EXTERNAL GEAR PUMP

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ABSTRACT
An external gear pump capable of achieving both a sealing property and a sliding property is disclosed. The external gear pump includes a pair of rotating shafts that are respectively pivotally supported by bearings provided in a casing; at least a pair of gears that are respectively fixed to the pair of rotating shafts and are externally meshed with each other; a side plate that is provided in sliding contact with one side surfaces of the pair of gears; and a seal block integrally including a side surface sliding part and a tooth tip sliding part. The external gear pump further includes movement restrictors on both sides of a straight line connecting axes of the pair of gears, and the movement restrictors restrict the seal block from moving with respect to the casing on a plane orthogonal to the rotating shafts.

Diagram of external gear pump with labeled parts.
EXTERNAL GEAR PUMP

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention
[0002] The present invention relates to an external gear pump that is used for a hydraulic pressure source for a hydraulic system and other devices and is also preferably used to increase the pressure of a low-viscosity fluid such as gasoline and a brake fluid.

[0003] 2. Background Art

[0005] JP Patent Application Publication No. 2010-31771 A discloses an external gear pump including: a pump assembly including: a pair of gears that respectively have rotating shafts pivotally supported and are externally meshed with each other; a side plate that is provided in sliding contact with side surfaces of the pair of gears; and a seal block that is located close to the gears in a given direction and seals the gears in contact with the side plate, the pump assembly driving one of the rotating shafts; a casing that houses the pump assembly; and bearings that are fixed to the casing and respectively pivotally support the rotating shafts, in which the seal block is restricted from moving with respect to a component formed integrally with the casing on a plane orthogonal to the rotating shafts.

[0006] JP Patent Application No. 2010-121447 A discloses a gear pump including a pump assembly including: gears driven by a drive shaft; a pair of side plates that suppress leakage of an operating fluid from gear side surfaces; and a tooth tip sealing member that seals tooth tips, in which at least one of the side plates and the tooth tip sealing member are integrally formed.

[0007] In the external gear pump disclosed in JP Patent Application No. 2010-31771 A, one side surfaces of the gears slide on a plurality of members such as the casing as a pressure vessel and the bearings, and a used material is not suitable for sliding in some cases, so that the sliding resistance may be increased.

[0008] In the external gear pump disclosed in JP Patent Application No. 2010-121447 A, the strength of components needs to be designed with a sufficiently large tolerance in order to prevent the deformation of the seal block when a pressure is applied thereto.

[0009] The present invention has been made by focusing attention on the above-mentioned problems, and therefore has an object to provide an external gear pump that is capable of achieving both the sealing property and the sliding property and is advantageous for the production cost.

SUMMARY OF THE INVENTION

[0010] In order to solve the above-mentioned problems, an external gear pump according to the present invention includes: a casing; a pair of rotating shafts that are respectively pivotally supported by bearings provided in the casing; at least a pair of gears that are respectively fixed to the pair of rotating shafts and are externally meshed with each other; a side plate that is provided in sliding contact with one side surfaces of the pair of gears; and a seal block integrally including: a side surface sliding part that slidingly contacts another side surfaces of the pair of gears; and a tooth tip sliding part that seals tooth tips of the gears. The external gear pump further includes movement restrictors on both sides of a straight line connecting axes of the pair of gears, and the movement restrictors restrict the seal block from moving with respect to the casing on a plane orthogonal to the rotating shafts.

[0011] According to the present invention, the gear side surface sliding part and the tooth tip sealing part are integrally formed in the seal block. Accordingly, a material suitable for each sliding surface can be selected, and the deformation of the seal block can be small. As a result, the present invention provides the external gear pump capable of achieving both the sealing property and the sliding property.

[0012] Further, the present invention provides the external gear pump capable of reducing the number of components to thereby cut the production cost, in addition to the above-mentioned effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a view illustrating an external gear pump according to Embodiment 1 of the present invention, which is a cross-sectional view taken along the line C-C' in FIG. 2.

[0014] FIG. 2 is a view illustrating the external gear pump according to Embodiment 1 of the present invention, which is a cross-sectional view taken along the line A-A' in FIG. 1.

[0015] FIG. 3 is a view illustrating the external gear pump according to Embodiment 1 of the present invention, which is a cross-sectional view taken along the line B-B' in FIG. 1.

[0016] FIG. 4 is a plan view illustrating a first seal block constituting the external gear pump according to Embodiment 1 of the present invention.

[0017] FIG. 5 is a plan view illustrating a lower surface of a middle casing constituting the external gear pump according to Embodiment 1 of the present invention.

[0018] FIG. 6 is a plan view when the first seal block is attached using a jig 60 in the external gear pump according to Embodiment 1 of the present invention.

[0019] FIG. 7 is a front view when the first seal block is attached using the jig 60 in the external gear pump according to Embodiment 1 of the present invention, which is a cross-sectional view taken along the line E-E' in FIG. 6.

[0020] FIG. 8 is a perspective view illustrating a convex insertion pin used for the external gear pump according to the present invention.

[0021] FIG. 9 is a plan view illustrating a state where a middle casing 6 is removed from an external gear pump according to Embodiment 2 of the present invention.

[0022] FIG. 10 is a view illustrating an external gear pump according to Embodiment 3 of the present invention, which is a cross-sectional view taken along the line H-H' in FIG. 11.

[0023] FIG. 11 is a view illustrating the external gear pump according to Embodiment 3 of the present invention, which is a cross-sectional view taken along the line G-G' in FIG. 10.

[0024] FIG. 12 is a view illustrating the external gear pump according to Embodiment 3 of the present invention, which is a cross-sectional view taken along the line F-F' in FIG. 10.

[0025] FIG. 13 is a cross-sectional view illustrating a configuration of an external gear pump according to Embodiment 4 of the present invention.
Hereinafter, embodiments of the present invention are described with reference to the drawings.

Embodiment 1

An external gear pump according to Embodiment 1 of the present invention is described. An external gear pump according to Embodiment 1 is illustrated in FIG. 1 to FIG. 3, and includes: a front casing 2 provided on a side on which a drive source for a motor (not illustrated) and other members is set; a rear casing 3 provided on the opposite side to the motor; a middle casing 6 provided between the front casing 2 and the rear casing 3; a drive shaft 4 that is set rotatably with respect to these casings and is driven by the drive source; a driven shaft 5; a first pump unit 20 that is provided inside of the middle casing 6 on the front casing 2 side; and a second pump unit 10 provided on the rear casing 3 side.

The front casing 2 is provided with: a through-hole 2a into which the drive shaft 4 can be inserted, the through-hole 2a having a stepped shape that allows a sealing member 36 and a front bearing 30 for the drive shaft to be inserted into the through-hole 2a on the drive source side and on the middle casing 6 side, respectively; and an insertion hole 2b having a stepped shape that allows the driven shaft 5 and a front bearing 32 for the driven shaft to be inserted into the insertion hole 2b.

The rear casing 3 is provided with: an insertion hole 3a into which the drive shaft 4 can be inserted, the insertion hole 3a having a stepped shape that allows a rear bearing 31 for the drive shaft 4 to be inserted into the insertion hole 3a on the middle casing 6 side; and an insertion hole 3b having a stepped shape that allows the driven shaft 5 and a rear bearing 33 for the driven shaft to be inserted into the insertion hole 3b.

The middle casing 6 is provided with: a cylindrical concave part 6c on the front casing 2 side and a cylindrical concave part 6d on the rear casing 3 side, for inserting the first pump unit 20 and the second pump unit 10, respectively; an insertion hole 6f formed in at least one of the cylindrical concave parts 6c and 6d, for inserting a sealing member 35; further, a through-hole 6g into which the drive shaft 4 is inserted; and a through-hole 6h into which the driven shaft 5 is inserted.

The drive shaft 4 is pivotally supported by: the rear casing 3 via the rear bearing 31 for the drive shaft, the rear bearing 31 being provided in the rear casing 3; and the front casing 2 via the front bearing 30 for the drive shaft, the front bearing 30 being provided in the front casing 2.

The driven shaft 5 is pivotally supported by: the rear casing 3 via the rear bearing 33 for the driven shaft, the rear bearing 33 being provided in the rear casing 3; and the front casing 2 via the front bearing 32 for the driven shaft, the front bearing 32 being provided in the front casing 2.

The first pump unit 20 is inserted into the cylindrical concave part 6c, and the second pump unit 10 is inserted into the cylindrical concave part 6d. In this state, a pump operation can be obtained. Configurations and behaviors of the first pump unit 20 and the second pump unit 10 are basically the same as each other, except that the first pump unit 20 is attached to the front casing 2 and the second pump unit 10 is attached to the rear casing 3. Accordingly, with the first pump unit 20 being taken as an example, the configurations and behaviors of these pump units are described below in detail.

The first pump unit 20 includes a first drive gear 23, a first driven gear 24, a first seal block 22, a first side plate 21, a first seal block sealing member 26, and a first side plate sealing member 25. The first drive gear 23 is meshed with the first driven gear 24, and these two gears 23 and 24 integrally rotate. In addition, a keyway is formed in the first drive gear 23, and a drive pin 4a that is fitted into the drive shaft 4 to move integrally therewith is fitted to the keyway. With this configuration, the first drive gear 23 and the drive shaft 4 integrally rotate. Similarly, a keyway is formed in the first driven gear 24, and a drive pin 5a that moves integrally with the driven shaft 5 is fitted to the keyway. With this configuration, the first driven gear 24 and the driven shaft 5 integrally rotate. Accordingly, the first drive gear 23, the first driven gear 24, and the driven shaft 5 integrally rotate along with the rotation of the drive shaft 4.

The first side plate 21 is a member for sealing gear side surfaces in sliding contact with the side surfaces of the first drive gear 23 and the first driven gear 24, and is sandwiched between the middle casing 6 and these two gears 23 and 24. In addition, the sealing member 25 is provided on the middle casing 6 side of the first side plate 21. The first seal block 22 has an I shape as illustrated in FIG. 1, and seals gear side surfaces opposite to the gear side surfaces sealed by the first side plate 21 and also seals tooth tips.

Next, with reference to FIG. 4, a structure of the first seal block 22 is described. The first seal block 22 is provided with a groove 22a such that a sliding surface is formed inside of gear tooth bottoms, and slidingly contacts the gear side surfaces via a convex sliding-contact part 22g. The sliding friction can be reduced by using, for example, a resin for the first seal block 22. In addition, in order to position the first seal block 22 in the front casing 2, a first pin insertion hole 22a of the first seal block 22 and a second pin insertion hole 22f of the first seal block 22 are provided respectively on the right side and the left side in FIG. 1 and FIG. 2. As illustrated in FIG. 4, the first seal block 22 also includes tooth tip sliding surfaces 22e and 22f for sealing when the tooth tips slide.

A method of attaching the first seal block 22 is described. The tooth tip sliding surfaces 22e and 22f of the first seal block 22 keep the seal with the tooth tips of the gears. Accordingly, the tooth tip sliding surfaces 22e and 22f are each required to have a diameter slightly smaller than those of passages of the tooth tips during pump driving and have small individual variations in cutting amount (to be described later) by the tooth tips. If these are not appropriate, a gap generated at the time of pressure application may increase leakage of the tooth tip parts, and variations in cutting amount (to be described later) of the first seal block 22 by the tooth tips may lead to occurrence of variations in volumetric efficiency.

In view of the above, a method of positioning the seal block is described with reference to FIG. 6 and FIG. 7. First, a jig 60 including a shaft part 60a and a gear alternative part 60b is used. The shaft part 60a has the largest diameter that allows the shaft part 60a to be inserted into the through-hole 2a of the front casing 2, and the gear alternative part 60b has a diameter corresponding to a desired tooth tip position. Note that the diameter corresponding to a desired tooth tip position means, for example, a diameter that falls within the following range. That is, when the tooth tips are the closest to the tooth tip seal, the relation of [distance from bearing center to tooth tips]−[distance from bearing center to tooth tip seal]...
is established, and when the tooth tips are the farthest from the tooth tip seal, the relation of [distance from bearing center to tooth roots on tooth tip seal side]=[distance from bearing center to tooth tip seal] is established.

Next, the jig 60 having such a configuration as described above is inserted into the front casing 2, whereby a fixing position of the first seal block 22 is determined. In this state, holes extending from the first seal block 22 into the front casing 2 are formed together using, for example, a drill on the right side (inlet side, a hole from the first pin insertion hole 22α of the first seal block 22 to the first pin insertion hole 22δ of the front casing 2) and the left side (outlet side, a hole from the second pin insertion hole 22η of the first seal block 22 to the second pin insertion hole 22ξ of the front casing 2) of a line connecting the drive shaft and the driven shaft. After that, a first pin 50 is inserted into the first pin insertion hole 22α of the first seal block 22 and the first pin insertion hole 22δ of the front casing 2, and a second pin 51 is inserted into the second pin insertion hole 22η of the first seal block 22 and the second pin insertion hole 22ξ of the front casing 2. In this way, the first seal block 22 is fixed to the front casing 2. According to a similar method, the second seal block 12 is fixed to the rear casing 3.

The first pin 50 is formed into a columnar shape, and the first pin insertion hole 22α of the first seal block 22 and the first pin insertion hole 22δ of the front casing 2 are each formed into a cylindrical shape having the same diameter as that of the first pin 50. The first seal block 22 is fixed by the first pin 50 rotatably with respect to the front casing 2. Similarly, the second pin 51 is formed into a columnar shape, and the second pin insertion hole 22η of the first seal block 22 and the second pin insertion hole 22ξ of the front casing 2 are each formed into a cylindrical shape having the same diameter as that of the second pin 51. In this way, the first seal block 22, which is rotatably supported by the first pin 50, is restricted from moving in a rotation direction thereof, and thus is restricted from moving with respect to the front casing 2 on a plane orthogonal to the drive shaft 4 and the driven shaft 5.

Note that it is sufficient for the second pin 51 to restrict the movement in the rotation direction about the first pin 50, and hence the second pin 51 may be formed into, for example, a convex shape illustrated in FIG. 8 instead of the columnar shape. It is preferable to set the second pin 51 in a direction in which a convex part thereof restricts movement in an upper-lower direction in FIG. 9 (the rotation direction about the first pin 50). In this way, the position of the first seal block 22 with respect to the front casing 2 is fixed.

In addition, as illustrated in FIG. 1, the first seal block sealing member 26 is provided in a circular ring-like pattern in an outer periphery of a side surface of the first seal block 22 on the front casing 2 side. A low suction pressure is applied inside of the first seal block sealing member 26. On the other hand, a high discharge pressure generated during pump driving is applied to a gear-side side surface of the first seal block 22 in a zone outside from the sliding-contact part 22g and to a side surface of the middle casing 6 in a zone outside from a seal line 22h. Accordingly, this discharge pressure causes a force pushing the first seal block 22 against the front casing 2 from the upper side to the lower side in FIG. 1 (from the near side to the far side of the sheet of FIG. 2), and this restricts the first seal block 22 from moving in the upper-lower direction in FIG. 1. At this time, it is sufficient to restrict the movement in the upper-lower direction, and hence the first seal block sealing member 26 may be set at an inner position instead of the outer periphery of the first seal block 22, under the condition that a pressure-applied area outside from the sealing member 26 set at the inner position is smaller than a higher pressure-applied area on the opposite side.

Note that, although both the holes are formed together in the present embodiment, because it is sufficient that the distance from the bearing center to the tooth tips be a desired distance, the forming method is not limited to the above as long as hole positions and shapes of the first pin insertion hole 22α of the first seal block 22, the first pin insertion hole 22δ of the front casing 2, the second pin insertion hole 22η of the first seal block 22, and the second pin insertion hole 22ξ of the front casing 2 can be processed with a precision high enough to achieve the desired distance.

As a result, the first seal block 22 is fixed both orthogonally and parallel to the drive shaft 4 and the driven shaft 5.

Next, behaviors and effects of Embodiment 1 are described. When the drive shaft 4 is driven by the drive source (not illustrated), the first drive gear 23 follows the drive shaft 4 to rotate in a direction indicated by an arrow 55 in FIG. 2, and the first driven gear 24 meshes with the first drive gear 23 rotates in a direction indicated by an arrow 55.

At this time, a liquid enters the middle casing 6 from an inlet port 41 via a route (not illustrated), fills an inlet part 56, and is housed in tooth grooves to be transported in the rotation direction along with the rotations of the first drive gear 23 and the first driven gear 24. After that, the first drive gear 23 and the first driven gear 24 start to be meshed with each other on an outlet part 57 side, whereby the liquid is pushed out of the tooth grooves. Accordingly, the liquid is continuously transported by the rotations of the first drive gear 23 and the first driven gear 24, and the pressure on the outlet part 57 side thus increases, so that the liquid is discharged from an outlet port (not illustrated). On this occasion, the seal is kept between the respective tooth tips of the first drive gear 23 and the first driven gear 24 and the seal block 22, and hence only the pressure on the inlet part 56 side of this seal decreases, whereas the pressure in other portions increase.

During pump driving, the tooth tips of the first drive gear 23 and the first driven gear 24 are pushed out from the high-pressure side to the low-pressure side, that is, to the right in FIG. 2, by an amount of gap between the drive shaft 4 and the driven shaft 5 and an amount of gap between each of the drive shaft 4 and the driven shaft 5 and the bearings. In the case of assemblage in which the tooth tips of the first drive gear 23 and the first driven gear 24 come into contact with the tooth tip sliding surfaces 22e and 22f of the first seal block 22 when being pushed out, the tooth tip sliding surfaces 22e and 22f of the first seal block 22 are cut off by an amount of movement of the tooth tips. In the external gear pump 1, a break-in operation is performed by such cutting off. The break-in operation absorbs production variations between the tooth tip sliding surface 22f or 22e and the first drive gear 23 or the first driven gear 24, and thus minimizes a gap between the tooth tips and the first seal block 22 during pump driving. Accordingly, the external gear pump 1 produces an effect of suppressing, to the minimum, a return of the liquid from the high-pressure side to the low-pressure side and thus increasing volumetric efficiency.

In the external gear pump 1 of Embodiment 1, the position of the first seal block 22 with respect to the gears can be determined with a high precision, and hence a difference in component dimensions due to production variations can be
absorbed at the time of assemblage. Further, the break-in operation time can be adjusted by adjusting the fixing position of the first seal block 22. For example, in the case of using the jig 60, of which the diameter is adjusted, the first seal block 22 is positioned against the jig 60 to be fixed, whereby the first seal block 22 can be easily fixed at a middle position. This can provide a configuration with a high volumetric efficiency while the break-in operation time is the shortest.

[0049] Further, the gear side surface sliding part and the tooth tip sliding part are integrally formed in the first seal block 22, and hence a material that makes a sliding resistance of each sliding part small can be selected for the first seal block 22. In addition, the load is supported by the first pin 50, and hence the material can be selected for the first seal block 22 with a focus on the sliding property. This can provide a gear pump with an excellent mechanical efficiency.

[0050] Furthermore, the first seal block 22 is fixed at two points, and hence the used pins can have a large cross-sectional area, resulting in an increase in flexural rigidity. Accordingly, the deformation of the first seal block 22 due to the load is small, a gap in the tooth tip sliding surfaces 22e and 22f can be reduced, and a high sealing property of the external gear pump 1 can be achieved.

[0051] Moreover, the two pump units are provided, and hence, for example, in the case of the use as a pump for a brake, it is possible to provide an external gear pump with such a high reliability that two separated high pressures can be made by a single drive source.

Embodiment 2

[0052] An external gear pump according to Embodiment 2 is described as an example in which the first pin insertion hole 22a of the first seal block 22 is formed into a circular shape but a shape in which movement only in one direction is restricted.

[0053] FIG. 9 is a plan view (a view corresponding to FIG. 5 of Embodiment 1) illustrating a state where the middle casing 6 is removed from the external gear pump according to Embodiment 2. As illustrated in FIG. 9, in the first pin insertion hole 22a of the first seal block 22, a right half thereof in FIG. 9 is processed so as to have the same diameter as that of the first pin 50, and a left side thereof is processed such that a gap is formed between a hole inner surface and the first pin 50.

[0054] The second pin insertion hole 22b of the first seal block 22 is formed into a cylindrical shape, and the second pin 51 is formed into a columnar shape or may be formed into the convex shape illustrated in FIG. 8.

[0055] During pump driving, a high pressure is applied to the first seal block 22 from the right side in FIG. 9, and a low pressure is applied thereto from the left side in FIG. 9 only in a portion in which the gear tooth tip sliding part is sealed, so that a leftward force is applied as a whole. Accordingly, the first seal block 22 does not move to the right, and hence the first seal block 22 is fixed rotatably with respect to the front casing 2 by restricting only half the circumference thereof similarly to the time of restricting the entire circumference thereof. Further, the first seal block 22 is restricted by the second pin 51 from moving in the rotation direction of the first seal block 22, so that the first seal block 22 is restricted from moving with respect to the front casing 2 on the plane orthogonal to the drive shaft 4 and the driven shaft 5. Other configurations and behaviors than the above are the same as those of Embodiment 1.

Embodiment 3

[0056] Embodiment 2 produces an effect that the restriction of only half the circumference facilitates assemblage and a component precision tolerance of the respective parts can be increased, in addition to effects similar to those of Embodiment 1.

Embodiment 4

[0057] An external gear pump according to Embodiment 3 is described as an example in which one pump unit is provided.

[0058] A configuration of the external gear pump 1 according to Embodiment 3 is described with reference to FIG. 10 to FIG. 12. The external gear pump 1 according to Embodiment 3 includes: the front casing 2 provided on the side on which the drive source for the motor (not illustrated) and other members is set; a cover casing 70 provided on the opposite side to the motor; a pair of the shafts 4 and 5 that are set rotatably with respect to the front casing 2 and the cover casing 70, the drive shaft 4 being driven by the drive source, the driven shaft 5 following rotation of the drive shaft 4; and a pump unit 90 that is provided inside of the cover casing 70 on the front casing 2 side.

[0059] The cover casing 70 is provided with a cylindrical concave part 70a into which the pump unit 90 can be inserted. The pump unit 90 has the same configuration as that of the first pump unit 20 in Embodiment 1, and a method of attaching the pump unit 90 is similar to the method of attaching the first pump unit 20 to the front casing 2 in Embodiment 1 or Embodiment 2. Other configurations and behaviors are similar to those of Embodiment 1.

[0060] Embodiment 3 can produce an effect similar to those of Embodiment 1 or Embodiment 2. Further, in Embodiment 3, because only one pump unit is provided, the external gear pump according to Embodiment 3 is suitably used for hydraulic equipment with only one system provided for pressure rising, and the configuration of the external gear pump can be simplified.

Embodiment 4

[0061] An external gear pump according to Embodiment 4 is described as an example in which one pump unit is provided and one rotating shaft is pivotally supported at two points.

[0062] A configuration of the external gear pump 1 according to Embodiment 4 is described with reference to FIG. 13.

[0063] The cover casing 70 is provided with the cylindrical concave part 70a into which the pump unit 90 can be inserted, on the front casing 2 side thereof. In addition, the cover casing 70 is provided with an insertion hole 70b having a stepped shape, and the drive shaft 4 and a (cover casing side) bearing 80 are inserted into the insertion hole 70b. In addition, the cover casing 70 is further provided with an insertion hole 70c having a stepped shape, and the driven shaft 5 and a (cover casing side) bearing 81 are inserted into the insertion hole 70c.

[0064] The drive shaft 4 is pivotally supported by: the front casing 2 via the front bearing 30 for the drive shaft; and the cover casing 70 via the cover casing side bearing 80. The driven shaft 5 is pivotally supported by: the front casing 2 via the front bearing 32 for the driven shaft; and the cover casing 70 via the cover casing side bearing 81. Other configurations and behaviors are the same as those of Embodiment 3, and Embodiment 4 can produce an effect similar to that of Embodiment 3.
In Embodiment 4, because both ends of each of the drive shaft 4 and the driven shaft 5 are supported, the load is distributed, and tilts of the shafts can be suppressed. As a result, an increase in sliding resistance on the gear sliding surface and the tooth tip sliding surface can be suppressed, and hence the external gear pump I capable of enhancing the sliding property can be provided.

In Embodiments 1 to 4 described above, the pins are used, but movement restrictors such as keys and bolts may be used instead. In addition, various metals, synthetic resins, and other substances are used for the materials of the seal blocks.

DESCRIPTION OF SYMBOLS

1. An external gear pump comprising:
   a casing;
   a pair of rotating shafts that are respectively pivotally supported by bearings provided in the casing;
   at least a pair of gears that are respectively fixed to the pair of rotating shafts and are externally meshed with each other;
   a side plate that is provided in sliding contact with one side surfaces of the pair of gears; and
   a seal block integrally including:
     a side surface sliding part that slidingly contacts another side surfaces of the pair of gears; and
     a tooth tip sliding part that seals tooth tips of the gears, wherein:
     the external gear pump further comprises movement restrictors on both sides of a straight line connecting axes of the pair of gears; and
     the movement restrictors restrict the seal block from moving with respect to the casing on a plane orthogonal to the rotating shafts.

2. The external gear pump according to claim 1, wherein:
   at least one of the movement restrictors restricts the seal block from moving in a direction substantially parallel to the straight line connecting the pair of gears, on the plane orthogonal to the rotating shafts; and
   at least another one of the movement restrictors restricts the seal block from moving in both of a direction substantially orthogonal to and the direction substantially parallel to the straight line connecting the pair of gears, on the plane orthogonal to the rotating shafts.

3. The external gear pump according to claim 1, wherein:
   at least one of the movement restrictors restricts the seal block from moving in a direction substantially parallel to the straight line connecting the pair of gears, on the plane orthogonal to the rotating shafts; and
   at least another one of the movement restrictors restricts the seal block from moving in a direction that is substantially orthogonal to the straight line connecting the pair of gears and is toward the pair of gears from the tooth tip sliding part, on the plane orthogonal to the rotating shafts.

4. The external gear pump according to claim 1, wherein
   at least one of the movement restrictors is a pin.

5. The external gear pump according to claim 1, wherein
   the seal block is made of a resin.

6. The external gear pump according to claim 1, further comprising a sealing member on a surface of the seal block, the surface being in contact with the casing, wherein
   an area of a portion of the surface in contact with the casing is smaller than a high-pressure applied area on an opposite side of the seal block, the portion being surrounded by the sealing member and receiving a high pressure.

7. The external gear pump according to claim 6, wherein
   the sealing member is provided in a circular pattern on the surface of the seal block, the surface being in contact with the casing.

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