US 20190178236A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2019/0178236 A1**

(43) **Pub. Date: Jun. 13, 2019**

SONG

(54) **DRIVING PART FOR VARIABLE-CAPACITY COMPRESSOR**

(71) Applicant: **Hanon Systems**, Daejeon (KR)

(72) Inventor: **Se Young SONG**, Daejeon (KR)

(21) Appl. No.: **15/779,954**

(22) PCT Filed: **Apr. 26, 2017**

(86) PCT No.: **PCT/KR2017/004467**

§ 371 (c)(1),
(2) Date: **May 30, 2018**

(30) **Foreign Application Priority Data**

Aug. 16, 2016 (KR) 10-2016-0103666

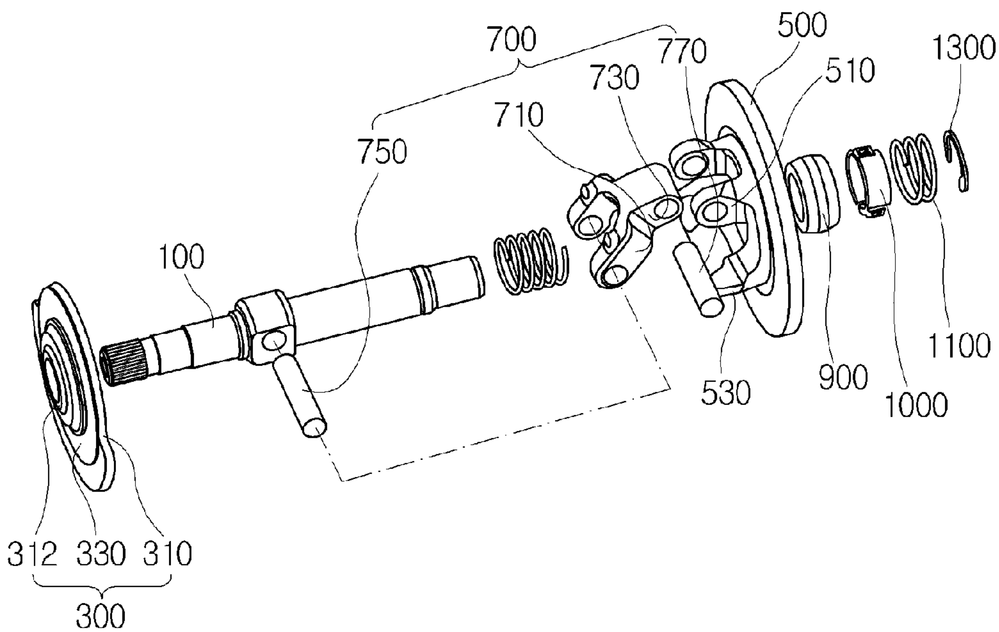
Publication Classification

(51) **Int. Cl.**
F04B 27/08 (2006.01)
F04B 27/18 (2006.01)

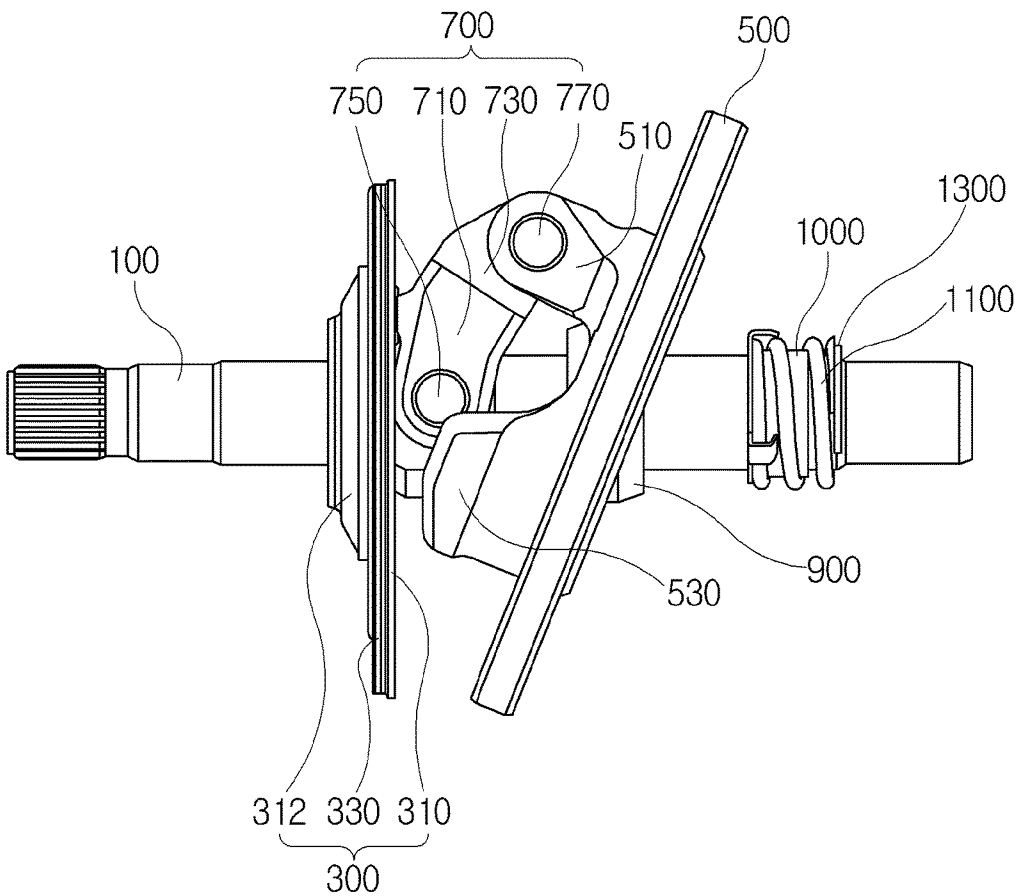
(52) **U.S. Cl.**
CPC ***F04B 27/0895*** (2013.01); ***F04B 27/18*** (2013.01)

(57) **ABSTRACT**

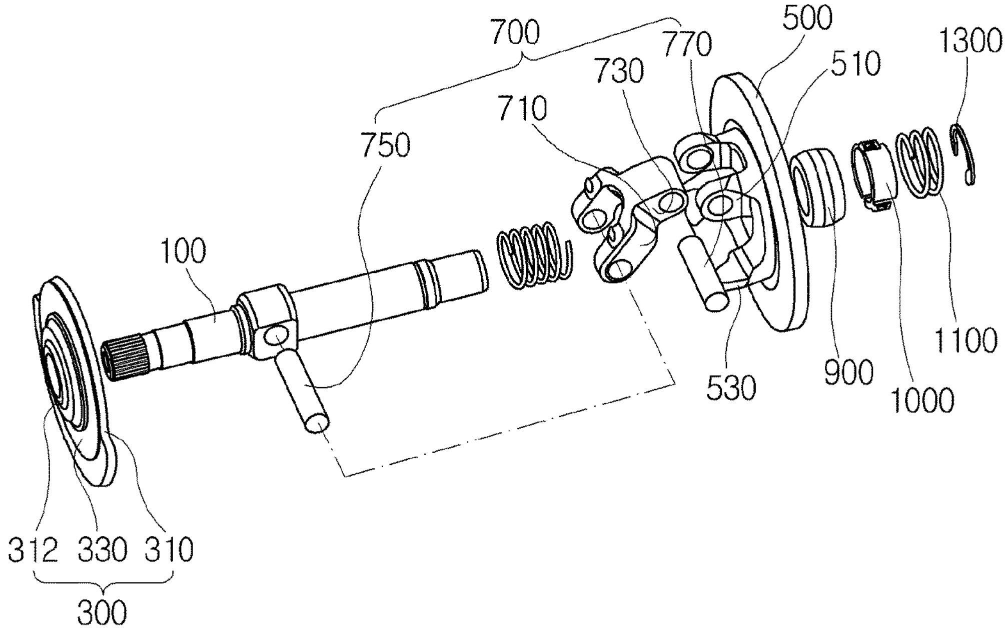
The drive unit has an effect of maintaining controllability and preventing a hunting problem caused under low flow conditions since it includes a friction ring module.



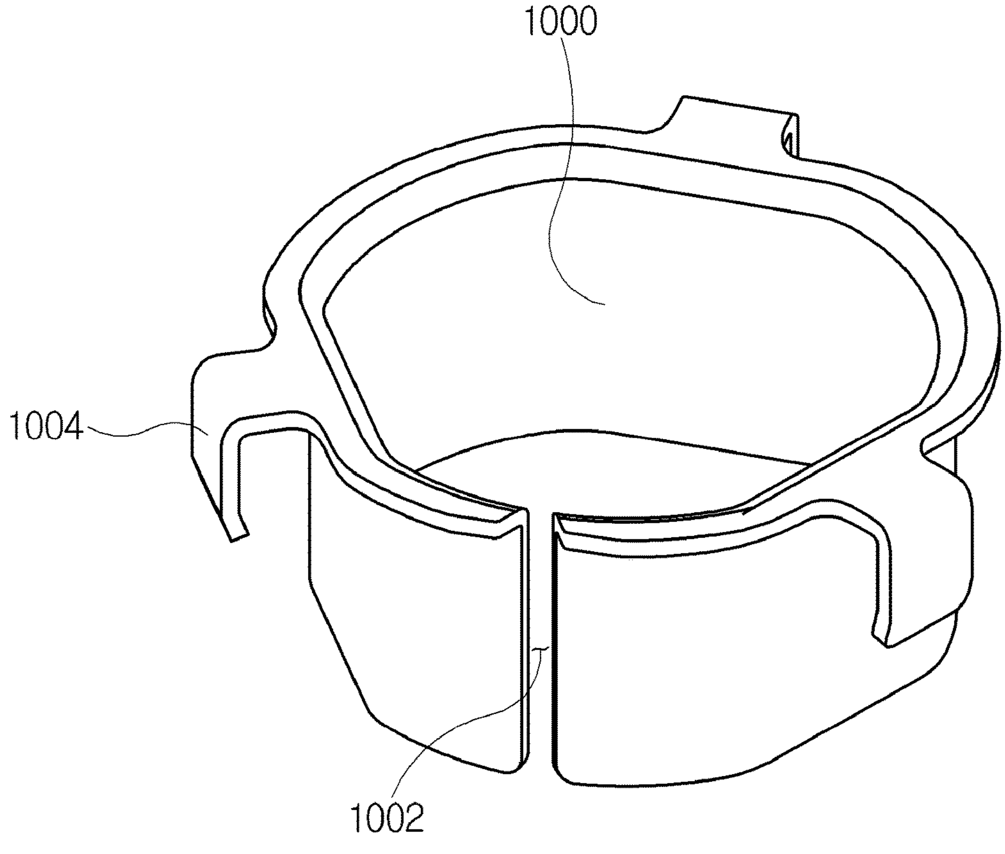
[FIG. 1]


700
750
710
730
770
500
510
100
1000
1300
1100
900
530
312
330
310
300

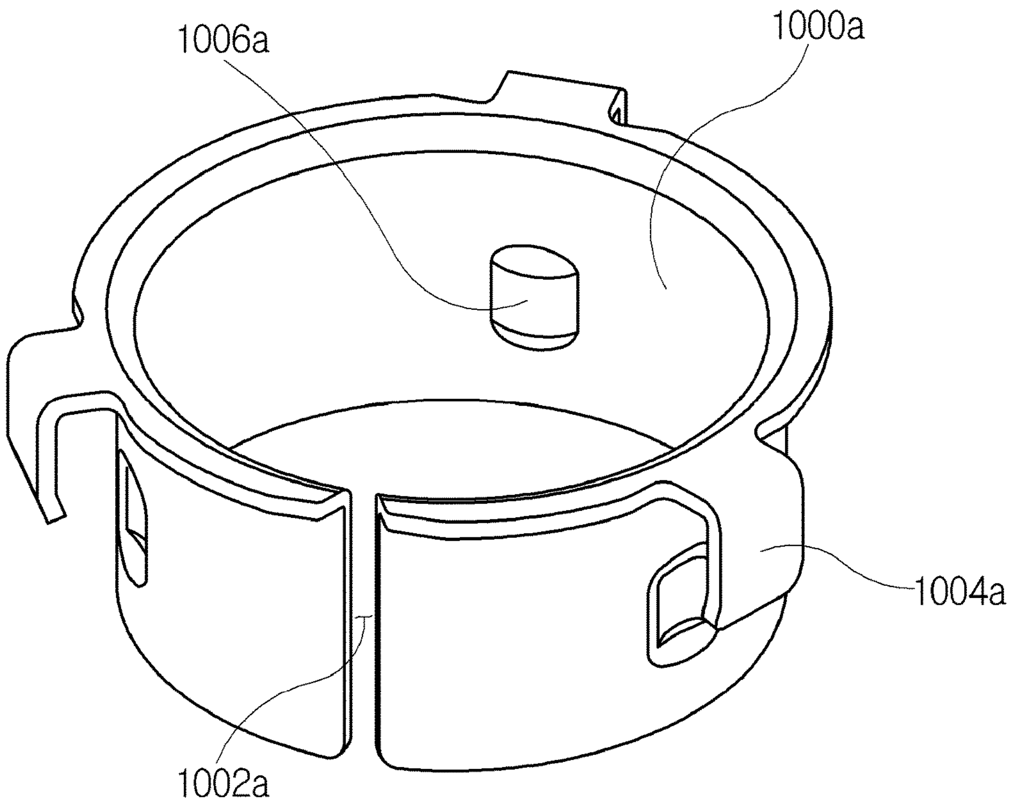
[FIG. 2]


700
770
500
510
1300
730
710
750
100
530
900
1100
1000
312
330
310
300

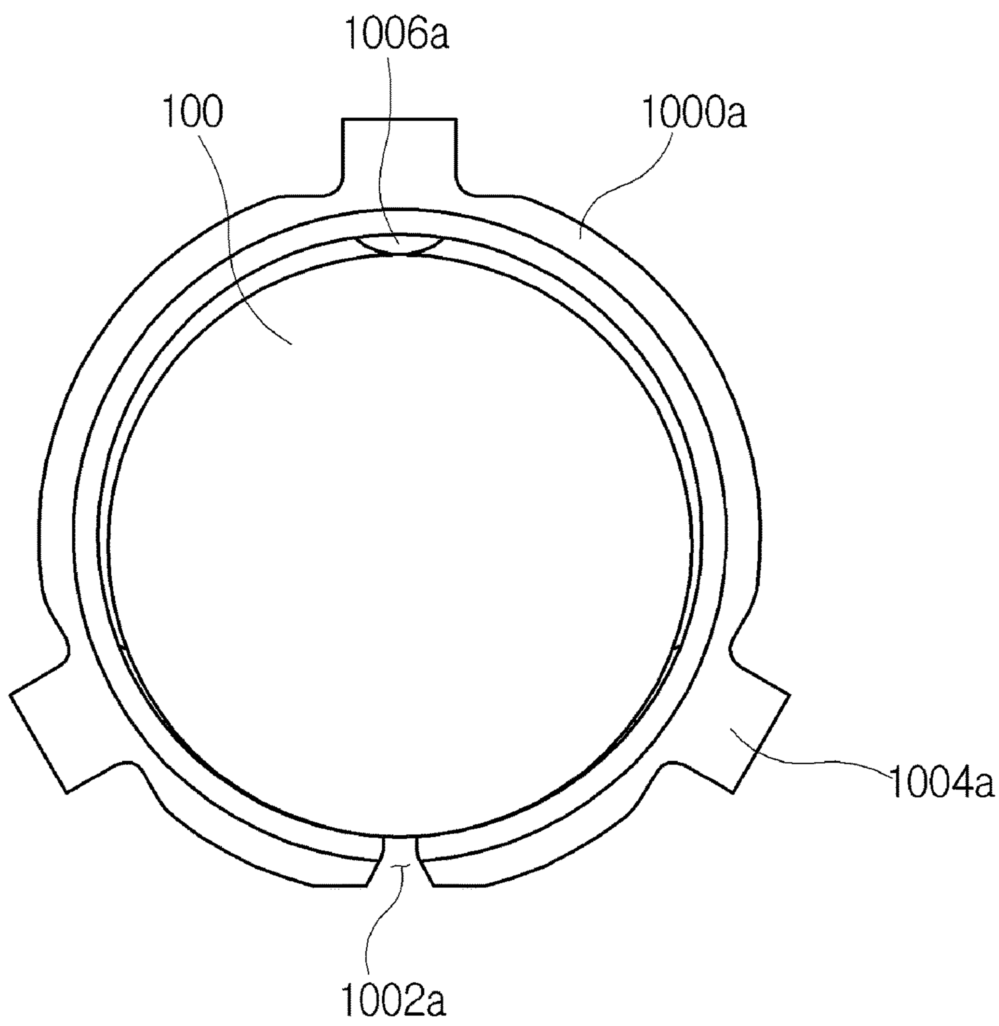
[FIG. 3]



[FIG. 4]



[FIG. 5]



DRIVING PART FOR VARIABLE-CAPACITY COMPRESSOR

TECHNICAL FIELD

[0001] The present invention relates to a drive unit for a variable capacity compressor, and more particularly, to a drive unit for a variable capacity compressor, which has a simplified structure.

BACKGROUND ART

[0002] In general, a compressor applied to air conditioning systems sucks refrigerant gas having passed through an evaporator to compress the same to high temperature and high pressure, and then discharges the compressed refrigerant gas to a condenser. As this compressor, there are used various types of compressors such as a reciprocating compressor, a rotary compressor, a scroll compressor, and a swash plate compressor.

[0003] The swash plate compressor includes a disc-shaped swash plate that is obliquely installed to a drive shaft rotated by power transmitted from an engine to be rotated by the drive shaft. In addition, the principle of the swash plate compressor is to suck or compress and discharge refrigerant gas by rectilinearly reciprocating a plurality of pistons within cylinders along with the rotation of the swash plate. By way of example, a variable capacity-type swash plate compressor disclosed in Korean Patent Application Publication No. 2012-0100189 includes a swash plate, which is installed to a drive shaft and has an angle of inclination varied with the thermal load, in order to regulate the discharge rate of refrigerant in such a manner that the feed rates of pistons are changed while the angle of inclination of the swash plate is varied.

[0004] Typically, a drive unit for a conventional variable capacity-type swash plate compressor has a structure in which a hinge pin fixedly positioned to a hub slides relative to a rotor fixed to a rotary shaft to adjust an angle of inclination of a swash plate through a shaft bush sliding about the rotary shaft.

[0005] However, this hinge mechanism requires the process of press-fitting the rotor to the rotary shaft, thereby causing complexity of work processes and product structures. Hence, the drive unit is disadvantageous in terms of weight, process, or price competitiveness. In addition, the drive unit is disadvantageous in that the gap between components is relatively large due to the clearance of the high mechanism.

DISCLOSURE

Technical Problem

[0006] Accordingly, the present invention has been made in view of the above-mentioned problems, and an object thereof is to provide a drive unit for a variable capacity compressor, which has a simplified structure.

Technical Solution

[0007] In accordance with one aspect of the present invention, a drive unit for a variable capacity compressor includes a drive shaft (**100**), one end of which is connected to a pulley of an engine, so that a driving force is transmitted from the engine to the drive shaft (**100**), a support balance (**300**) coupled to a pulley-side end of the drive shaft (**100**) to support a thrust bearing, a swash plate (**500**) spaced apart from the support balance (**300**) and allowing a discharge rate and a pressure of refrigerant to be regulated according to an angle of inclination of the swash plate (**500**), a hinge part (**700**) configured to connect the support balance (**300**) to the swash plate (**500**) and transmit a rotational force of the drive shaft (**100**) to the swash plate (**500**), and a friction ring module configured to control the angle of inclination of the swash plate (**500**) under low flow conditions by a frictional force generated between the drive shaft (**100**) and the friction ring module.

[0008] The friction ring module may include a polygonal pipe-shaped ring body (**1000**) fitted to the drive shaft (**100**) in its longitudinal direction, and a support spring (**1100**) fitted onto the ring body (**1000**).

[0009] Alternatively, the friction ring module may include a cylindrical ring body (**1000***a*) fitted to the drive shaft (**100**) in its longitudinal direction, and a support spring (**1100**) fitted onto the ring body (**1000***a*).

[0010] The ring body (**1000**, **1000***a*) may have an inner diameter smaller than an outer diameter of the drive shaft (**100**).

[0011] The ring body (**1000**, **1000***a*) may have an opening (**1002**, **1002***a*) formed in its longitudinal direction.

[0012] The drive unit may further include a circular or semicircular retainer (**1300**) disposed at one side of the drive shaft (**100**) facing the connected pulley to restrict movement of the friction ring module.

[0013] The ring body (**1000**, **1000***a*) may include a plurality of hooks (**1004**, **1004***a*) extending outward from one end thereof facing the swash plate (**500**) and bent toward the retainer (**1300**).

[0014] The support spring (**1100**) may be inserted between the hooks (**1004**, **1004***a*) and the ring body (**1000**, **1000***a*).

[0015] The support spring (**1100**) may have an inner diameter greater than an outer diameter of the ring body (**1000**, **1000***a*).

[0016] A distance between the ring body (**1000**, **1000***a*) and each of the hooks (**1004**, **1004***a*) may be larger than a thickness of the support spring (**1100**).

[0017] The ring body (**1000**, **1000***a*) may move along the drive shaft (**100**) when the angle of inclination of the swash plate (**500**) is changed, and be stopped by coming into contact with the retainer (**1300**) when the swash plate (**500**) is inclined at a minimum angle.

[0018] The ring body (**1000***a*) may have a plurality of friction protrusions (**1006***a*) protruding from its inner peripheral surface to the drive shaft (**100**).

[0019] In accordance with another aspect of the present invention, in a variable capacity compressor includes a drive shaft (**100**) rotatably supported in a housing and a swash plate (**500**) allowing a discharge rate of refrigerant to be variably controlled according to an angle of inclination of the swash plate (**500**) while a driving force transmitted to the drive shaft (**100**) is transmitted to the swash plate (**500**), the variable capacity compressor includes a friction member (**1000**, **1000***a*) coupled to the drive shaft (**100**) to be axially movable, positioned between the swash plate (**500**) and a support spring (**1100**) for applying a force in a direction of increasing the angle of inclination of the swash plate in an initial stage of operation, and configured to have a centrifugal force, wherein the friction member (**1000**, **1000***a*) restricts a rapid change in the angle of inclination of the swash plate (**500**) under low flow conditions by a frictional force generated between the friction member (**1000**, **1000***a*) and the drive shaft (**100**).

[0020] The friction member (**1000**, **1000***a*) may be modularized with the support spring (**1100**) to be axially coupled to the drive shaft (**100**).

Advantageous Effects

[0021] A drive unit for a variable capacity compressor according to exemplary embodiments of the present invention has an effect of maintaining controllability and also preventing a hunting problem caused under low flow conditions since it includes a friction ring module.

BRIEF DESCRIPTION OF DRAWINGS

[0022] FIG. **1** is an assembled perspective view illustrating a drive unit for a variable capacity compressor at a maximum angle of inclination according to an embodiment of the present invention.

[0023] FIG. **2** is an exploded perspective view illustrating the drive unit for a variable capacity compressor according to FIG. **1**.

[0024] FIG. **3** is a perspective view illustrating a friction ring of the drive unit for a variable capacity compressor according to FIG. **1**.

[0025] FIG. **4** is a perspective view illustrating a friction ring of a drive unit for a variable capacity compressor according to another embodiment of the present invention.

[0026] FIG. **5** is a top view illustrating a coupled state of the friction ring according to FIG. **4**.

BEST MODE FOR INVENTION

[0027] Hereinafter, a drive unit for a variable capacity compressor according to exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0028] FIG. **1** is an assembled perspective view illustrating a drive unit for a variable capacity compressor at a maximum angle of inclination according to an embodiment of the present invention. FIG. **2** is an exploded perspective view illustrating the drive unit for a variable capacity compressor according to FIG. **1**. FIG. **3** is a perspective view illustrating a friction ring of the drive unit for a variable capacity compressor according to FIG. **1**.

[0029] As illustrated in FIGS. **1** and **2**, the drive unit for a variable capacity compressor, which is designated by reference numeral **10**, according to the embodiment of the present invention is inserted into a compressor consisting of a cylinder block and front and rear housings. The drive unit **10** includes a pulley (not shown) that is powered by an engine, a drive shaft **100** that is coupled to the pulley to be rotated by the pulley, and a support balance **300** and a swash plate **500** that are coupled to the drive shaft. The support balance **300** and the swash plate **500** are interconnected by a hinge part **700**. A coil spring **910** and a bush **900** are coupled between the swash plate **500** and the drive shaft **100** to help initially operate the swash plate **500**. The drive unit **10** includes a friction ring module that is formed at the opposite end of the pulley connection portion of the drive shaft **100**, thereby maintaining controllability and also preventing hunting under low flow conditions.

[0030] One end of the drive shaft **100** is connected to the pulley to be rotatably supported by the front housing, and the other end thereof is rotatably supported by the rear housing. The drive shaft **100** has a hinge connection portion **110** that is in contact with the support balance **300**.

[0031] The hinge connection portion **110** serves to prevent the support balance **300** from moving to the swash plate **500** while connecting the hinge part **700** to the drive shaft **100**. To this end, the hinge connection portion **110** has a through-hole that is formed through the drive shaft **100** in the direction leading both ends of a counter weight **330** of the support balance **300** in FIG. **1** (the direction is defined on the basis of the support balance since the support balance is fixedly coupled to the drive shaft so as not to rotate for itself). The through-bole formed in the hinge connection portion **110** may affect the stiffness of the drive shaft **100**. Therefore, it is preferable to prevent a reduction in stiffness of the drive shaft **100** by reinforcing the thickness of the drive shaft **100** in the vicinity of the through-hole. Accordingly, the hinge connection portion **110** is formed to protrude outward from the outer peripheral surface of the drive shaft **100**.

[0032] The support balance **300** is coupled to the pulley-side end of the drive shaft **100**, and the swash plate **500** is fitted to the drive shaft **100** in the state in which the swash plate **500** is spaced apart from the support balance **300** by a predetermined distance.

[0033] The support balance **300** is substituted for a conventional rotor formed integrally with lug plates, and serves to support a thrust bearing (not shown). The conventional rotor is disposed opposite to the swash plate in order to transmit rotational force to the swash plate and balance the drive unit (static balance function) since yawing is generated due to imbalance of weight when a mass is provided on the drive shaft **100**. Although the conventional rotor formed integrally with lug plates is performed for the above functions, it is difficult to reduce the size of the drive unit due to the large size and weight of the rotor and the complicated hinge structure. In addition, the drive shaft **100** or the peripheral parts thereof may be deformed in the process of press-fitting the rotor to the drive shaft **100**. Accordingly, the present invention is intended to propose the support balance **300** as a substitute for the rotor.

[0034] The support balance **300** includes a disc-shaped bearing support **310**, a stepped portion **312** that protrudes toward the connected pulley and has a smaller diameter than the bearing support **310**, and a ring-shaped counter weight **330** that is provided on one side of the outer peripheral surface of the bearing support **310** and has a greater radius than the bearing support **310**.

[0035] The stepped portion **312** is formed integrally with the bearing support **310**, and each of the bearing support **310** and the stepped portion **312** has a hollow formed at the center thereof for insertion of the drive shaft **100**.

[0036] The counter weight **330** is preferably disposed at the lower side of the bearing support **310** in the arrangement of the drive unit illustrated in FIGS. **1** and **2**. The support balance **300** has an eccentric load by the one-sided counter weight **330** thereto. The counter weight **330** serves to prevent an eccentricity of weight due to the structure of the hinge part **700** for adjusting the angle of the swash plate, and is thus disposed opposite to the weighted portion of the swash plate **500** and the hinge part **700**.

[0037] Unlike the conventional rotor coupled by press-fit, the support balance **300** has an eccentric structure at the hollow thereof into which the drive shaft **100** is inserted.

Thus, the support balance **300** is maintained in the coupled state without rotating on the drive shaft **100**.

[0038] The swash plate **500** is connected to a piston (not shown) inserted into a cylinder bore formed in the cylinder block. The piston reciprocates in the cylinder bore along with the rotation of the swash plate **500** to thereby suck refrigerant or compress the refrigerant in the cylinder bore. The discharge rate and pressure of the refrigerant is regulated by adjusting the angle of inclination of the swash plate **500**.

[0039] The swash plate **500** has a swash plate arm **510** and a hub **530** that protrude from the flat surface thereof facing the support balance **300**. The swash plate arm **510** is relatively disposed at the upper side of the swash plate **500** whereas the hub **530** is relatively disposed at the lower side of the swash plate **500** in the state in which the hub **530** is spaced apart from the swash plate arm **510**, in FIGS. **1** and **2**.

[0040] The swash plate arm **510** consists of a pair of swash plate arms that face each other and are made of a sheet of metal, and the swash plate arms **510** have respective through-holes formed therein for insertion of a second hinge pin **770** to be described later. The hinge part **700** is inserted between the swash plate arms **510** to be rotatably coupled to the swash plate arms **510** by the second hinge pin **770**.

[0041] The hub **530** has a substantially semi-cylindrical shape, and protrudes further than the swash plate arms **510** toward the support balance **300**. The hub **530** serves to restrict the movement of the swash plate **500** such that the swash plate **500** is not inclined above a predetermined angle when the angle of inclination of the swash plate **500** is adjusted. To this end, the hub **530** preferably protrudes enough to come into contact with the support balance **300** when the swash plate **500** is inclined at a maximum angle.

[0042] The support balance **300** is connected to the swash plate **500** by the hinge part **700**.

[0043] The hinge part **700** includes a pair of first hinge arms **710** disposed at both sides of the hinge connection portion **110** of the drive shaft **100**, a second hinge arm **730** protruding toward the swash plate arms **510**, a first hinge pin **750** coupled to the first hinge arms **710**, and a second hinge pin **770** coupled to the second hinge arm **730**.

[0044] The first hinge arms **710** are connected to the second hinge arm **730**. The first hinge arms **710** face each other and are made of a sheet of metal. The first hinge arms **710** grasp the hinge connection portion **110** at both sides thereof and have respective through-holes formed therein for insertion of the first hinge pin **750**, in FIG. **3**. The first hinge pin **750** is coupled to the first hinge arms **710** by passing through the through-hole of the hinge connection portion **110** through one of the first hinge arms **710** and then passing through the other of the first hinge arms **710**. The first hinge arms **710** are rotatably coupled to the hinge connection portion **110** by the first hinge pin **750**. If the hinge connection portion **110** has a curved outer peripheral surface according to the shape of the outer peripheral surface of the drive shaft **100**, the hinge connection portion **110** does not come into surface contact with the first hinge arms **710** but a gap is formed therebetween. Thus, the contact surface of the hinge connection portion **110** coming into contact with the first hinge arms **710** is preferably flat rather than curved such that the first hinge arms **710** are able to stably grasp the hinge connection portion **110**.

[0045] The second hinge arm **730** has a thickness corresponding to the distance between the pair of swash plate arms **510**, and has a through-hole formed therein for insertion of the second hinge pin **770**. The second hinge pin **770** is inserted into one of the swash plate arms **510**, passes through the second hinge arm **730**, and is then inserted into the other facing swash plate arm **510**. The swash plate arms **510** are rotatably coupled to the second hinge arm **730** by the second hinge pin **770**.

[0046] As illustrated in FIG. **2**, the bush **900** has a cylindrical shape and is inserted between the swash plate **500** and the drive shaft **100**. The coil spring **910** is inserted between the bush **900** and the drive shaft **100**. The bush **900** is elastically supported by the coil spring **910** and slides along the drive shaft **100**. The bush **900** slides together with the swash plate **500** when the angle of inclination of the swash plate **500** is changed, with the consequence that the swash plate **500** is smoothly movable along the drive shaft **100**.

[0047] Meanwhile, the friction ring module is provided to prevent a hunting phenomenon in which noise occurs when the angle of the swash plate is not maintained small due to too low friction under low flow conditions.

[0048] As illustrated in FIGS. **2** and **3**, the friction ring module includes a ring body **1000** and a support spring **1100**. A retainer **1300** is fitted to the opposite end of the pulley connection portion of the drive shaft **100** to restrict the movement of the friction ring module. The retainer **1300** has a circular or semicircular ring shape, and serves as a stopper.

[0049] The ring body **1000** has a polygonal pipe shape. A portion of the ring body **1000** is cut to form an opening **1002**, and the ring body **1000** is fitted to the drive shaft **100** in the longitudinal direction thereof. Since the ring body **1000** is not cylindrical, the ring body **1000** is coupled to the drive shaft **100** with a gap therebetween in some sections without entirely surrounding the outer peripheral surface of the drive shaft **100**. The opening **1002** is formed in the longitudinal direction of the drive shaft **100**. Preferably, the ring body **1000** has an inner diameter smaller than the outer diameter of the drive shaft **100** in the state in which the opening **1002** is not formed in the ring body **1000**. This is to generate a force in the central direction of the drive shaft **100** and thus generate a frictional force between the ring body **1000** and the drive shaft **100**. There is no problem in the assembly of the ring body **1000** because the ring body **1000** has the opening **1002** even though the inner diameter of the ring body **1000** is smaller than the outer diameter of the drive shaft **100**. The ring body **1000** has a plurality of hooks **1004** formed at one end thereof facing the swash plate **500** so that the support spring **1100** is coupled to the hooks **1004**.

[0050] The hooks **1004** extend outward from one end of the ring body **1000** facing the swash plate **500** and are bent toward the retainer **1300**. Preferably, the distance between each of the hooks **1004** and the outer peripheral surface of the ring body **1000** is larger than the thickness of the support spring **1100** so as not to interfere with the operation of the support spring **1100**. The support spring **1100** is inserted between the hooks **1004** and the ring body **1000**.

[0051] One end of the support spring **1100** is inserted between the hooks **1004** and the ring body **1000**, and the other end thereof extends toward the retainer **1300**. The support spring **1100** has an inner diameter slightly greater than the outer diameter of the ring body **1000**.

[0052] The reason that the hooks **1004** are formed in the ring body **1000** despite the greater inner diameter of the support spring **1100** than the outer diameter of the ring body **1000** is to smoothly assemble the support spring **1100**. That is, the hooks **1004** serve to temporarily fix the support spring **1100** in the assembly thereof to prevent the support spring **1100** from moving to the swash plate **500**. However, the hooks **1004** does not interfere with the movement of the support spring **1100** to the retainer **1300**.

[0053] As illustrated in FIGS. **4** and **5**, a friction ring module of a drive unit according to another embodiment of the present invention includes a cylindrical ring body **1000***a* having an opening **1002***a* formed at one side thereof. The ring body **1000***a* has a plurality of hooks **1004***a* formed on the outer peripheral surface thereof, and may further have a plurality of friction protrusions **1006***a* protruding from the inner peripheral surface thereof to the drive shaft **100** (the same components as those of the previous embodiment will not be described in detail).

[0054] The friction protrusions **1006***a* serve to increase a frictional force between the drive shaft **100** and the ring body **1000***a*, and to increase a force generated in the central direction of the drive shaft **100**, as illustrated in FIG. **5**.

[0055] The shape of the ring body **1000***a* is not restricted. However, in the case where the ring body **1000***a* is configured to have a cylindrical shape and support the drive shaft **100** at three points by the friction protrusions **1006***a* and uses a multiple press as in the present embodiment, it is possible to enhance productivity.

[0056] If the frictional force is too high, there is a problem in that pressure does not change at all due to fixation of the friction ring module to the drive shaft **100**. On the other hand, if the frictional force is too low, there is a problem in that noise occurs (hunting) since it is difficult to keep the angle of the swash plate small under low load conditions.

[0057] In the present invention, the ring body **1000***a* has an inner diameter smaller than the outer diameter of the drive shaft **100** or has the friction protrusions **1006***a* to properly maintain the frictional force. Therefore, the drive unit has an effect of maintaining controllability and also preventing hunting under low flow conditions.

[0058] In the above-mentioned embodiments, the ring body **1000** or **1000***a* moves between the bush **900** and the retainer **1300** that are inserted between the swash plate **500** and the drive shaft **100**, and the movement of the ring body is stopped while the ring body is pushed by the bush **900** at the minimum angle of the swash plate **500** to come into contact with the retainer **1300**. Accordingly, the length of the ring body **1000** or **1000***a* in the longitudinal direction of the drive shaft **100** is varied depending on the position of the retainer **1300** when the swash plate **500** is inclined at a minimum angle.

[0059] Meanwhile, the ring body **1000** may be coupled to the drive shaft **100** to be axially movable, may be positioned between the swash plate **500** and the support spring **1100** for applying a force in the direction of increasing the angle of inclination of the swash plate in the initial stage of operation, and may be configured to have a centrifugal force. Thus, since the ring body **1000** serves to restrict a rapid change in the angle of inclination of the swash plate **500** under low flow conditions by the frictional force generated between the ring body **1000** and the drive shaft **100**, the ring body **1000** may be defined as a friction member. In addition, the ring body **1000** may be modularized with the support spring **1100** to be axially coupled to the drive shaft **100**.

[0060] Since the drive unit includes the friction ring module having the above-mentioned structure, it is possible to maintain controllability and prevent a hunting problem caused under low flow conditions.

INDUSTRIAL APPLICABILITY

[0061] The present invention can be applied to a drive unit for a variable capacity compressor, which has a simplified structure.

1.-**14**. (canceled)

15. A drive unit for a variable capacity compressor, comprising:

- a drive shaft, one end of which is connected to a pulley of an engine, so that a driving force is transmitted from the engine to the drive shaft;
- a support balance coupled to a pulley-side end of the drive shaft to support a thrust bearing;
- a swash plate spaced apart from the support balance and allowing a discharge rate and a pressure of refrigerant to be regulated according to an angle of inclination of the swash plate;
- a hinge part configured to connect the support balance to the swash plate and transmit a rotational force of the drive shaft to the swash plate; and
- a friction ring module configured to control the angle of inclination of the swash plate under low flow conditions by a frictional force generated between the drive shaft and the friction ring module.

16. The drive unit according to claim **15**, wherein the friction ring module comprises a ring body fitted to the drive shaft in its longitudinal direction, and a support spring fitted onto the ring body.

17. The drive unit according to claim **16**, wherein the ring body is polygonal pipe shape or cylindrical shape.

18. The drive unit according to claim **16**, wherein the ring body has an inner diameter smaller than an outer diameter of the drive shaft.

19. The drive unit according to claim **16**, wherein the ring body has an opening formed in its longitudinal direction.

20. The drive unit according to claim **16**, further comprising a circular or semicircular retainer disposed at one side of the drive shaft facing the connected pulley to restrict movement of the friction ring module.

21. The drive unit according to claim **20**, wherein the ring body comprises a plurality of hooks extending outward from one end thereof facing the swash plate and bent toward the retainer.

22. The drive unit according to claim **21**, wherein the support spring is inserted between the hooks and the ring body.

23. The drive unit according to claim **22**, wherein a distance between the ring body and each of the hooks is larger than a thickness of the support spring

24. The drive unit according to claim **16**, wherein the support spring has an inner diameter greater than an outer diameter of the ring body.

25. The drive unit according to claim **20**, wherein the ring body moves along the drive shaft when the angle of inclination of the swash plate is changed, and is stopped by coming into contact with the retainer when the swash plate is inclined at a minimum angle.

26. The drive unit according to claim **16**, wherein the ring body has a plurality of friction protrusions protruding from its inner peripheral surface to the drive shaft.

27. A variable capacity compressor, which comprises a drive shaft rotatably supported in a housing and a swash plate allowing a discharge rate of refrigerant to be variably controlled according to an angle of inclination of the swash plate while a driving force transmitted to the drive shaft is transmitted to the swash plate, the variable capacity compressor comprising:

a friction member coupled to the drive shaft to be axially movable, positioned between the swash plate and a support spring for applying a force in a direction of increasing the angle of inclination of the swash plate in an initial stage of operation, and configured to have a centrifugal force,

wherein the friction member restricts a rapid change in the angle of inclination of the swash plate under low flow conditions by a frictional force generated between the friction member and the drive shaft

28. The variable capacity compressor according to claim **27**, wherein the friction member is modularized with the support spring to be axially coupled to the drive shaft.

* * * * *