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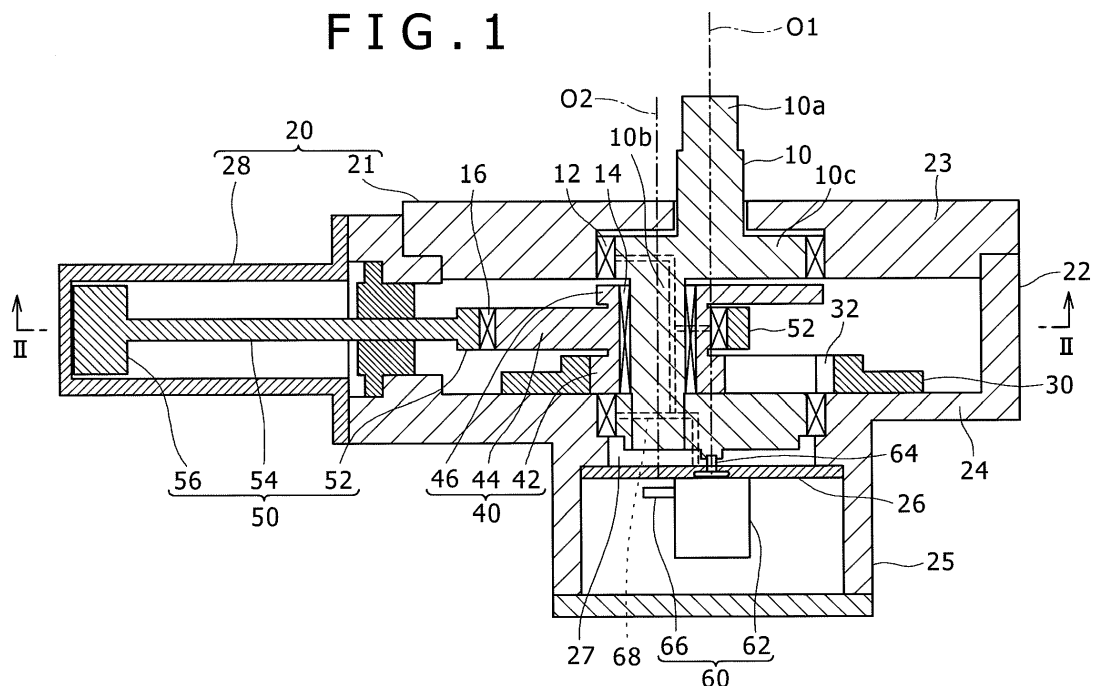
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(54) **Compressor**

(57) A compressor of the present invention includes a crank shaft, a bearing, a casing, an outer-race gear that is disposed so as to surround the crank shaft, a planetary gear that has a radius of a pitch circle set to a half of a radius of a pitch circle of the outer-race gear and causes the crank shaft to be inserted therethrough so that the planetary gear rotates relative to the crank shaft, a piston that is connected to the planetary gear so as to

rotate relative to the planetary gear and moves in a reciprocating manner in the direction parallel to the radial direction of the outer-race gear inside the casing in a manner such that the planetary gear rotates inside the outer-race gear while engaging with the outer-race gear, and a pump that supplies lubricant to the bearing. Here, the pump is accommodated inside the casing.

**FIG. 1**

## Description

### BACKGROUND OF THE INVENTION

(FIELD OF THE INVENTION)

[0001] The present invention relates to a compressor.

(DESCRIPTION OF THE RELATED ART)

[0002] Hitherto, there is known a compressor that includes a so-called hypocycloid mechanism with an outer-race gear and a planetary gear. For example, JP 60-144594 A discloses a compressor including a crank shaft that is rotationally driven by a motor, a casing that accommodates the crank shaft, an outer-race gear that is disposed so as to surround the crank shaft, a planetary gear that rotates inside the outer-race gear while engaging with an inner gear of the outer-race gear, and a piston that is connected to the planetary gear so as to rotate relative to the planetary gear. The planetary gear causes the crank shaft to be inserted therethrough so that the planetary gear rotates relative to the crank shaft. Further, a radius of a pitch circle of the planetary gear is set to a half of a radius of a pitch circle of the outer-race gear. The casing includes a cylinder that has a shape extending linearly along the direction parallel to the radial direction of the outer-race gear, and the piston is accommodated inside the cylinder. Further, an engagement point between the outer-race gear and the planetary gear while the piston is located at the top dead center inside the cylinder is set so as to match a point close to the piston in the intersection point between the pitch circle of the outer-race gear and the longitudinal direction of the cylinder. For this reason, when the planetary gear rotates inside the outer-race gear (revolves about the center of the outer-race gear) while engaging with the outer-race gear with the rotation of the crank shaft, the piston linearly moves in a reciprocating manner along the longitudinal direction of the cylinder inside the cylinder. Here, the cylinder has a shape in which the piston is guided in the longitudinal direction thereof while taking the posture of the piston at the top dead center, that is, a shape in which the piston is guided so as to move in a reciprocating manner along the longitudinal direction thereof without causing the piston to be inclined with respect to the longitudinal direction of the cylinder. Accordingly, when the planetary gear revolves inside the outer-race gear in a spinning state, the piston moves in a reciprocating manner while taking the same posture inside the cylinder. That is, in the compressor, the rotational movement of the planetary gear that is driven so as to revolve inside the outer-race gear by the crank shaft is converted into the linear reciprocating movement of the piston.

### SUMMARY OF THE INVENTION

[0003] In general, the compressor of the related art in-

cludes a bearing that receives the crank shaft, and lubricant is supplied into the bearing by a pump. Then, there is a case in which the lubricant leaks from the pump when the lubricant is supplied from the pump to the bearing. In this case, since there is a need to provide an oil receiving portion that receives the lubricant leaking from the pump, cost increases and the number of components increases. In order to remove the oil receiving portion, there is a need to use a high-performance pump having excellent lubricant sealing performance. Even in this case, there is an increase in cost.

[0004] An object of the present invention is to provide a compressor that includes a hypocycloid mechanism and may decrease the number of components at low cost.

[0005] In order to solve the above-described problems, a compressor according to the present invention includes: a crank shaft that is rotationally driven by a prime mover; a bearing that receives the crank shaft; a casing that accommodates the crank shaft and the bearing; an outer-race gear that is disposed inside the casing so as to surround the crank shaft; a planetary gear that has a radius of a pitch circle set to a half of a radius of a pitch circle of the outer-race gear and causes the crank shaft to be inserted therethrough so that the planetary gear rotates relative to the crank shaft; a piston that is connected to the planetary gear so as to rotate relative to the planetary gear and moves in a reciprocating manner along the direction parallel to the radial direction of the outer-race gear inside the casing when the planetary gear rotates inside the outer-race gear while engaging with the outer-race gear; and a pump that is accommodated inside the casing and supplies lubricant to the bearing.

[0006] According to the present invention, the pump is accommodated inside the casing. For this reason, even when the lubricant leaks from the pump when the lubricant is supplied to the bearing, the lubricant stays inside the casing, and does not leak to the outside of the casing. Accordingly, there is no need to additionally provide a component such as an oil receiving portion that receives the lubricant leaking from the pump, and the leakage of the lubricant from the pump is permitted. Thus, there is no need to use a high-performance pump having excellent lubricant sealing performance. Further, since the compressor of this embodiment includes a so-called hypocycloid mechanism with the outer-race gear and the planetary gear, there is no need to require a strict lubricating condition like a compressor using a piston crank mechanism with a cross head. In addition, since the rotational movement of the crank shaft is directly converted into the reciprocating movement of the piston, the power transmission efficiency is excellent compared to the compressor using the piston crank mechanism.

[0007] Even in this case, the crank shaft may be connected to the pump so that the pump is driven by the rotation of the crank shaft.

[0008] With such a configuration, since the prime mover as the power source for rotating the crank shaft is used

as the power source of the pump, there is no need to provide a dedicated power source for driving the pump, and hence the structure becomes simplified.

**[0009]** Further, in the present invention, an oil buffer may be formed between the crank shaft and an attachment wall for the pump.

**[0010]** With such a configuration, the lubricant may be sufficiently supplied to the bearing and the like.

**[0011]** As described above, according to the present invention, it is possible to provide a compressor that includes a hypocycloid mechanism and may decrease the number of components at low cost.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0012]**

FIG. 1 is a cross-sectional view schematically illustrating the structure of a compressor of a first embodiment of the present invention.

FIG. 2 is a cross-sectional view taken along the line II-II of FIG. 1.

FIG. 3 is a cross-sectional view illustrating the compressor of FIG. 1 when viewed from a different angle.

FIG. 4 is a cross-sectional view illustrating the vicinity of an attachment wall for a compressor of a second embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

##### (First Embodiment)

**[0013]** A compressor of a first embodiment of the present invention will be described by referring to FIGS. 1 to 3.

**[0014]** As illustrated in FIGS. 1 to 3, a compressor of this embodiment includes a crank shaft 10 that is rotationally driven by a prime mover, a bearing 12 that receives the crank shaft 10, a casing 20, an outer-race gear 30 that is disposed inside the casing 20, a planetary member (planetary carrier) 40 that includes a planetary gear 42 engaging with an inner gear 32 of the outer-race gear 30, a piston 50 that moves in a reciprocating manner along a specific reciprocating direction inside the casing 20 while rotating relative to the planetary member 40, and a pump 60 that supplies lubricant to the bearing 12 or each gear. Furthermore, FIG. 2 is a cross-sectional view taken along the line II-II of FIG. 1, but FIG. 2 illustrates an imaginary planetary gear 42. Further, FIG. 2 illustrates a pitch circle P of the planetary gear 42 by the one-dotted chain line.

**[0015]** As illustrated in FIGS. 1 and 3, the crank shaft 10 includes a main shaft 10a that is connected to the prime mover, a crank pin 10b that includes a center axis O2 disposed at a position biased from the center axis O1 of the main shaft 10a so as to extend in a direction parallel to the center axis O1, and a crank arm 10c that connects the main shaft 10a to the crank pin 10b.

**[0016]** As illustrated in FIGS. 1 and 2, the casing 20 mainly includes a crank casing 21 that accommodates the crank shaft 10 and a cylinder 28 that accommodates the piston 50. Furthermore, a suction line that suctions a gas such as a hydrogen gas into the cylinder 28 and a discharge line that discharges a gas compressed inside the cylinder 28 to the outside of the cylinder 28 are not illustrated in the drawings.

**[0017]** The crank casing 21 accommodates the crank shaft 10, the bearing 12, the outer-race gear 30, the planetary member 40, a part of the piston 50, and the pump 60. More specifically, the crank casing 21 includes a main body 22 that accommodates the crank shaft 10, the bearing 12, the outer-race gear 30, the planetary member 40, and a part of the piston 50 and a pump accommodation portion 25 that accommodates the pump 60. As illustrated in FIGS. 1 and 3, the pump accommodation portion 25 is adjacent to the main body 22 in the direction of the center axis O1 of the main shaft 10a. An attachment wall 26 for the pump 60 is provided in the boundary between the main body 22 and the pump accommodation portion 25 inside the crank casing 21. An oil buffer 27 that retains lubricant drawn from the pump 60 is formed in a space surrounded by the attachment wall 26, the main body 22, and the crank shaft 10. In this embodiment, the crank casing 21 has airtightness and pressure resistance. More specifically, the pressure resistance corresponds to the pressure resistance capable of withstanding the pressure substantially equal to the pressure of the gas suctioned from the suction line.

**[0018]** As illustrated in FIGS. 1 and 3, the main body 22 includes a first wall 23 that holds the crank arm 10c close to the main shaft 10a and a second wall 24 that holds the crank arm 10c distant from the main shaft 10a. The first wall 23 includes a first opening that is formed in the direction of the center axis O1, and the first opening retains the main shaft 10a and retains the crank arm 10c and the bearing 12 on the close side from the main shaft 10a. The second wall 24 includes a second opening that is formed in the direction of the center axis O1, and the second opening retains the bearing 12 and the crank arm 10c on the far side from the main shaft 10a. The first wall 23 and the second wall 24 are disposed so as to face each other in a posture in which both walls are perpendicular to the center axis O1. The attachment wall 26 is attached to the outer surface of the second wall 24 so as to block the second opening of the second wall 24. As illustrated in FIG. 3, a lower end 24a of the second wall 24 is separated from the bottom wall of the crank casing 21, and hence the inside of the main body 22 is connected to the inside of the pump accommodation portion 25. For this reason, the lubricant that is supplied to each bearing or each gear and falls to the lower portion of the main body 22 is led to the pump accommodation portion 25. That is, the lower portion of the main body 22 and the lower portion of the pump accommodation portion 25 serve as an oil reservoir. The pump accommodation portion 25 has a shape that surrounds the pump 60 along

with the attachment wall 26. Furthermore, the inner surface of the bottom wall of the pump accommodation portion 25 is set to a position lower than the inner surface of the bottom wall of the main body 22.

**[0019]** As illustrated in FIG. 1, the cylinder 28 extends in a linear shape along the direction parallel to the radial direction of the circle formed about the center axis O1 of the outer-race gear 30 within a horizontal plane. The cylinder 28 guides the reciprocating movement of the piston 50 along the parallel direction (the reciprocating direction).

**[0020]** As illustrated in FIGS. 1 and 3, the bearing 12 is provided between the crank shaft 10 and the crank casing 21, and more specifically, between the crank arm 10c and the main body 22. Further, a first bearing 14 that permits the rotation of the planetary member 40 relative to the crank pin 10b is provided between the crank shaft 10 and the planetary member 40, and a second bearing 16 that permits the rotation of the piston 50 relative to the planetary member 40 is provided between the planetary member 40 and the piston 50.

**[0021]** The outer-race gear 30 is an internally-toothed gear that includes the inner gear 32. As illustrated in FIG. 3, the outer-race gear 30 has a radius larger than the rotation radius of the crank pin 10b, and is disposed inside the main body 22 of the crank casing 21 so as to surround the crank shaft 10. More specifically, the outer-race gear 30 is attached to the inner surface of the second wall 24 of the main body 22 in a posture in which the center thereof matches the center axis O1 of the main shaft 10a of the crank shaft 10.

**[0022]** The planetary member 40 includes the planetary gear 42 that engages with the outer-race gear 30, an eccentric shaft 44 that is connected to the planetary gear 42, and a counter weight 46 that is connected to the eccentric shaft 44. As illustrated in FIGS. 1 and 3, the planetary gear 42, the eccentric shaft 44, and the counter weight 46 are connected in this order in the direction of the center axis O1 of the main shaft 10a so as to rotate together. The crank pin 10b of the crank shaft 10 is inserted through the planetary member 40 so that the planetary member 40 rotates relative to the crank shaft 10.

**[0023]** The planetary gear 42 rotates inside the outer-race gear 30 (revolves about the center axis O1) while engaging with the outer-race gear 30 as the crank pin 10b of the crank shaft 10 rotates about the center axis O1. The radius of the pitch circle P (see FIG. 2) of the planetary gear 42 is set to a half of the radius of the pitch circle of the outer-race gear 30. Here, an engagement point (hereinafter, referred to as a "top dead center engagement point P1") between the outer-race gear 30 and the planetary gear 42 while the piston 50 is located at the top dead center inside the cylinder 28 is set so as to match the point close to the piston 50 in the intersection point between the pitch circle of the outer-race gear 30 and the longitudinal direction of the cylinder 28. Then, since the radius of the pitch circle P of the planetary gear 42 is a half of the radius of the outer-race gear 30, the

top dead center engagement point P1 linearly moves in a reciprocating manner along the longitudinal direction of the cylinder 28, that is, the reciprocating direction with the rotation of the planetary gear 42.

**[0024]** As illustrated in FIGS. 1 and 3, the eccentric shaft 44 is adjacently connected to the planetary gear 42 in the direction of the center axis O1 so that the center thereof is located at a position biased from the center axis of the planetary gear 42 (the center axis O2 of the crank pin 10b). Specifically, the center axis of the eccentric shaft 44 is set so as to pass the top dead center engagement point P1. For this reason, the eccentric shaft 44 rotates (spins) about the center axis of the eccentric shaft 44 while rotating relative to the crank pin 10b with the revolution of the planetary gear 42, and linearly moves in a reciprocating manner along the reciprocating direction. In this embodiment, the eccentric shaft 44 is formed in a disk shape.

**[0025]** As illustrated in FIGS. 1 and 2, the counter weight 46 is adjacently connected to the eccentric shaft 44 in the direction of the center axis O1 so that the center of gravity thereof is located at the opposite to the center of gravity of the eccentric shaft 44 with respect to the center axis of the planetary gear 42.

**[0026]** As illustrated in FIGS. 1 and 2, the piston 50 includes an annular portion 52 that surrounds the eccentric shaft 44 through the second bearing 16, a piston rod 54 that extends in the longitudinal direction of the cylinder 28 from the annular portion 52, and a piston body 56 that is connected to the front end of the piston rod 54.

**[0027]** The annular portion 52 is rotatable relative to the eccentric shaft 44. For this reason, the annular portion 52 linearly moves in the reciprocating direction so as to follow the linear movement of the eccentric shaft 44 along the reciprocating direction. That is, since the second bearing 16 is interposed between the eccentric shaft 44 and the annular portion 52, the rotational movement of the eccentric shaft 44 is not transmitted to the annular portion 52, and only the linear movement of the eccentric shaft 44 is transmitted to the annular portion 52.

**[0028]** The piston rod 54 has a shape that extends along the extension line of the track of the center of the eccentric shaft 44 during the reciprocating movement of the eccentric shaft 44 (the track of the top dead center engagement point P1 during the revolution of the planetary gear 42 about the center axis O1) along the reciprocating direction. The piston rod 54 linearly moves inside the cylinder 28 along with the linear movement of the annular portion 52 in the reciprocating direction.

**[0029]** Here, the cylinder 28 has a shape in which the piston 50 is guided in the longitudinal direction while the posture of the piston 50 at the top dead center is maintained. More specifically, the cylinder 28 has a shape in which the piston body 56 is guided in a reciprocating manner along the longitudinal direction thereof without being inclined with respect to the longitudinal direction of the cylinder 28. For this reason, when the planetary gear 42 revolves about the center axis O1 in a spinning state, the

piston body 56 linearly moves in a reciprocating manner inside the cylinder 28 while taking the same posture as that of the top dead center. Thus, the piston body 56 compresses a gas suctioned from the suction line.

**[0030]** As illustrated in FIGS. 1 and 3, the pump 60 includes a pump body 62 that supplies lubricant to each of the bearings (the bearing 12, the first bearing 14, and the second bearing 16) and the gears, and a suction portion 66 that suctions the lubricant from the oil reservoir inside the crank casing 21 to the pump body 62. The pump body 62 is attached to the attachment wall 26 provided inside the crank casing 21. The pump body 62 is connected to the crank shaft 10 through a coupling 64 disposed in a hole formed in the attachment wall 26. Specifically, the coupling 64 connects a portion passing the center axis O1 in the crank arm 10c distant from the main shaft 10a to a rotor (not illustrated) built in the pump body 62. For this reason, the drive power of the crank shaft 10 is transmitted to the pump body 62 through the coupling 64. The pump body 62 supplies the lubricant suctioned from the oil reservoir inside the crank casing 21 by the suction portion 66 to each bearing or each gear at a predetermined supply pressure through a supply line 68 (see FIG. 1).

**[0031]** Here, the pressure inside the crank casing 21 becomes a pressure substantially equal to the pressure of the gas suctioned from the suction line, and the supply pressure at which the pump 60 supplies the lubricant becomes a pressure (hereinafter, referred to as a "pure supply pressure") purely necessary for supplying the lubricant to each bearing or each gear. For this reason, the sealing pressure that seals the leakage of the lubricant from the inside of the pump body 62 to the outside of the pump body 62 may be set to the pure supply pressure or so. On the contrary, in a case where the crank casing 21 has airtightness and pressure resistance and the pump 60 is disposed at the outside of the casing 20, the supply pressure at which the pump 60 supplies the lubricant becomes the sum of the inner pressure of the crank casing 21 and the pressure at which the lubricant is supplied to each bearing or each gear. For this reason, the sealing pressure that seals the leakage of the lubricant from the inside of the pump body 62 to the outside of the pump body 62 becomes higher than the pure supply pressure. That is, in this embodiment, since the crank casing 21 has airtightness and pressure resistance and the pump 60 is accommodated inside the casing 20, the sealing pressure of the pump 60 may be decreased. Thus, it is possible to ensure the sealing performance of the pump without using a high-performance pump having excellent sealing performance.

**[0032]** Next, the running operation of the compressor of this embodiment will be described.

**[0033]** When the prime mover is driven, the crank shaft 10 is rotationally driven. In accordance with this rotational driving operation, the planetary gear 42 spins about the center axis O2 of the crank pin 10b while rotating relative to the crank pin 10b of the crank shaft 10 and revolves

about the center axis O1 of the main shaft 10a inside the outer-race gear 30 while engaging with the outer-race gear 30. Here, the top dead center engagement point P1 is set so as to match the point near the piston 50 in the intersection point between the pitch circle of the outer-race gear 30 and the longitudinal direction of the cylinder 28. Furthermore, since the radius of the pitch circle P of the planetary gear 42 is a half of the radius of the outer-race gear 30, the eccentric shaft 44 linearly moves in a reciprocating manner along the reciprocating direction along with the planetary gear 42 while rotating (spinning) about the center axis thereof, when the planetary gear 42 revolves inside the outer-race gear 30 while the engagement point of both gears is maintained at the top dead center engagement point P1. The piston 50 linearly moves in a reciprocating manner in the reciprocating direction relative to the eccentric shaft 44 so as to follow the reciprocating movement of the eccentric shaft 44. Thus, a gas suctioned from the suction line is compressed. Further, the pump 60 occasionally supplies the lubricant suctioned from the oil reservoir inside the crank casing 21 to each bearing or each gear.

**[0034]** As described above, in the compressor of this embodiment, the pump 60 is accommodated inside the casing 20. For this reason, even when the lubricant leaks from the pump 60 when the lubricant is supplied to the bearing 12 or each gear, the lubricant stays inside the casing 20 and does not leak to the outside of the casing 20. Accordingly, there is no need to additionally provide a component such as an oil receiving portion that receives the lubricant leaking from the pump 60, and the leakage of the lubricant from the pump 60 is permitted. Thus, there is no need to use a high-performance pump having excellent lubricant sealing performance. Further, since the compressor of this embodiment includes a so-called hypocycloid mechanism with the outer-race gear 30 and the planetary gear 42, there is no need to require a strict lubricating condition like a compressor using a piston crank mechanism with a cross head. In addition, the rotational movement of the crank shaft 10 is directly converted into the reciprocating movement of the piston 50. Therefore, the power transmission efficiency is excellent compared to the compressor using the piston crank mechanism.

**[0035]** Further, in this embodiment, since the crank shaft 10 is connected to the pump 60 so that the pump 60 is driven by the rotation of the crank shaft 10, the prime mover as the power source for rotating the crank shaft 10 is used as the power source of the pump 60. Accordingly, since there is no need to provide a dedicated power source for driving the pump 60, the structure becomes simplified.

**[0036]** Further, in this embodiment, since the oil buffer 27 is formed in a space surrounded by the attachment wall 26, the main body 22, and the crank shaft 10, the lubricant may be sufficiently supplied to the bearing 12 and the like.

**[0037]** Further, in the compressor of this embodiment,

the crank casing 21 has airtightness and pressure resistance in addition to the configuration in which the pump 60 is accommodated inside the crank casing 21. Accordingly, the sealing pressure for sealing the leakage of the lubricant from the inside of the pump 60 to the outside of the pump 60 may be decreased so as to become the pure supply pressure or so. Thus, it is possible to ensure the sealing performance of the pump without using a high-performance pump having excellent sealing performance.

(Second Embodiment)

**[0038]** FIG. 4 is a cross-sectional view illustrating the vicinity of the attachment wall 26 of a compressor of a second embodiment of the present invention. Furthermore, in the second embodiment, only the difference from the first embodiment will be described, and the structure, the operation, and the effect which are the same as those of the first embodiment will not be described.

**[0039]** In this embodiment, a cylindrical member 29 is attached to the surface opposite to the attachment surface for the pump 60 in the attachment wall 26. The end of the crank shaft 10 is inserted into the cylindrical member 29. An oil seal 29a is attached between the cylindrical member 29 and the end of the crank shaft 10. Thus, a space is formed which is surrounded by the cylindrical member 29, the crank shaft 10, and the attachment wall 26. That is, in this embodiment, this space serves as the oil buffer 27. For this reason, in this embodiment, the volume capacity of the oil buffer 27 may be flexibly adjusted through the adjustment of the inner diameter of the cylindrical member 29. Furthermore, the cylindrical member 29 may be formed as a single member with the attachment wall 26.

**[0040]** Furthermore, it is understood that the embodiments disclosed herein are merely examples and do not limit the present invention in all respects. The scope of the present invention is expressed by claims instead of the embodiments, and includes the meaning equivalent to claims and all modifications within the scope.

**[0041]** For example, in the above-described embodiment, an example has been described in which the crank shaft 10 and the pump body 62 are connected to each other through the coupling 64. However, the pump 60 may be driven while being independent from the crank shaft 10. That is, a power source that drives the pump 60 may be provided separately from the prime mover that rotates the crank shaft 10. With such a configuration, it is possible to individually manage the driving of the crank shaft 10 and the driving of the pump 60.

**[0042]** Further, a portion that holds the bearing 12 may be a member separated from the first wall 23 or the second wall 24. The piston 50 may be driven in an arbitrary direction such as a gravity direction, so long as the piston moves in a reciprocating manner along the direction parallel to the radial direction of the outer-race gear 30.

**[0043]** A compressor of the present invention includes

a crank shaft, a bearing, a casing, an outer-race gear that is disposed so as to surround the crank shaft, a planetary gear that has a radius of a pitch circle set to a half of a radius of a pitch circle of the outer-race gear and causes the crank shaft to be inserted therethrough so that the planetary gear rotates relative to the crank shaft, a piston that is connected to the planetary gear so as to rotate relative to the planetary gear and moves in a reciprocating manner in the direction parallel to the radial direction of the outer-race gear inside the casing in a manner such that the planetary gear rotates inside the outer-race gear while engaging with the outer-race gear, and a pump that supplies lubricant to the bearing. Here, the pump is accommodated inside the casing.

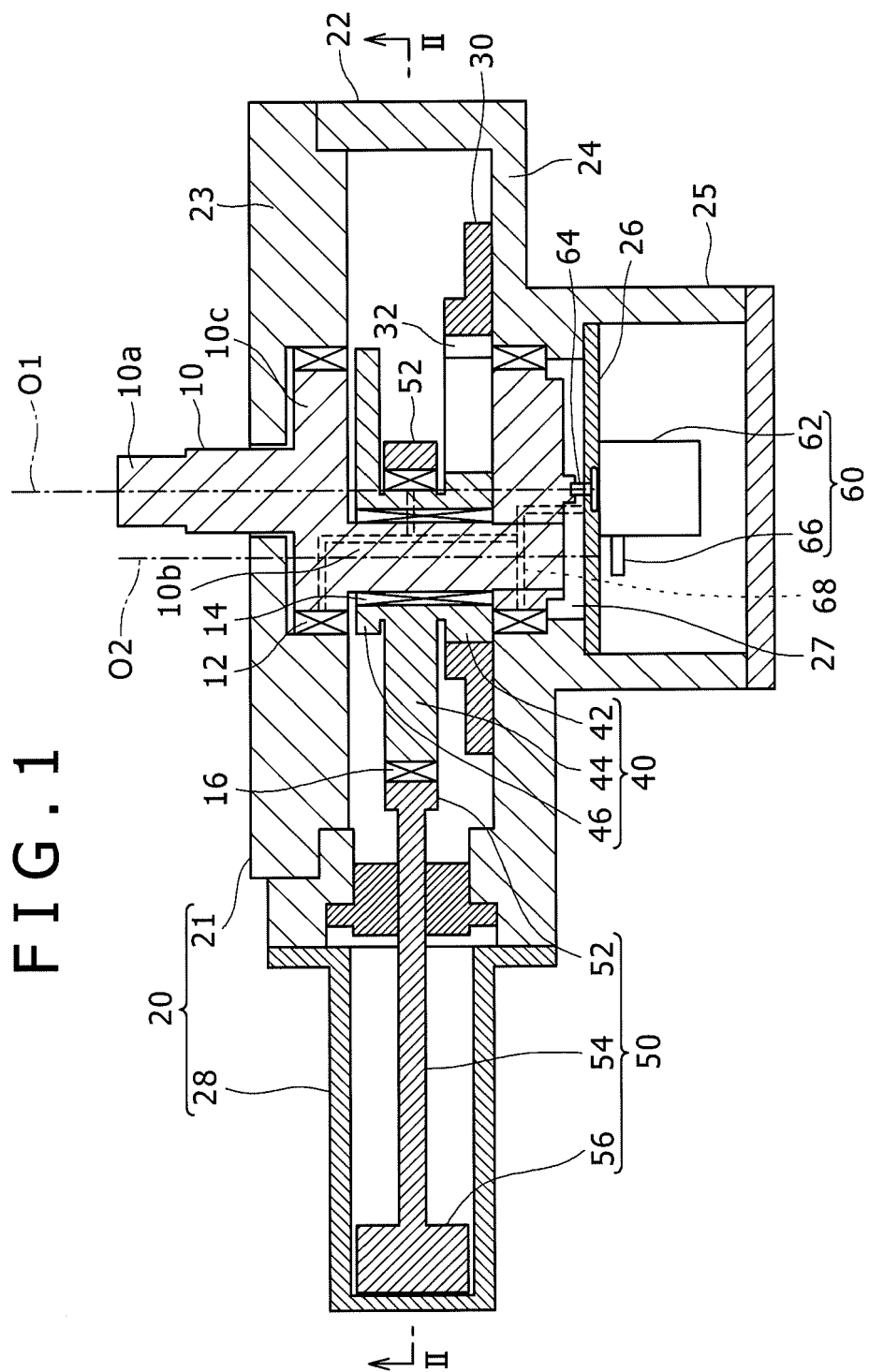
## Claims

### 1. A compressor comprising:

a crank shaft that is rotationally driven by a prime mover;  
a bearing that receives the crank shaft;  
a casing that accommodates the crank shaft and the bearing;  
an outer-race gear that is disposed inside the casing so as to surround the crank shaft;  
a planetary gear that has a radius of a pitch circle set to a half of a radius of a pitch circle of the outer-race gear and causes the crank shaft to be inserted therethrough so that the planetary gear rotates relative to the crank shaft;  
a piston that is connected to the planetary gear so as to rotate relative to the planetary gear, the piston moving in a reciprocating manner along the direction parallel to the radial direction of the outer-race gear inside the casing when the planetary gear rotates inside the outer-race gear while engaging with the outer-race gear; and  
a pump that is accommodated inside the casing and supplies lubricant to the bearing.

2. The compressor according to claim 1, wherein the crank shaft is connected to the pump so that the pump is driven by the rotation of the crank shaft.

3. The compressor according to claim 1, wherein an oil buffer is formed between the crank shaft and an attachment wall for the pump.



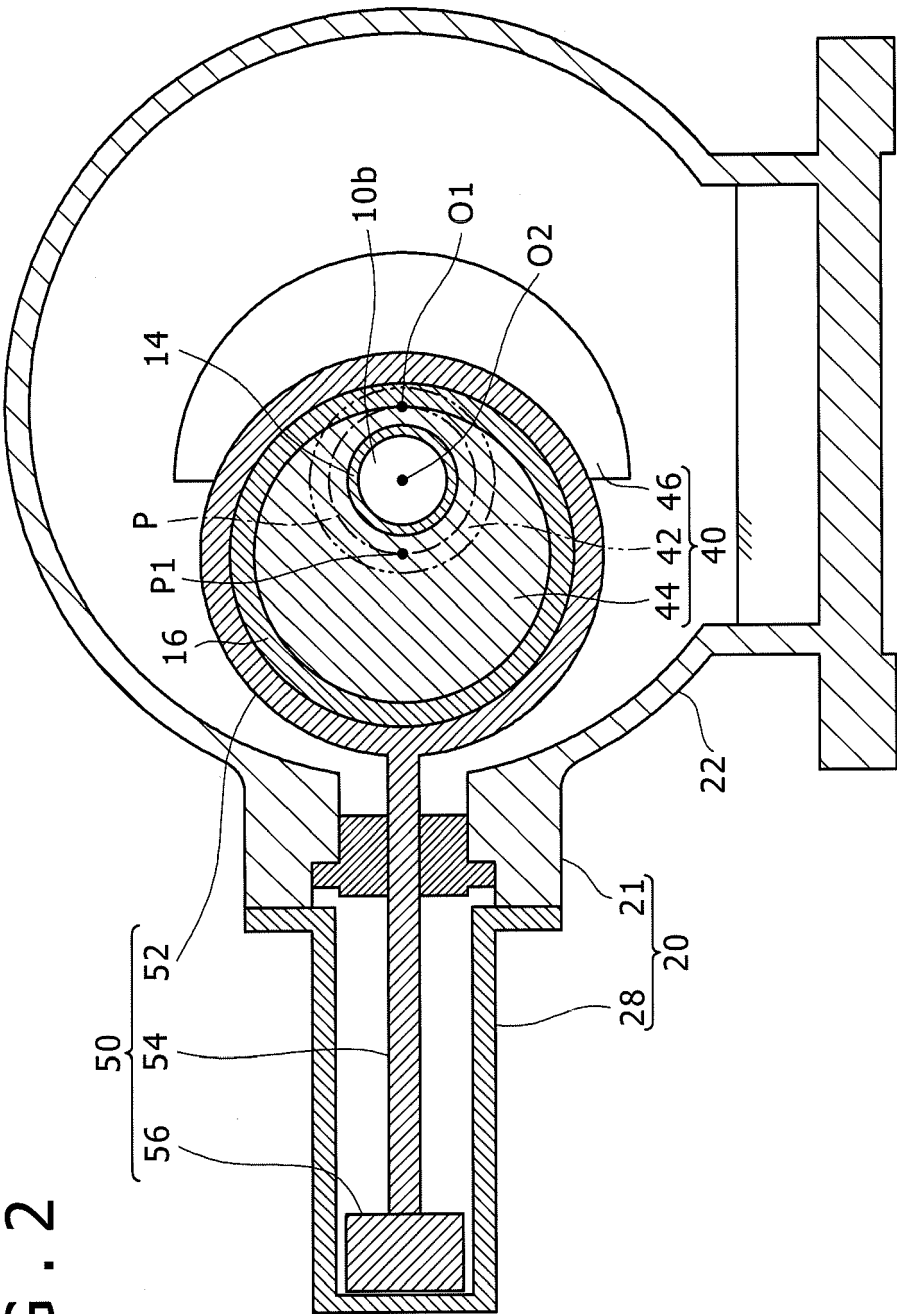


FIG. 2

FIG. 3

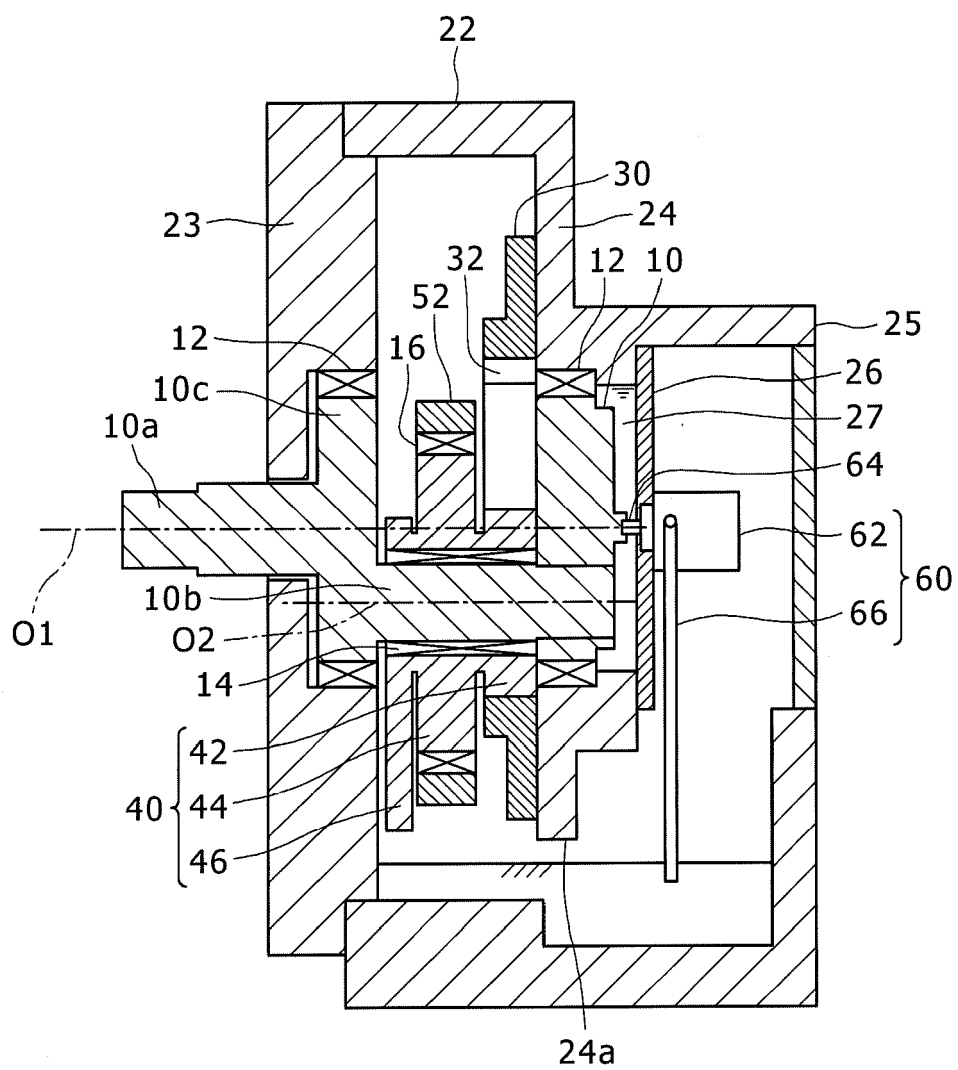
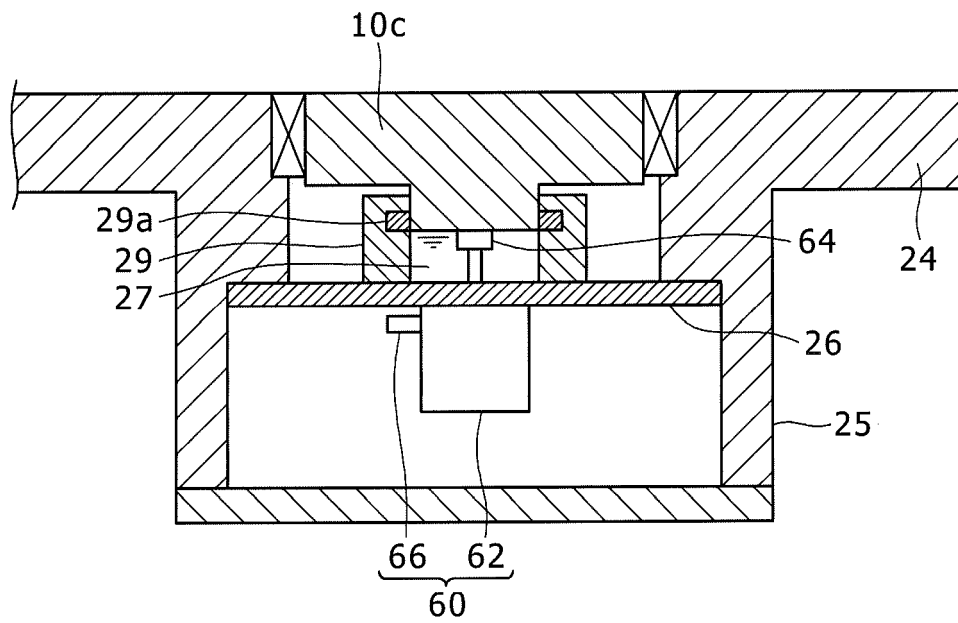


FIG. 4



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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