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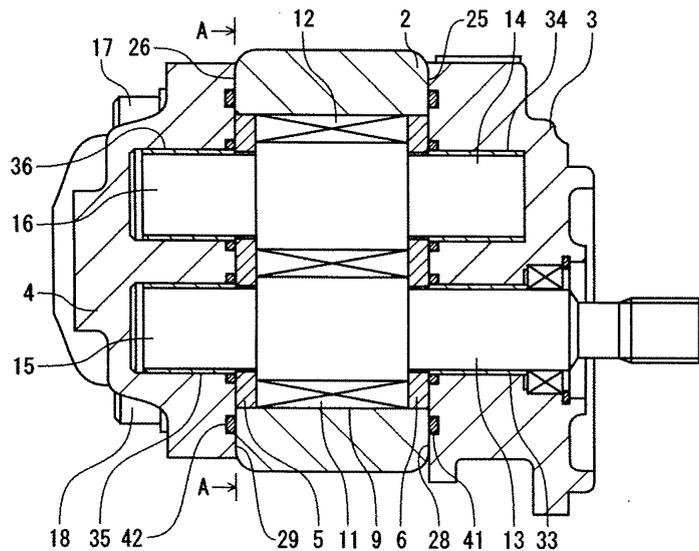
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(54) **GEAR PUMP**

(57) A gear pump (1) that discharges a fluid by rotating while a pair of gears (11, 12) are intermeshed includes a body (2) into which the respective gears (11, 12) are incorporated, a housing (3, 4) that contacts the body (2), a number of particles (30) that are interposed between

an end surface (25, 26) of the body (2) and an end surface (28, 29) of the housing (3, 4), which contact each other, to prevent positional deviation between the body (2) and the housing (3, 4), and a fastening member (17 to 20) that fastens the housing (3, 4) to the body (2).



**FIG. 1**

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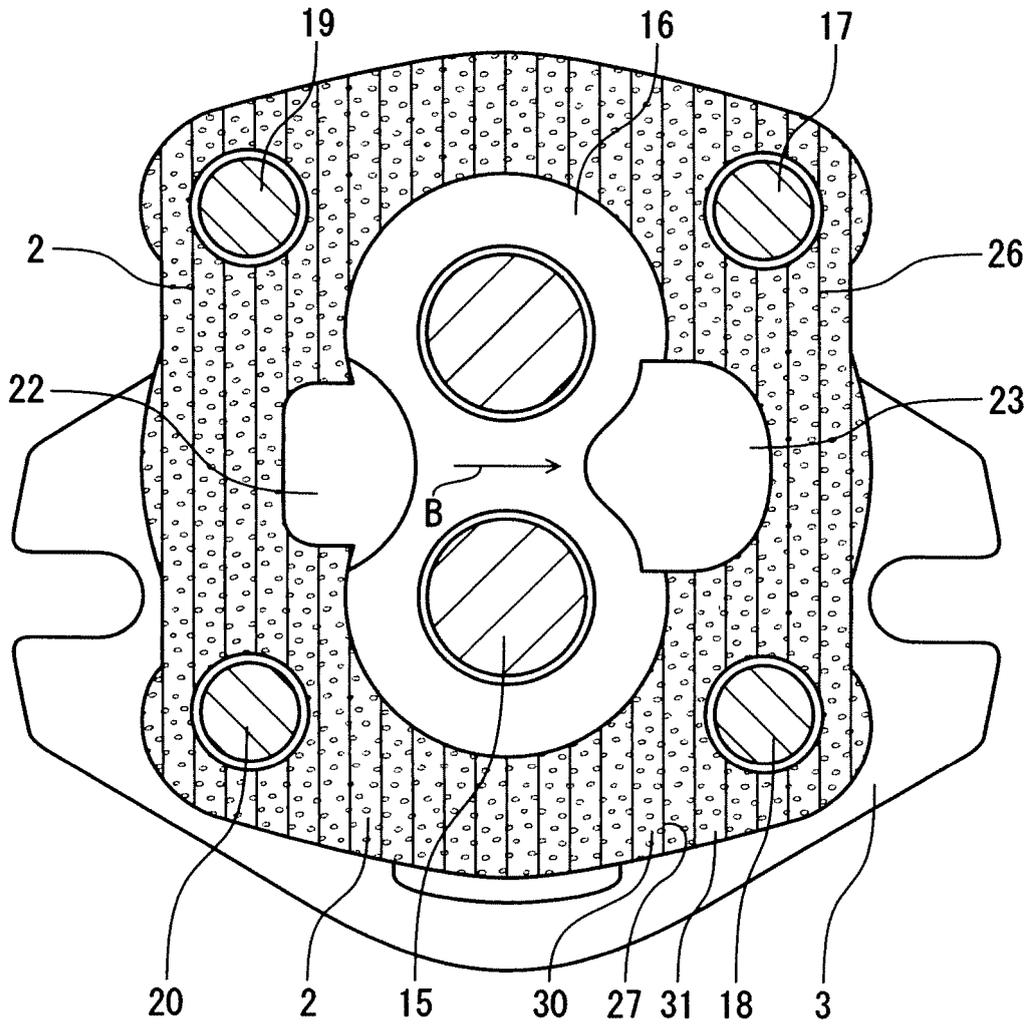


FIG. 2

**Description**

## TECHNICAL FIELD

**[0001]** This invention relates to a gear pump that discharges a fluid by rotating while a pair of gears are intermeshed.

## BACKGROUND ART

**[0002]** A gear pump provided in an oil pressure device, a water pressure device, and so on includes a body into which a pair of gears is incorporated and a housing that contacts the body. The body and the housing are fastened to each other by a plurality of bolts.

**[0003]** During an operation of the gear pump, a force that attempts to move the housing in a single direction relative to the body is generated by fluid pressure generated in the body.

**[0004]** JP6-147133A discloses a conventional gear pump in which processing teeth are formed on an end surface of the body which contacts the housing. When the body and the housing are fastened to each other by the plurality of bolts, rib-shaped processing teeth engraved in the end surface of the body dig into the end surface of the housing, thereby preventing positional deviation between the body and the housing.

## DISCLOSURE OF THE INVENTION

**[0005]** However, when a cutting depth of the processing teeth engraved in the end surface of the body is small, positional deviation between the body and the housing cannot be prevented sufficiently.

**[0006]** On the other hand, when the cutting depth of the processing teeth is large, a gap may be formed between the body and the housing, and as a result, fluid may leak from the gear pump.

**[0007]** It is therefore an object of this invention to provide a gear pump in which positional deviation between a body and a housing is prevented without increasing a cutting depth of processing teeth engraved in an end surface of the body.

**[0008]** This invention provides a gear pump that discharges a fluid by rotating while a pair of gears are intermeshed, comprising a body into which the respective gears are incorporated, a housing that contacts the body, a number of particles that are interposed between an end surface of the body and an end surface of the housing, which contact each other, to prevent positional deviation between the body and the housing, and a plurality of fastening members that fasten the housing to the body.

**[0009]** According to this invention, a number of particles are interposed between the end surface of the body and the end surface of the housing, thereby increasing a frictional force generated in a joint portion between the body and the housing such that positional deviation generated between the body and the housing by a fluid pres-

sure in the gear pump can be prevented effectively, and as a result, a pump efficiency of the gear pump can be maintained.

## 5 BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]**

10 FIG. 1 is a longitudinal sectional view of a gear pump according to an embodiment of this invention.

FIG. 2 is a sectional view taken along an A-A line in FIG. 1.

## 15 BEST MODES FOR CARRYING OUT THE INVENTION

**[0011]** An embodiment of this invention will be described below with reference to the figures.

20 **[0012]** As shown in FIG. 1, a gear pump 1 comprises a body 2 into which a drive gear 11 and a driven gear 12 are incorporated as a pair of gears, and housings 3, 4 that contact the body 2 from either side. Side plates 5, 6 are interposed between respective end faces of the drive gear 11 and driven gear 12 and the housings 3, 4.

25 **[0013]** A gear chamber 9 that houses the drive gear 11 and driven gear 12 is provided on an inner side of the body 2, and the housings 3, 4 contact respective end surfaces 25, 26 of the body 2.

30 **[0014]** The housing 3 includes an end surface 28 that contacts the end surface 25 of the body 2 so as to close one end of the body 2 and function as a mounting flange attached to a support member, not shown in the figure.

35 **[0015]** A seal ring 41 is interposed between the end surface 25 of the body 2 and the housing 3, and the gear chamber 9 is sealed by the seal ring 41.

**[0016]** It should be noted that the housing 3 may be formed integrally with the body 2.

40 **[0017]** The housing 4 includes an end surface 29 that contacts the end surface 26 of the body 2 and functions as a cover that closes another end of the body 2.

**[0018]** A seal 42 is interposed between the end surface 26 of the body 2 and the housing 4, and the gear chamber 9 is sealed by the seal 42.

45 **[0019]** The body 2 and the housings 3, 4 are fastened to each other by four bolts 17 to 20. The bolts 17 to 20, which are provided as fastening members, respectively use axial force to press the end surface 25 of the body 2 and the end surface 28 of the housing 3 against each other and press the end surface 26 of the body 2 and the end surface 29 of the housing 4 against each other. As a result, the body 2 and the housings 3, 4 are fixed by frictional force generated between the end surface 25 and the end surface 28 and frictional force generated between the end surface 26 and the end surface 29.

55 **[0020]** Shafts 13, 15 are formed on either end of the drive gear 11. Shafts 14, 16 are formed on either end of the driven gear 12. The shafts 13, 14 are supported on the housing 3 to be free to rotate via respective bearings

33, 34, while the shafts 15, 16 are supported on the cover 4 to be free to rotate via respective bearings 35, 36.

**[0021]** The shaft 15 of the drive gear 11 is driven to rotate in a clockwise direction, as shown by an arrow in FIG. 2, while the shaft 16 of the driven gear 12 rotates in a counter-clockwise direction, as shown by an arrow in FIG. 2.

**[0022]** When the drive gear 11 and driven gear 12 rotate while intermeshing within the gear chamber 9, fluid aspirated from a low pressure port 23 positioned in a tangential direction to an intermeshing surface is transported by a gear intermeshing portion of the drive gear 11 and driven gear 12 so as to be discharged from a high pressure port 22. Working oil, for example, is used as the fluid that circulates through the gear pump 1.

**[0023]** During an operation of the gear pump 1 described above, a fluid pressure in the high pressure port 22 is higher than a fluid pressure in the low pressure port 23, and therefore a force which attempts to move the housings 3, 4 relative to the body 2 in a direction indicated by an arrow B in FIG. 2 is generated in a joint portion between the body 2 and the housings 3, 4.

**[0024]** To fix the housings 3, 4 relative to the body 2 against the differential pressure generated in the gear pump 1, processing teeth 27 are formed on the end surface 26 of the body 2, as shown in FIG. 2. Similarly, processing teeth 27 are formed on the end surface 26 of the body 2.

**[0025]** The processing teeth 27 are constituted by cutting a large number of narrow grooves using a milling machine. The processing teeth 27 are formed to extend in a vertical direction that is substantially orthogonal to a slippage direction indicated by the arrow B in FIG. 2.

**[0026]** It should be noted that the processing teeth 27 are not limited to this constitution, and may be formed in a mesh form, for example.

**[0027]** The body 2 is formed from a harder material than the housings 3, 4.

The body 2 is formed from an iron-based material, for example, whereas the housings 3, 4 are respectively formed from an aluminum-based material, for example.

**[0028]** When the housings 3, 4 are fastened to the body 2 using the bolts 17 to 20, the processing teeth 27 of the hard body 2 dig into the end surfaces 28, 29 of the housings 3, 4. As a result, positional deviation occurring when the housings 3, 4 are moved relative to the body 2 by the fluid pressure in the gear pump 1 is suppressed.

**[0029]** However, when a cutting depth of the processing teeth 27 engraved in the end surfaces 25, 26 of the body 2 is small, positional deviation of the housings 3, 4 cannot be prevented sufficiently. On the other hand, when the cutting depth of the processing teeth 27 is large, a gap may be formed between the body 2 and the housings 3, 4, and as a result, fluid may leak from the gear pump 1.

**[0030]** In response to this problem, in this invention a large number of fine particles 30 are interposed in the joint portion between the body 2 and the housings 3, 4

so that positional deviation between the body 2 and the housings 3, 4 is prevented without increasing the cutting depth of the processing teeth 27.

**[0031]** The particles 30 are constituted by a material that is harder than the materials of the body 2 and the housings 3, 4, such as shavings of steel, cast iron, carbon material, and so on, for example.

**[0032]** By using hard particles 30, the particles 30 dig into the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4, thereby increasing a frictional force generated along the joint portion between the body 2 and the housings 3, 4 such that positional deviation there-between can be prevented effectively.

**[0033]** The particles 30 are intermixed with a coating agent 31 and applied to the two end surfaces 25, 26 of the body 2 together with the coating agent 31.

**[0034]** The coating agent 31 adheres to the joint portion between the body 2 and the housings 3, 4, thereby eliminating gaps and preventing corrosion such as electrolytic corrosion.

**[0035]** As described above, this invention provides the gear pump 1 that discharges fluid by rotating while the drive gear 11 and the driven gear 12 are intermeshed, and comprises the body 2 into which the drive gear 11 and driven gear 12 are incorporated, the housings 3, 4 that contact the body 2, the large number of particles 30 that are interposed between the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4, which contact each other, to prevent positional deviation between the body 2 and the housings 3, 4, and the plurality of bolts (fastening members) 17 to 20 that fasten the housings 3, 4 to the body 2.

**[0036]** By interposing the large number of particles 30 between the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4, positional deviation generated along the joint portion between the body 2 and the housings 3, 4 by the fluid pressure in the gear pump 1 can be prevented effectively, and therefore a pump efficiency of the gear pump 1 can be maintained.

**[0037]** In this embodiment, the particles 30 are formed from a harder material than the body 2 and the housings 3, 4.

**[0038]** Hence, the hard particles 30 dig into the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4, and as a result, positional deviation generated between the body 2 and the housings 3, 4 by the fluid pressure in the gear pump 1 can be prevented effectively.

**[0039]** In this embodiment, the processing teeth 27 are formed on at least one of the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4, and positional deviation between the body 2 and the housings 3, 4 is prevented via both the particles 30 and the processing teeth 27.

**[0040]** Hence, the body 2 and the housings 3, 4 are positioned by both the processing teeth 27 and the particles 30, and therefore positional deviation of the hous-

ings 3, 4 can be prevented sufficiently even when the cutting depth of the processing teeth 27 is small. As a result, fluid leakage between the body 2 and the housings 3, 4 can be prevented by making the cutting depth of the processing teeth 27 small.

**[0041]** In this embodiment, the particles 30 are intermixed with the coating agent 31, whereupon the particles 30 are applied together with the coating agent 31 to at least one of the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4.

**[0042]** Hence, the particles 30 can be distributed evenly over the end surfaces 25, 26 of the body 2 or the end surfaces 28, 29 of the housings 3, 4, and therefore positional deviation generated between the body 2 and the housings 3, 4 by the fluid pressure in the gear pump 1 can be prevented effectively.

**[0043]** By using an anti-corrosion agent as the coating agent 31, corrosion such as electrolytic corrosion can be prevented on the joint portion between the body 2 and the housings 3, 4.

**[0044]** In another embodiment, the particles 30 are formed from a softer material than the body 2 and the housings 3, 4 such that the particles 30 are compressed between the body 2 and the housings 3, 4. As a result, frictional force is increased via the compressed particles 30.

**[0045]** In another embodiment, both the end surfaces 25, 26 of the body 2 and the end surfaces 28, 29 of the housings 3, 4 are formed smooth, and positioning is performed between the body 2 and the housings 3, 4 using the particles 30 alone, i.e. without using the processing teeth 27.

#### INDUSTRIAL APPLICABILITY

**[0046]** The gear pump according to this invention is suitable for use as a pump provided in an oil pressure device, a water pressure device, or similar.

#### Claims

1. A gear pump that discharges a fluid by rotating while a pair of gears are intermeshed, **characterized by:**

a body into which the respective gears are incorporated;

a housing that contacts the body;

a number of particles that are interposed between an end surface of the body and an end surface of the housing, which contact each other, to prevent positional deviation between the body and the housing; and

a fastening member that fastens the housing to the body.

2. The gear pump as defined in Claim 1, **characterized in that** the particles are formed from a harder mate-

rial than the body and the housing.

3. The gear pump as defined in Claim 1, **characterized in that** processing teeth are formed on at least one of the end surface of the body and the end surface of the housing, and positional deviation between the body and the housing is prevented via both the particles and the processing teeth.

4. The gear pump as defined in Claim 1, **characterized in that** the particles are intermixed with a coating agent, whereupon the particles are applied together with the coating agent to at least one of the end surface of the body and the end surface of the housing.



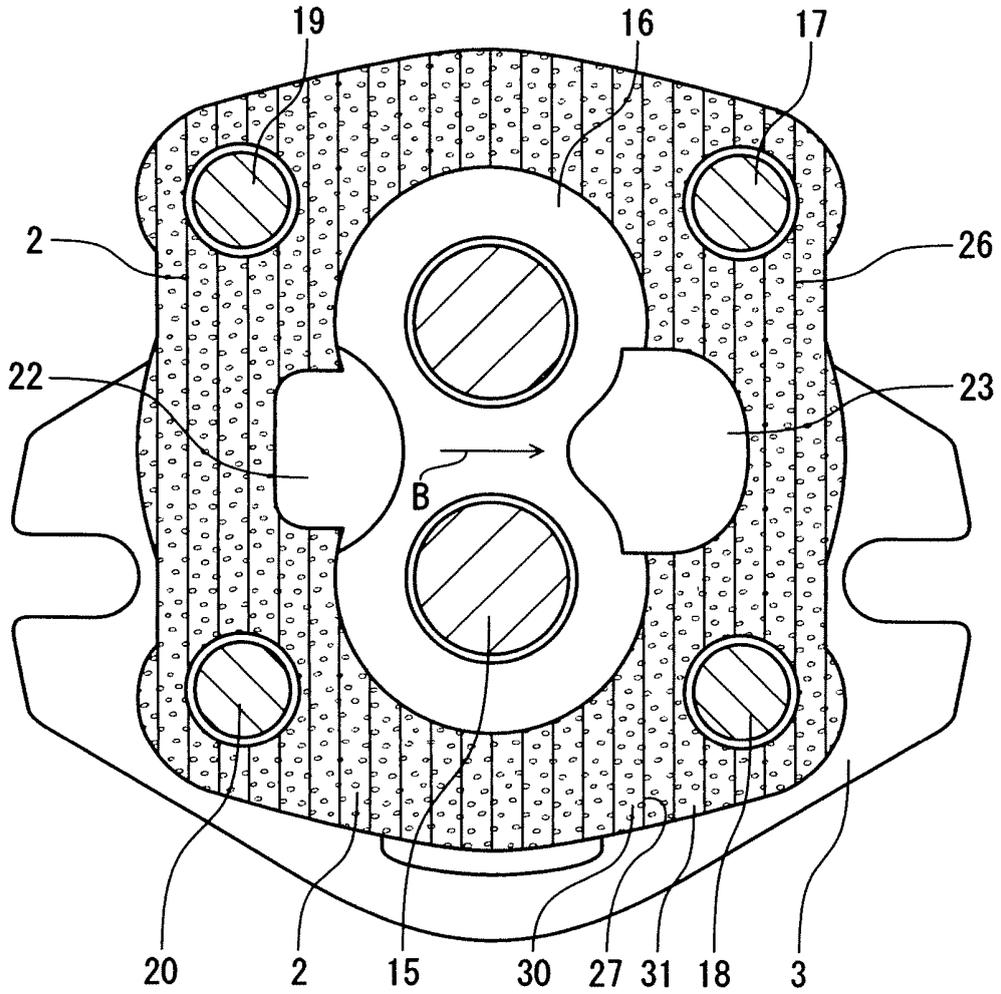


FIG. 2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/069638

A. CLASSIFICATION OF SUBJECT MATTER F04C2/18 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) F04C2/18		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007 Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-147133 A (Kayaba Industry Co., Ltd.), 27 May, 1994 (27.05.94), Par. Nos. [0007] to [0009]; Figs. 1 to 2 (Family: none)	1-4
Y	JP 2006-22948 A (Honda Motor Co., Ltd.), 26 January, 2006 (26.01.06), Par. Nos. [0008] to [0009]; Figs. 1 to 2 & GB 2415025 A & GB 2428279 A	1-4
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input type="checkbox"/> See patent family annex.
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Date of the actual completion of the international search 24 October, 2007 (24.10.07)	Date of mailing of the international search report 06 November, 2007 (06.11.07)	
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**REFERENCES CITED IN THE DESCRIPTION**

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