting or retaining a rear-side surface of the one end 11a of the same such that rear-side surface of the one end 11a of the connecting rod 11 is relatively rotatable with respect to the second support member 52.

The retainer 53 is formed with a central through hole 53b in which is fitted a boss 10b of the swash plate 10. Further, the retainer 53 has its outer peripheral portion formed with a plurality of holes, not shown, along the circumference thereof through each of which a protruding portion 52a of the second support member 52 of a corresponding one of the shoes 50 protrudes toward the piston 7. The retainer 53 is mounted on the boss 10b of the swash plate 10 in a manner relatively rotatably supported or held by an annular retainer support plate 55 which is fixed to the boss 10b of the swash plate 10 by a snap ring 54.

Within the rear head 3, there are formed a discharge chamber 12 and a suction chamber 13 surrounding the discharge chamber 12.

The valve plate 2 is formed with refrigerant outlet ports 16 for respectively connecting the cylinder bores 6 with the discharge chamber 12 and refrigerant inlet ports 15 for respectively connecting the cylinder bores 6 with the suction chamber 13. The refrigerant outlet ports 16 and the refrigerant inlet ports 15 are arranged at predetermined circumferential intervals, respectively, about the drive shaft 5. Each refrigerant outlet port 16 is opened and closed by a discharge valve 17. The discharge valve 17 is fixed to a rear head-side end face of the valve plate 2 by a bolt 19 and nut 20 together with a valve stopper 18.

On the other hand, each refrigerant inlet port 15 is opened and closed by a suction valve 21 arranged between a front-side end face of the valve plate 2 and the cylinder block 1. The bolt 19 has a guide hole, not shown, for guiding high-pressure refrigerant gas from the discharge chamber 12 to a radial bearing 24 and a thrust bearing 25.

The radial bearing 24 and the thrust bearing 25 are arranged in the cylinder block 1 for rotatably supporting a rear-side end of the drive shaft 5, while a radial bearing 26 is arranged in the front head 4 for rotatably supporting a front-side end of the drive shaft 5.

Further, a communication passage 60 is formed for communication between the suction chamber 13 and the crankcase 8. Arranged at an intermediate portion of the communication passage is a pressure control valve 61.

The drive shaft 5 has a thrust flange (rotating member) 40 rigidly fitted on a front-side portion thereof for transmitting torque of the drive shaft 5 to the swash plate 10. The thrust flange 40 is rotatably supported on an inner wall of the front head 4 by a thrust bearing 33. The thrust flange 40 and the swash plate 10 are connected with each other via a linkage 41. The swash plate 10 can tilt with respect to an imaginary plane perpendicular to the drive shaft 5.

The linkage 41 is comprised of a bracket 10e formed on a front-side surface 10c of the swash plate 10, a linear guide slot 10f formed in the bracket 10e, and a rod 43 secured to a swash plate-side surface 40a of the thrust flange 40 by a screw. A longitudinal axis of the guide slot 10f is tilted through a predetermined angle with respect to the front-side surface 10c of the swash plate 10. A spherical portion 43a of the rod 43 is slidably engaged with the guide slot 10f.

The swash plate 10 is mounted on the drive shaft 5 such that it is movable and tiltable in an axial direction. On the drive shaft 5 is fitted a coil spring 44 between the swash plate 10 and the thrust flange 40 to urge the swash plate 10 toward the cylinder block 1. Further, a stopper 45 is fixedly fitted on the drive shaft 5a, and there is mounted a coil spring 47 on the drive shaft 5 between the stopper 45 and the swash plate 10 to urge the swash plate 10 toward the thrust flange 40.

FIG. 5A is a view taken on line A-A of FIG. 3, while

FIG. 5B is a view taken on line B-B of FIG. 4.

The drive shaft 5 has a bottom dead center-side half of an intermediate portion thereof formed with a recess 70 extending axially and a sloped guide surface 71 continuing from the recess 70 in the direction of the cylinder block 1 to a portion of the drive shaft 5 having a uniform radius. The recess 70 has a curved bottom surface with a uniform radius of curvature in transverse cross-section and the sloped guide surface 71 is curved in transverse cross-section with a radius of curvature which increases at a fixed rate in the direction of the cylinder block 1. A portion of the inner peripheral surface of the central through hole 10d of the swash plate 10, which is opposed to the bottom dead center-side half of the intermediate portion of the drive shaft 5, has a curved surface formed in a manner stably and smoothly engageable with the recess 70 and the sloped guide surface 71. When the compressor enters the maximum piston-stroke condition, the inner peripheral surface of the central through hole 10d of the swash plate 10 is brought into contact with the recess 70 of the drive shaft 5 as shown in FIG. 5A. On the other hand, when the compressor enters the minimum piston-stroke condition, the center of the swash plate 10 is shifted toward the rear side, and the inner peripheral surface of the central through hole 10d moves away from the recess 70 of the drive shaft 5. When the compressor is in the minimum piston-stroke condition, the rotation axis of the swash plate 10 is identical with the axis of the drive shaft 5, whereas when the compressor is in the maximum piston-stroke condition, the rotation axis of the swash plate 10 is shifted toward the top dead center position side (diagonally upward as viewed in FIG. 3)

Next, the operation of the variable capacity swash plate compressor constructed as above will be described.

Torque of an engine, not shown, installed on an automotive vehicle, not shown, is transmitted to the drive shaft 5 to rotate the same. The torque of the drive shaft 5 is transmitted to the swash plate 10 via the thrust flange 40 and the linkage 41 to cause rotation of the swash plate 10.

The rotation of the swash plate 10 causes relative rotation of each shoe 50 on the sliding surface 10a of the swash plate 10 with respect to the swash plate 10, whereby the torque transmitted from the swash plate 10 is converted into reciprocating motion of a piston 7 corresponding to the shoe 50. As the piston 7 reciprocates within the cylinder bore 6, the volume of a compression chamber within the cylinder bore 6 changes. As a result, suction, compression and delivery of refrigerant gas are sequentially carried out in the compression chamber, whereby high-pressure refrigerant gas is delivered from the compression chamber in an amount corresponding to an inclination of the swash plate 10. During the suction stroke, the suction valve 21 opens to draw low-pressure refrigerant gas from the suction chamber 13 into the compression chamber within the cylinder bore 6. During the discharge stroke, the discharge valve 17 opens to deliver the high-pressure refrigerant gas from the compression chamber into the discharge chamber 12.

According to the variable capacity swash plate compressor of the embodiment, since the inclination of the swash plate 10 varies with pressure within the crankcase 8 in which the swash plate 10 is received, high-pressure refrigerant gas is delivered from the compression chamber in an amount corresponding to an inclination (angle with respect to the imaginary plane perpendicular to the drive shaft 5) of the swash plate 10. More specifically, as the pressure within the crankcase 8 increases, the inclination of the swash plate 10 becomes smaller, and when the portion 10g of the swash plate 10 moves to a position most distant from the thrust flange 40 as shown in FIG. 4, the amount of stroke of each piston 7 becomes minimum, whereby the capacity or delivery quantity of the compressor becomes minimum.

At this time point, the inclination of the swash plate 10 is smallest, while a contact area between the first support member 51 of the shoe 50 and the sliding surface 10a of the swash plate 10 is largest.

On the other hand, as the pressure within the crankcase 8 decreases, the inclination of the swash plate 10 becomes larger to shift the central portion of the swash plate 10 toward the front side of the compressor. When, as shown in FIG. 3, the inner peripheral surface of the central through hole 10d of the swash plate 10 is guided toward the front side of the compressor along the sloped guide face 71 formed on the drive shaft 5, to be brought into engagement with the recess 70, and the portion 10g of the swash plate 10 abuts on the thrust flange 40, the amount of stroke of each piston 7 becomes maximum, whereby the capacity or delivery quantity of the compressor becomes maximum.

Although the inclination of the swash plate 10 is largest at this time point, since the rotation axis of the swash plate 10 is shifted toward the top dead center position side, a large contact area is maintained between the first support member 51 of each shoe 50 positioned at the top dead center position portion of the swash plate 10 (i.e. shoe 50 corresponding to a piston 7 at its top dead center position) and the sliding surface 10a of the swash plate 10.

According to the variable capacity swash plate compressor of the first embodiment, when the compressor enters the maximum piston-stroke condition, the rotation axis of the swash plate 10 is shifted toward the top dead center position side as described above, so that it is possible to maintain a large contact area between the first support member 51 of the shoe 50 corresponding to each piston 7 at its top dead center position and the sliding surface 10a of the swash plate 10. Therefore, pressure acting on a unit area of a portion of the first support member 51 of the shoe 50 in contact with the sliding surface 10a of the swash plate 10 is prevented from increasing, which makes it possible to reduce abrasion of the sliding surface 10a of the swash plate 10.

FIGS. 6A and 6B are sectional views useful in explaining a variable capacity swash plate compressor according to a second embodiment of the invention. FIG. 6A shows the relationship between a drive shaft and an inner peripheral surface of a central through hole of a swash plate when the compressor is in a maximum piston-stroke condition, while FIG. 6B shows the relationship between the drive shaft and the inner peripheral surface of the central through hole of the swash plate when the compressor is in a minimum piston-stroke condition. Component parts and elements corresponding to those of the first embodiment are indicated by identical reference numerals, and description thereof is omitted.

The present embodiment is distinguished from the first embodiment, in which the recess 70 formed on the drive shaft 5 has the curved bottom surface formed with a predetermined radius of curvature in cross-section, and the central through hole 10d of the swash plate 10 has its inner peripheral surface formed with a curved portion which is engageable with the recess 70, in that a recess 80 formed on the drive shaft 65 has a flat bottom surface, while a central through hole 90d of the swash plate 10 has its inner peripheral surface formed with a flat portion which can be brought into surface contact with the bottom surface of the recess 80.

The second embodiment provides the same effect as obtained by the first embodiment.

Although in the above embodiments, description is made of cases in which the present invention is applied to a variable capacity swash plate compressor having a swash plate 10 connected to each piston 7 via a connecting rod 11, and shoes 50 each performing relative rotation on one sliding surface of the swash plate 10, this is not limitative, but the invention may be applied to another type of variable capacity swash plate compressor having a swash plate 10 connected to each piston 7 not via a connecting rod 11 but a pair of shoes performing relative rotation on both sliding surfaces of the swash plate 10, respectively.

It is further understood by those skilled in the art that the foregoing is the preferred embodiments of the invention, and that various changes and modification may be made without departing from the spirit and scope thereof.

Claims

1. A variable capacity swash plate compressor comprising a drive shaft (5), a rotatable member (40) rigidly fitted on the drive shaft (5) for rotation in unison therewith, a swash plate (10) which has a central through hole (10d) formed therethrough, which is axially movably mounted on the drive shaft (5) via an inner peripheral surface of the central through hole (10d), which is tiltably connected to the rotatable member (40), which has a sliding surface (10a) and which is rotatable in unison with the rotatable member (40) as the rotatable member (40) rotates, a cylinder block (1), a plurality of cylinder bores (6) axially formed through the cylinder block (1), a plurality of pistons (7) slidably received in respective ones of the cylinder bores (6), and a plurality of shoes (50) connected to respective ones of the pistons and each arranged on the sliding surface (10a) of the swash plate (10) for relative rotation with respect to the swash plate (10) as the drive shaft (5) rotates, to convert rotation of the swash plate (10) about the drive shaft (5) into axial reciprocating motion of each piston (7), wherein the amount of stroke of each piston (7) is changeable according to the inclination of the swash plate (10),

    characterised in that the drive shaft (5) is formed with a recess (70) for shifting the rotational axis of the swash plate (10) toward a top dead centre position side when said amount of stroke of each piston (7) becomes a maximum.

2. A variable capacity swash plate compressor according to claim 1, wherein the recess (70) of the drive shaft (5) is formed in a bottom dead centre-side half portion of an intermediate portion of the drive shaft (5) in an axially extending manner.

3. A variable capacity swash plate compressor according to claim 1 or 2, wherein the recess (70) of the drive shaft (5) has a curved bottom surface having a predetermined radius of curvature, the inner peripheral surface of the central through hole (10d) of the swash plate (10) having a portion with a curved surface engageable with the recess (70).

4. A variable capacity swash plate compressor according to claim 3, wherein the drive shaft (5) is formed with a sloped guide surface which continues from the recess (70) to a uniform radius portion of the drive shaft (5), for guiding the curved surface of the portion of the inner peripheral surface of the central through hole (10a) of the swash plate (10).

5. A variable capacity swash plate compressor according to claim 1 or 2, wherein the recess (80) of the drive shaft (65) has a flat bottom surface, the inner peripheral surface of the central through hole (90d) of the swash plate (10) having a portion having a flat surface for being brought into surface contact with the flat bottom surface of the recess (80).

6. A variable capacity swash plate compressor according to claim 5, wherein the drive shaft (65) is formed with a sloped guide surface which continues from the recess (80) to a uniform radius portion of the drive shaft (65), for guiding the flat surface of the portion of the inner peripheral surface of the central through hole (90d) of the swash plate (10).

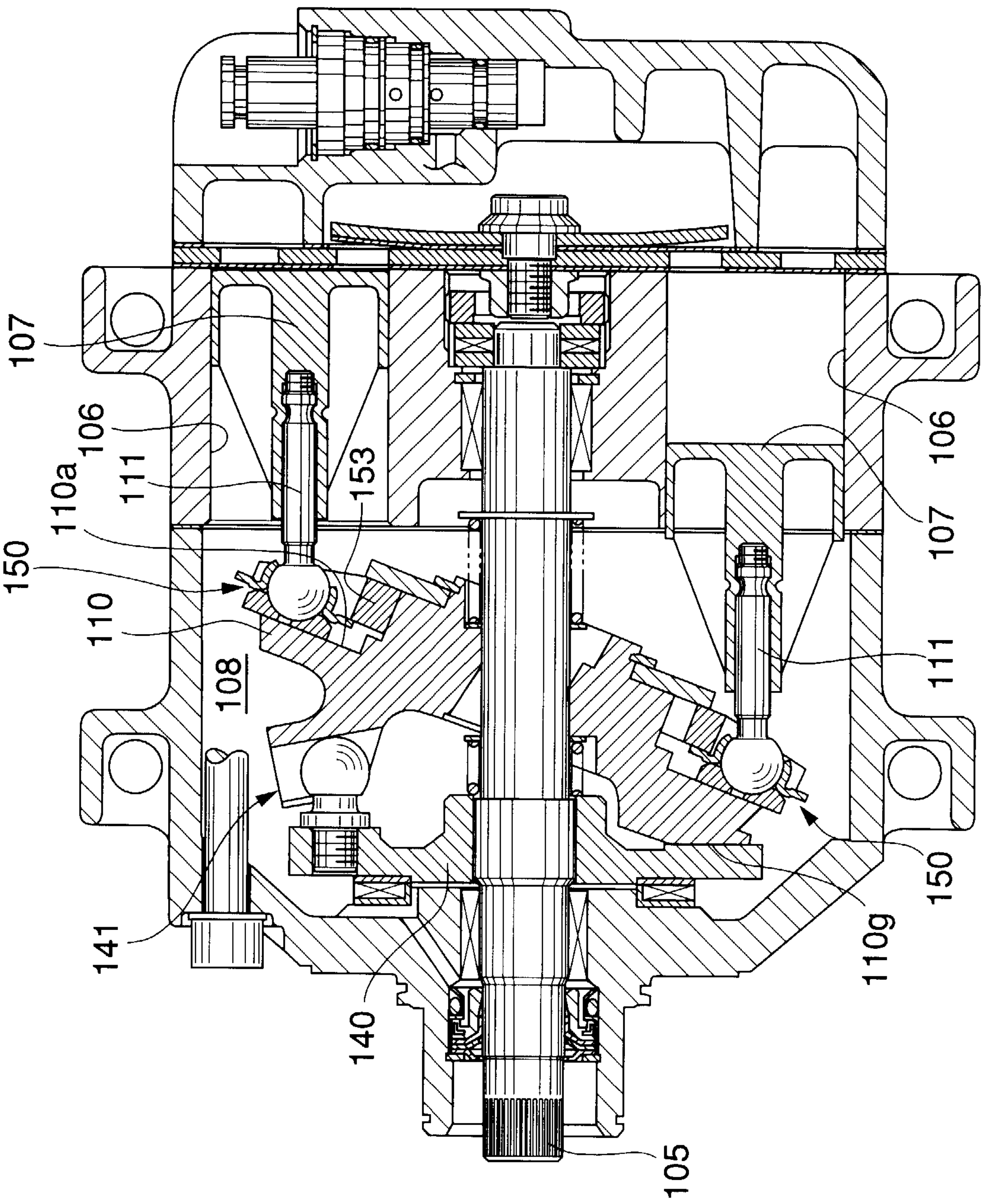

FIG.1
PRIOR ART

FIG.2
PRIOR ART

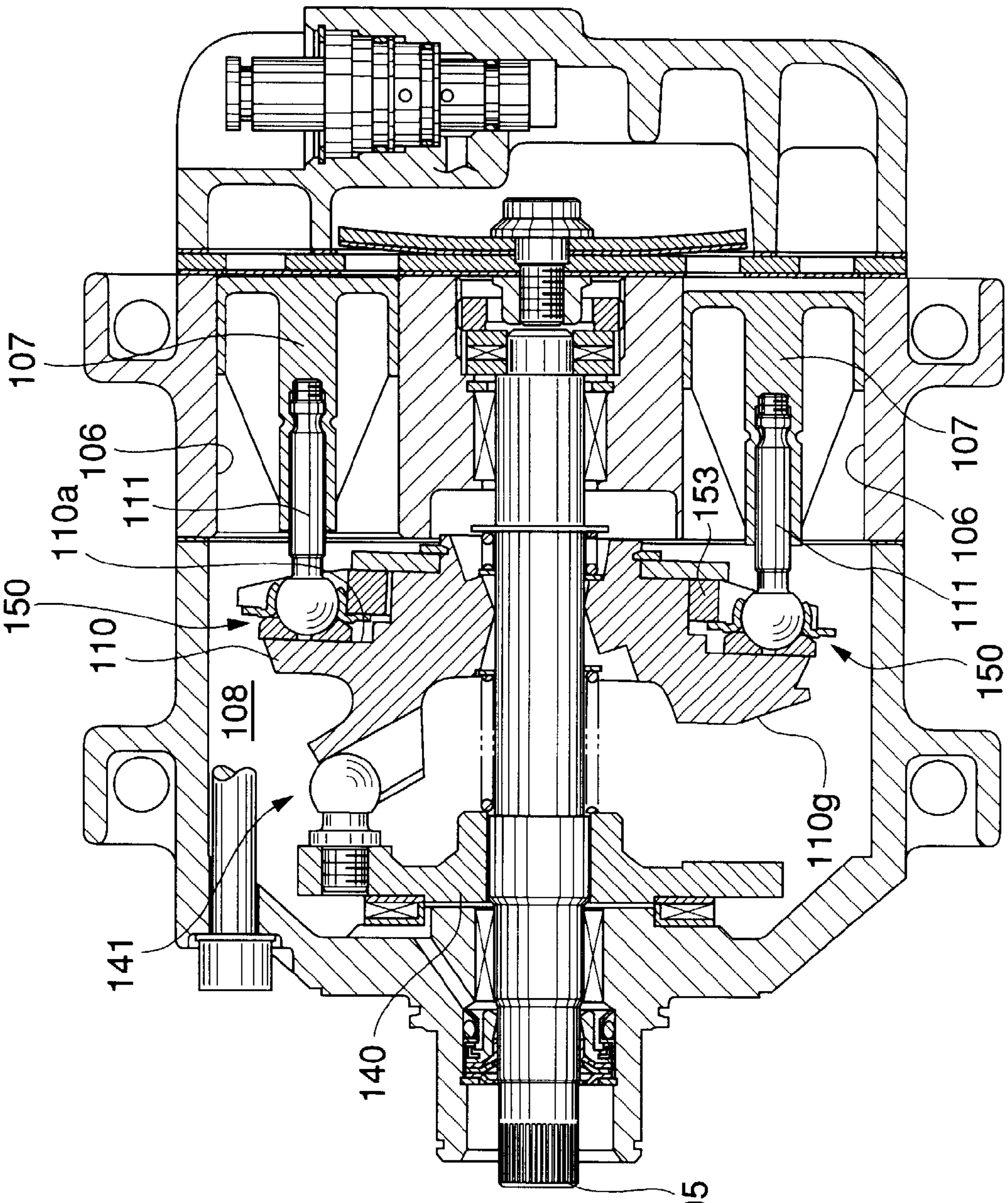

FIG.3

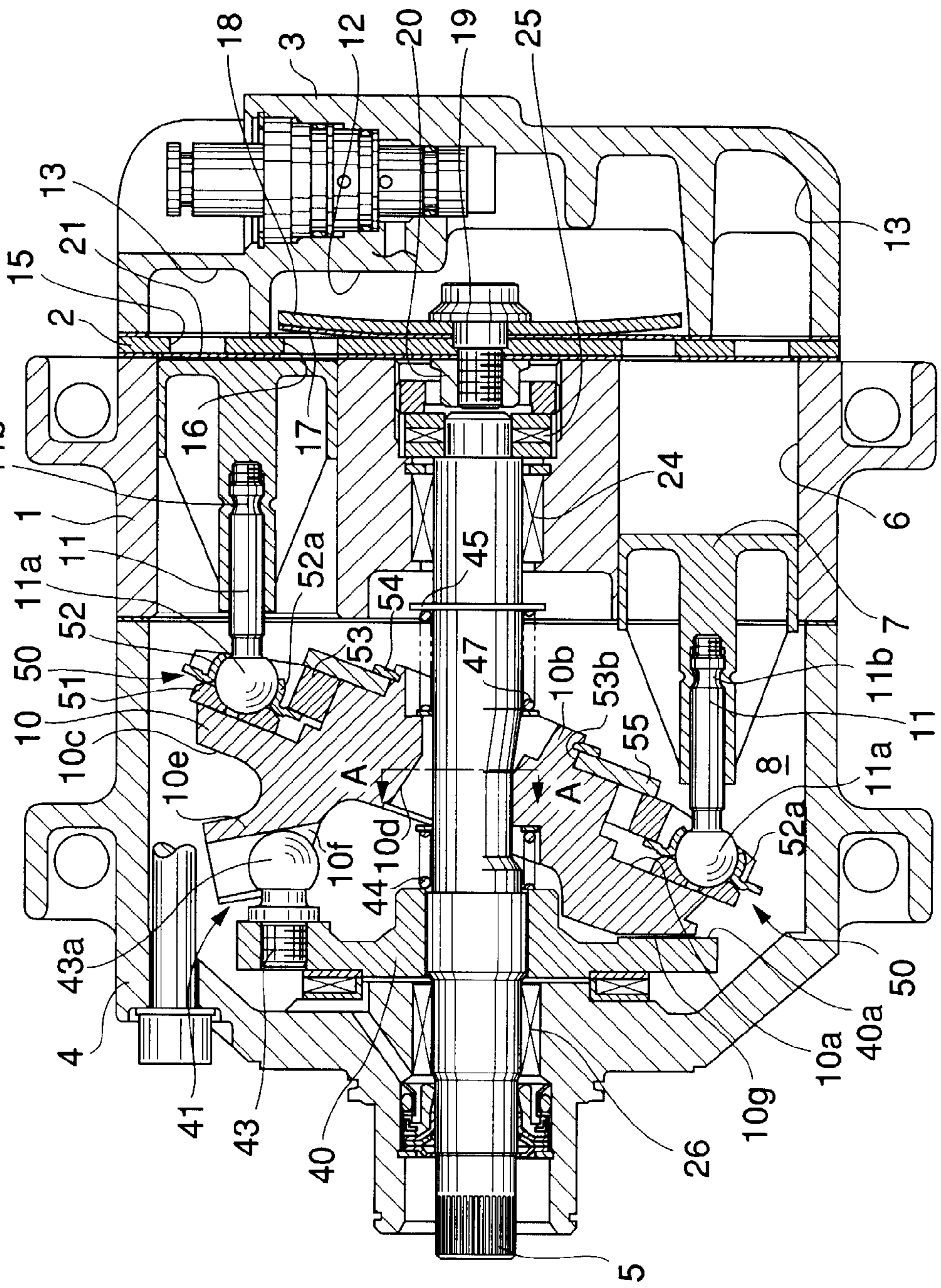
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FIG.4

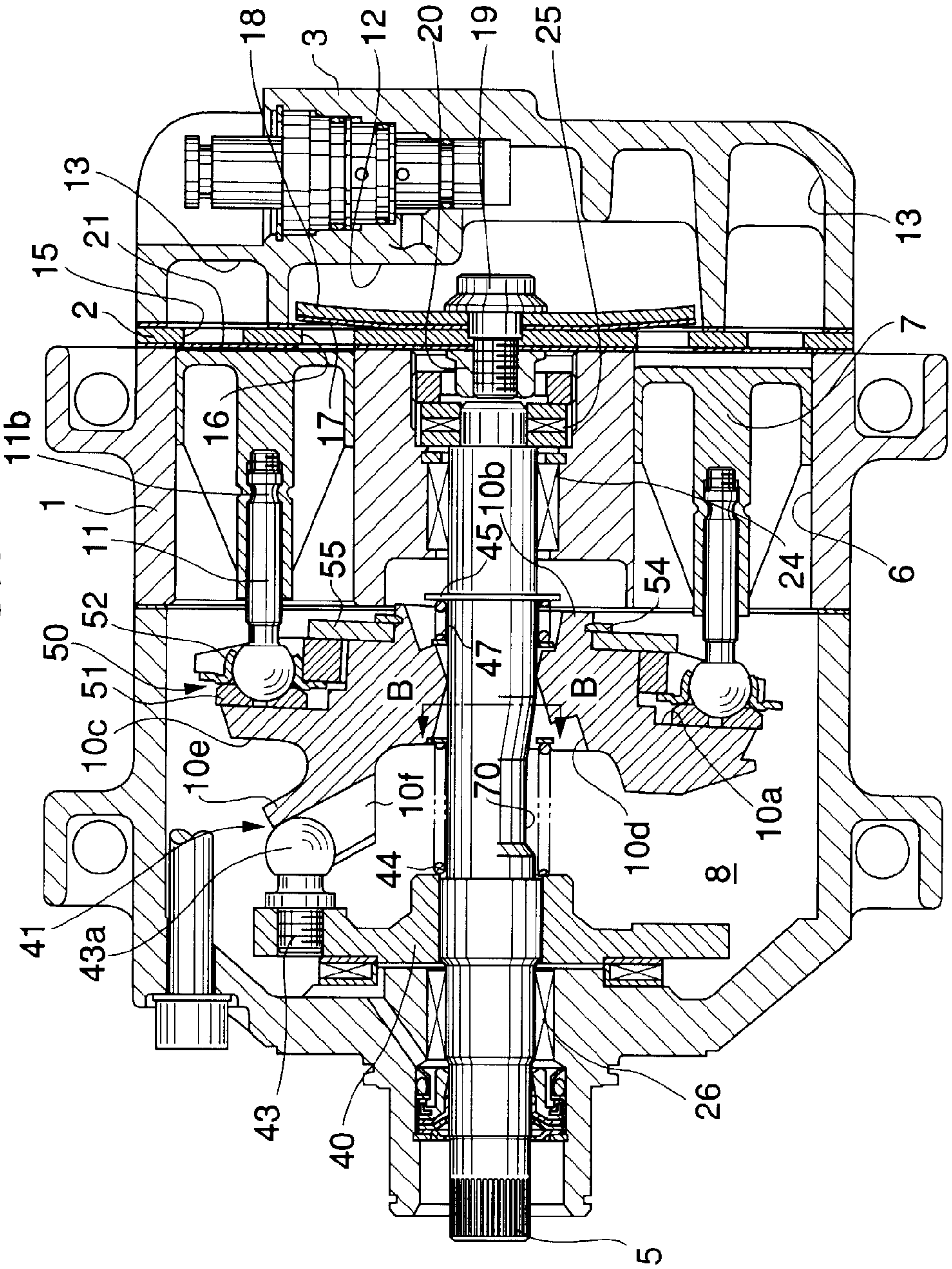
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FIG.5A

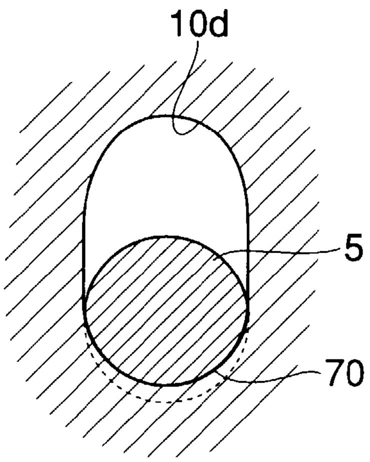

FIG.5B

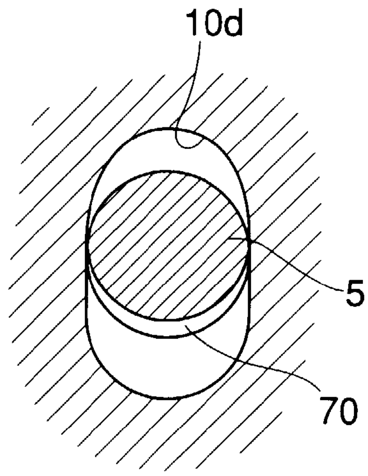

FIG.6A

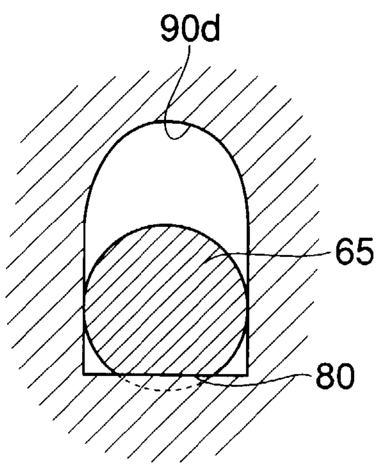

FIG.6B