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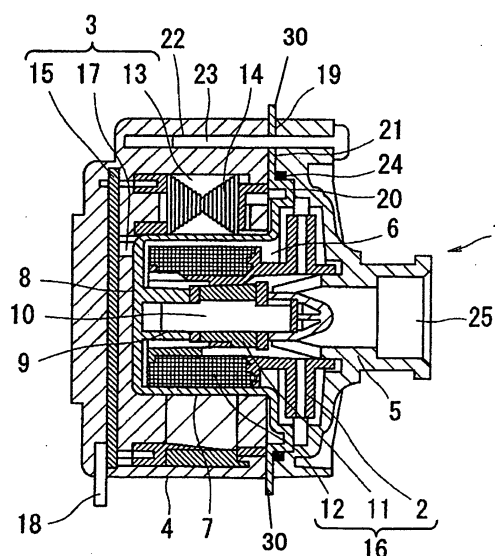
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(54) **PUMP**

(57) Present application provides a pump having less possibility of liquid leakage to the outside of a pump chamber. The pump of the present invention comprises a pump case 4 which a recess 7 is formed in the center of first surface of, a separating plate 8 joined along the whole of the first surface including the surface of the recess 7 of the first surface of the pump case 4; and a casing 5 joined to the separating plate 8 to define a pump chamber 6 together with the separating plate 8. Periphery

of the casing 5 is joined to one surface of the separating plate 8 which is the different surface from the surface to which the pump case 4 is joined. An impeller 2 is disposed in the pump chamber 6. The pump case 4 is provided with a motor part 3 for rotary driving the impeller 2 therein, and is integrally formed with the separating plate 8. A rim 30 formed across the outer circumference of the separating plate 8 protrudes outward than the outer circumference of the first surface of the pump case 4.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a pump.

BACKGROUND ART

[0002] Conventionally, such a pump disclosed in the Japanese Patent Publication Laid-Open No.2007-278195 has been known. This pump comprises an impeller for absorbing/discharging liquid, a pump case provided with a motor part for driving the impeller therein, and a casing fixed to the pump case. By making the pump case fix to the casing, the impeller is rotatably held in a pump chamber. Here, the pump chamber is a region enclosed by the pump case and the casing.

[0003] A recess, which is to make the pump chamber, is formed at the pump case. The pump is provided with a separating plate for separating the motor part and the pump chamber. The separating plate is provided along the inner surface of the recess and along the surface around the recess extended from the inner surface. The casing is fixed to the pump case in a manner that the separating plate intervening therebetween. The pump is configured to ensure the seal characteristics between the separating plate and the casing in order to prevent liquid leakage from the pump chamber to the outside.

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] The pump case of this pump is formed as follows. That is, the motor part and the separating plate are located in a mold, and thereafter resin material is injected and filled in a region enclosed by the mold and a surface of the separating plate, which is the opposite surface of the separating plate to the surface to which the casing is fixed. However, at this time, the resin material possibly exceeds the separating plate to flow around toward the surface of the separating plate to which the casing is fixed. Therefore, the seal characteristics between the separating plate and the casing is possibly disturbed, and thereby liquid possibly leaks from the pump chamber to the outside.

[0005] The present invention is invented in view of the above conventional embodiment, and object of the present invention is to provide a pump having less possibility of liquid leakage from the pump chamber to the outside.

MEANS TO SOLVE THE PROBLEM

[0006] The invention according to claim 1 is a pump comprising: a pump case which a recess is formed in the center of first surface of; a separating plate joined along the whole of said first surface including the surface of

said recess of said pump case; and a casing joined to said separating plate to define a pump chamber together with said separating plate. The characteristic point is as follows. Periphery of said casing is joined to one surface of said separating plate, said one surface of said separating plate being the different surface from the surface to which said pump case is joined. An impeller is disposed in said pump chamber. Said pump case is provided with a motor part for rotary driving said impeller therein. Said pump case is integrally formed with said separating plate. A rim formed across the outer circumference of said separating plate protrudes outward than the outer circumference of said first surface of said pump case.

[0007] The invention according to claim 2 is the pump as set forth in claim 1, wherein an O-ring is disposed on said separating plate so as to be located between said separating plate and said casing, and a rib is provided in a protruding condition on said separating plate along the outer circumference of said O-ring.

[0008] The invention according to claim 3 is the pump case as set forth in claim 1 or 2, wherein said pump case is formed of unsaturated polyester material of resin material.

EFFECT OF THE INVENTION

[0009] According to the invention described in claim 1, the material is less likely to flow to the surface of the separating plate to which the casing is fixed when forming the pump case by filling the material in the region enclosed by the mold and the opposite surface of the separating plate to which the casing is fixed. Therefore, it can reduce the possibility of disturbing the seal characteristics between the pump case and the casing. Thus, it can prevent the liquid leakage to the outside of the pump chamber.

[0010] According to the invention described in claim 2, even when the filled material flows to the surface of the separating plate to which the casing is fixed, the protrudingly provided rib can prevent the filled material from reaching the O-ring. Therefore, it can ensure the seal characteristics by the O-ring.

[0011] According to the invention described in claim 3, it can prevent the material from exceeding the separating plate to flow to the surface of the separating plate to which the casing is fixed.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 is a sectional view of the pump according to the first embodiment of the present invention, FIG. 2 is a sectional view in the manufacturing processes of the pump case according to the first embodiment of the present invention, FIG. 3 is a sectional view of the pump according to the second embodiment of the present invention,

and

FIG. 4 is a sectional view in the manufacturing processes of the pump case according to the second embodiment of the present invention.

MODE FOR CARRYING OUT THE INVENTION

[0013] An embodiment of the present invention is described below with reference to the drawings. FIG. 1 shows a pump 1 of the first embodiment of the present invention. This pump 1 includes an impeller 2 for absorbing/discharging liquid, a pump case 4 provided with a motor part 3 for driving the impeller 2 therein, and a casing 5 fixed to the pump case 4. A recess 7 is formed in the center of one surface (right side in FIG. 1) of the pump case 4. A separating plate 8 is joined to the whole of said one surface, including the surface of the recess, of the pump case 4. Periphery of the casing 5 is joined to one surface (right side in FIG. 1) of the separating plate 8. Said one surface of the separating plate 8 is the different surface from the surface to which the pump case 4 is joined. The casing 5 joined to the separating plate 8, a pump chamber 6 is defined by the separating plate 8 and the inner wall of the casing 5. The impeller 2 is pivotally arranged in the pump chamber 6. The pump case 4 has the motor part 3 for rotary driving the impeller 2 therein. The pump case 4 is formed integrally with the separating plate 8. That is, the separating plate 8 is provided so as to separate the motor part 3 and the pump chamber 6. The casing 5 is fixed to the pump case 4 in a manner that the separating plate 8 intervening therebetween.

[0014] The separating plate 8 is provided with a shaft hole 9 in substantially the center of the bottom face of the recess 7. One end of a column-shaped fixed shaft 10 is fitted in the shaft hole 9, and the fixed shaft 10 is vertically provided in substantially the center of the pump chamber 6.

[0015] Below the impeller 2 held in the pump chamber 6, a bearing 11 is provided continuously with the impeller 2. The bearing 11 is provided with a column-shaped slide hole which is slidable with respect to the column-shaped fixed shaft 10. The bearing 11 is configured to slide (rotate) around the fixed shaft 10. Thereby, the impeller 2 continued with the bearing 11 is held rotatably around the fixed shaft 10. Besides, a permanent magnet 12 is provided whole around the outer periphery of the bearing 11.

[0016] A stator 13 is provided inside the pump case 4 so that the stator 13 surrounds the pump chamber 6. The stator 13 is composed of a coil which a winding wire 14 being arranged. The winding wire 14 is connected to a control board 15 through such as a caulking terminal or a binding pin (not shown in figure). When electrifying from the control board 15 to the winding wire 14, a revolving magnetic field is generated. Thereby, the permanent magnet 12 is absorbed/repelled with respect to the generated revolving magnetic field, and a rotating body 16 rotates around the fixed shaft 10. Here, the rotating body

16 is composed of the impeller 2, the bearing 11, and the permanent magnet 12. A position sensing means 17 for detecting the position of the rotating body 16 is attached to the control board 15. The control board 15 receives the signal from the position sensing means 17, and controls the revolving magnetic field by controlling the energization toward the winding wire 14 so that the rotating body 16 rotates. Here, the motor part 3 is substantially composed of the stator 13, the control board 15, and the position sensing means 17. Besides, an end of the control board 15 is provided with a connector 18 for supplying electric power from outside to the control board 15.

[0017] Periphery of said one surface of the pump case 4 around the recess 7, the recess 7 being formed in said one surface, contacts with a flat surface 19 of the separating plate 8. The flat surface 19 is provided with a projecting portion 20 at the outer side of the recess 7 so that the projecting portion 20 surrounds the recess 7. Besides, a rim 30 is formed across the outer circumference of the separating plate 8 so that the rim 30 protrudes outward than the outer circumference of said one surface of said pump case 4 at which the recess 7 is formed.

[0018] The casing 5 has a contacting surface 21 which contacts with the flat surface 19 of the separating plate 8. The casing 5 is fixed to the pump case 4 via the separating plate 8 by fitting the contacting surface 21 all around to the flat surface 19. Besides, screw settlement bores 22 are provided in several places so as to communicate into the pump case 4, the separating plate 8 and the casing 5. The casing 5 is fastened to the pump case 4 by fixing screws 23 to the screw settlement bores 22. In addition, when the casing 5 is fixed to the pump case 4, an O-ring 24 is intervened in a corner formed by the projecting portion 20 and the flat surface 19. That is, the O-ring 24 is arranged so as to intervene between the separating plate 8 and the casing 5. Therefore, the seal characteristics between the separating plate 8 and the casing 5 can be ensured.

[0019] Here, the casing 5 is provided with an inlet opening 25 and a discharge opening (not shown in figure) for circulating water. The inlet opening 25 is communicated with the pump chamber 6. Because the pump chamber 6 is made to be a water-poured space by the circulating water absorbed through the inlet opening 25, the rotating body 16 can rotate easily by virtue of the lubrication of the circulating water. When the impeller 2 rotates, pumping action occurs, and the circulating water is discharged through the discharge opening. The above-described pump 1 is used, for example, as a boiling-up pump, reheating pump or a shower pump for the eco-cute business, a heat pump for the fuel cell equipment, or a pump for various cooling system.

[0020] Next, the production method of the pump case 4 of the present embodiment is described based on FIG. 2. The pump case 4 of the present embodiment is integrally formed with the separating plate 8 by making the resin material fill in a mold 26.

[0021] The mold 26 is consisting of an upper mold 26a

and a lower mold 26b. The separating plate 8 is placed on the lower mold 26b. The separating plate 8 is placed on the lower mold 26b in a manner that said one surface of the separating plate 8 faces downwardly, wherein said one surface of the separating plate 8 is the surface to which the casing 5 is fixed. When covering the separating plate 8 with the upper mold 26a from the other surface side of the separating plate 8, which is the opposite side to said one surface of the separating plate 8, and when making the upper mold 26a contact with the lower mold 26b, a void space 27 enclosed by the upper mold 26a, the lower mold 26b and said the other surface of the separating plate 8 is formed. After disposing the stator 13, the control board 15, the position sensing means 17 and the connector 18 in the void space 27, and joining the lower mold 26b to the upper mold 26a, the resin material is injected through an injecting opening 28 formed at the upper mold 26b to fill the void space 27. Then, the mold 26 is cooled, and the pump case 4 is produced. In this embodiment, the rim 30 provided at outer periphery of the separating plate 8 protrudes outward than the internal circumference of the mold 26. Therefore, when joining the upper mold 26a and the lower mold 26b, they can be joined while the rim 30 provided at outer periphery of the separating plate 8 being borne down by the upper mold 26b to the lower mold 26a.

[0022] Thus, according to the pump 1 and the production method for the pump 1 of the present embodiment, the rim 30 provided whole across the outer periphery of the separating plate 8 is formed so as to protrude outward than the outer periphery of the pump case 4 (that is, outward than the inner periphery of the mold 26). By virtue of such a configuration, the upper mold 26a can bear down on the outer periphery of the separating plate 8 toward the lower mold 26b when joining the mold 26. Therefore, when filling the resin material in the void space 27, the resin material is less likely flow to said one surface of the separating plate 8 side to which the casing 5 is fixed. Therefore, it can reduce the possibility of obstructing the seal characteristics between the pump case 4 and the casing 5. Thus, it can prevent the liquid leakage to the outside of the pump chamber 6.

[0023] From a viewpoint of fluidity, it is preferable that the resin material is unsaturated polyester material. According to such the material, it can further suppress the possibility for the material to flow toward said one surface side of the separating plate 8. Here, said one surface of the separating plate 8 is the surface to which the casing 5 is fixed.

[0024] Next, the second embodiment of the present invention is described with reference to FIG. 3. The same configuration with that described in the first embodiment is referred to the same code, and the explanation is omitted.

[0025] In the pump 1 of the present embodiment, the flat surface 19 of the separating plate 8 is provided protrudingly with a rib 29 at outward than the projecting portion 20 in a manner that the rib 29 surrounds the projecting

portion 20. Besides, on the flat surface 19, an O-ring 24 is intervened between the projecting portion 20 and the rib 29. That is, the rib 29 is provided protrudingly on the separating plate 8 along the outer circumference of the O-ring 24. By virtue of configuring the pump 1 in this way, it can further increase the seal characteristics between the pump case 4 and the casing 5.

[0026] The production method of the pump 1 of the present embodiment is shown in FIG. 4. Here, the production method is similar to that described in the first embodiment, therefore the explanation is omitted.

[0027] According to the pump 1 and the production method for the pump 1 of the present embodiment, even if the resin material filled in the mold 26 flows to said one surface side of separating plate 8 to which the casing 5 is fix, the projectngly provided rib 29 can prevent the filled material from reaching the O-ring 24. Therefore, it can ensure the seal characteristics by the O-ring 24.

Claims

1. A pump comprising:

a pump case which a recess is formed in the center of first surface of;
a separating plate joined along the whole of said first surface including the surface of said recess of said pump case; and
a casing joined to said separating plate to define a pump chamber together with said separating plate, wherein
periphery of said casing is joined to one surface of said separating plate, said one surface of said separating plate being the different surface from the surface to which said pump case is joined, an impeller is disposed in said pump chamber, said pump case is provided with a motor part for rotary driving said impeller therein, said pump case being integrally formed with said separating plate, and
a rim formed across the outer circumference of said separating plate protrudes outward than the outer circumference of said first surface of said pump case.

2. The pump as set forth in claim 1, wherein an O-ring is disposed on said separating plate so as to be located between said separating plate and said casing, and
a rib is provided in a protruding condition on said separating plate along the outer circumference of said O-ring.

3. The pump as set forth in claim 1 or 2, wherein said pump case is formed of unsaturated polyester material of resin material.

Amended claims under Art. 19.1 PCT**1. Amended).** A pump comprising:

a pump case which a recess is formed in the center of first surface of; 5
 a separating plate joined along the whole of said first surface including the surface of said recess of said pump case; and 10
 a casing joined to said separating plate to define a pump chamber together with said separating plate, wherein
 periphery of said casing is joined to one surface of said separating plate, said one surface of said separating plate being the different surface from the surface to which said pump case is joined, 15
 an impeller is disposed in said pump chamber, said pump case is provided with a motor part for rotary driving said impeller therein, said pump case being integrally formed with said separating plate, 20
 a rim formed across the outer circumference of said separating plate protrudes outward than the outer circumference of said first surface of said pump case, 25
 an O-ring is disposed on said separating plate so as to be located between said separating plate and said casing, and
 a rib is provided in a protruding condition on said separating plate along the outer circumference of said O-ring. 30

2. Cancelled).

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3. Amended). The pump as set forth in claim 1, wherein said pump case is formed of unsaturated polyester material of resin material.

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FIG. 1

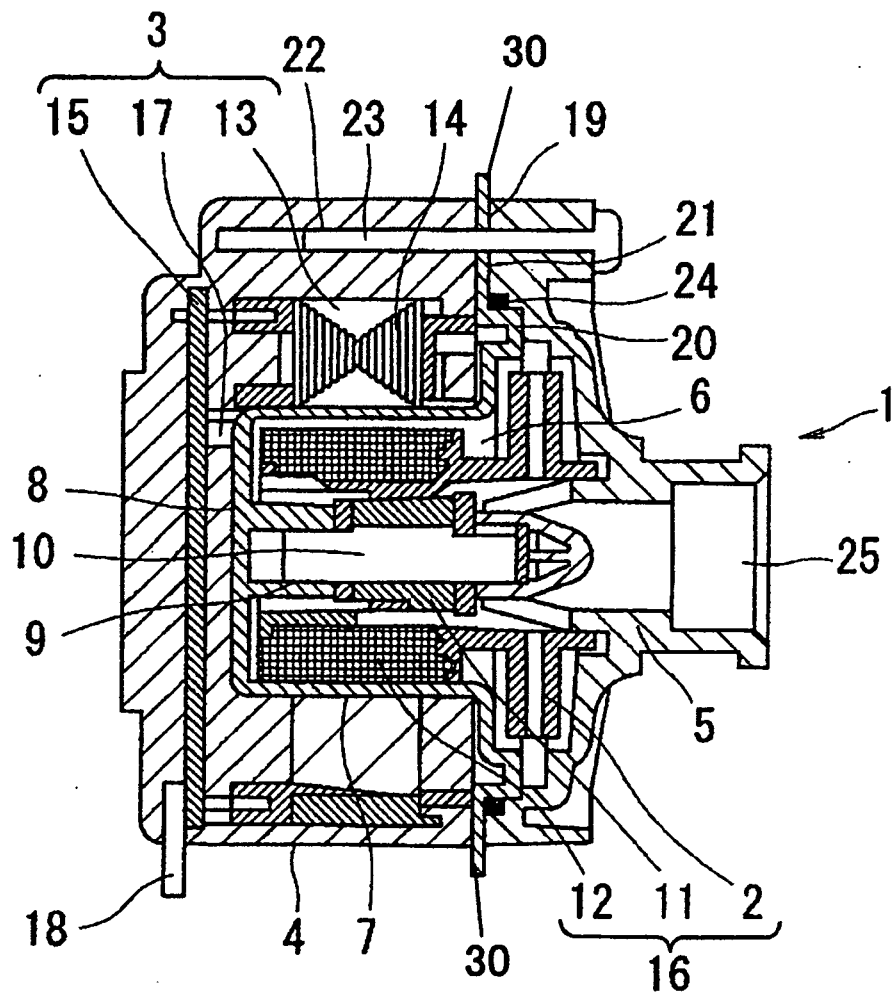


FIG. 2

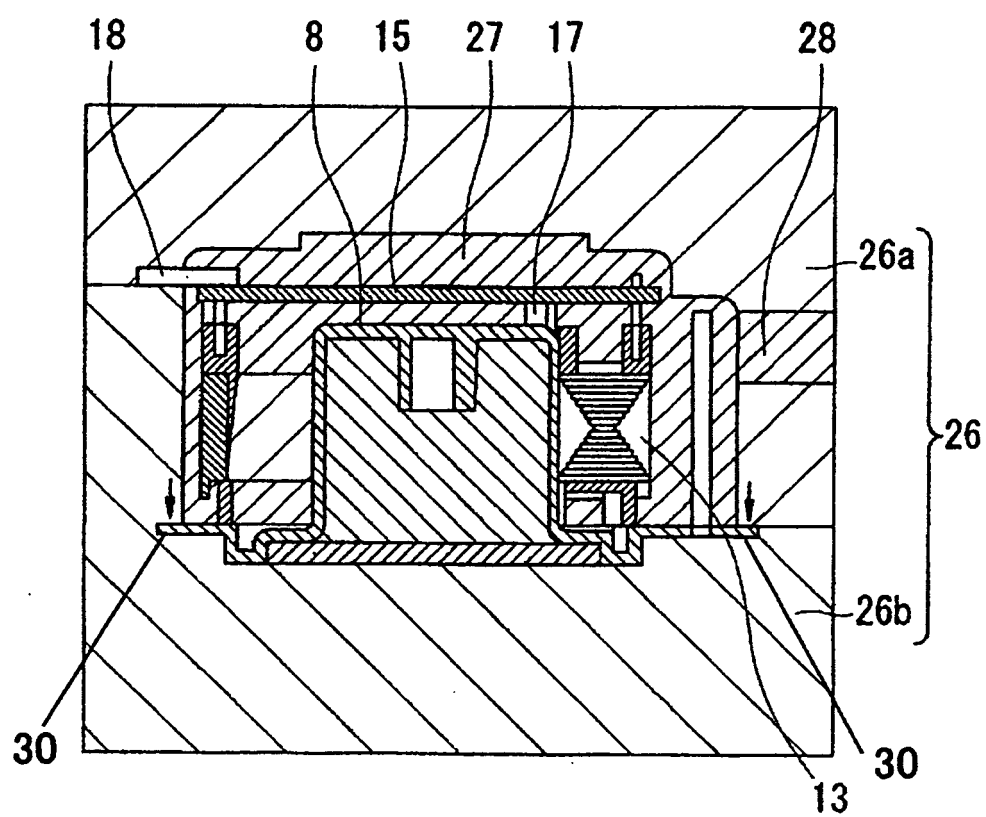


FIG. 3

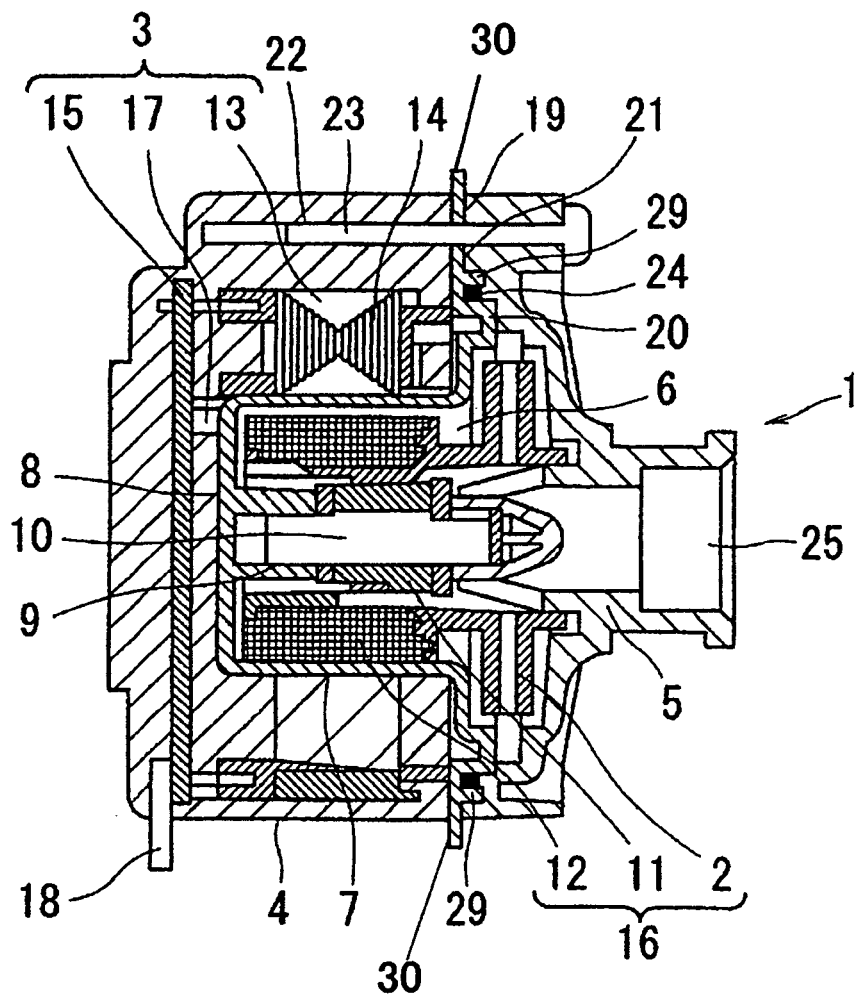
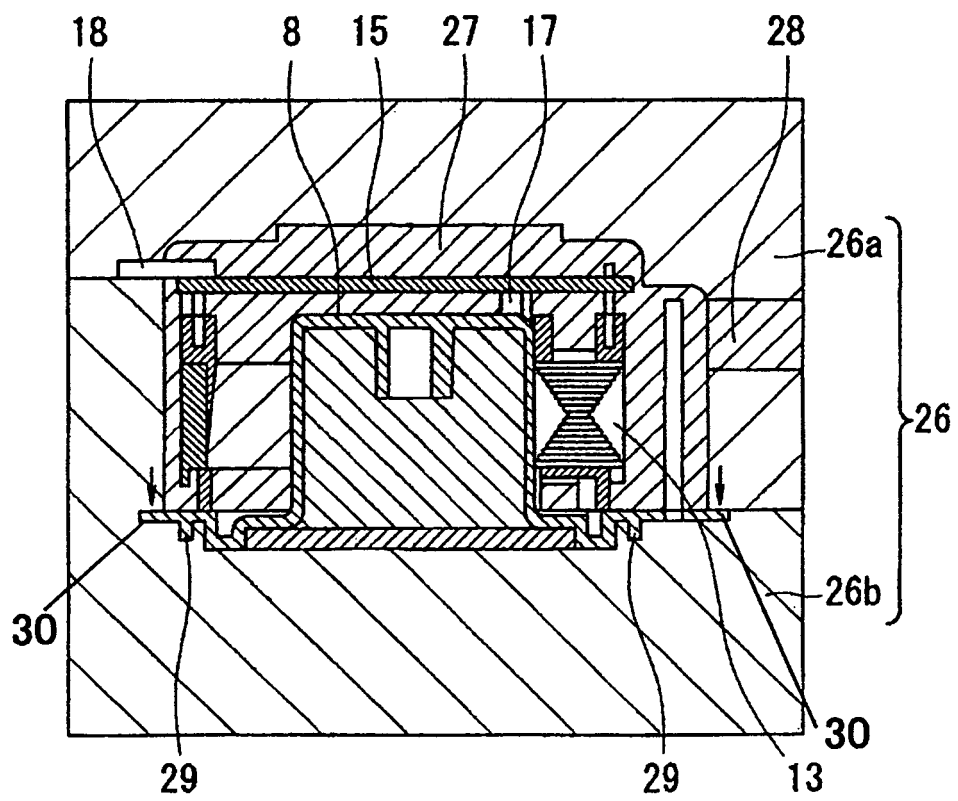


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/066385

A. CLASSIFICATION OF SUBJECT MATTER

F04D13/06 (2006.01) i, F04D29/60 (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)

F04D13/06, F04D29/60

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	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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.
X A	JP 2009-74433 A (Panasonic Electric Works Co., Ltd.), 09 April 2009 (09.04.2009), paragraph [0040]; fig. 6 & US 2009/0081059 A1 & EP 2039938 A2	1, 3 2
X A	JP 2009-74434 A (Panasonic Electric Works Co., Ltd.), 09 April 2009 (09.04.2009), paragraph [0033]; fig. 5 to 6 (Family: none)	1, 3 2
A	JP 2006-233836 A (Matsushita Electric Industrial Co., Ltd.), 07 September 2006 (07.09.2006), paragraph [0027]; fig. 1 (Family: none)	1-3

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search
15 October, 2010 (15.10.10)Date of mailing of the international search report
26 October, 2010 (26.10.10)Name and mailing address of the ISA/
Japanese Patent Office

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/066385

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2003/033914 A1 (Ebara Corp.), 24 April 2003 (24.04.2003), fig. 9 (Family: none)	1-3
A	JP 58-211594 A (Grundfos A/S), 09 December 1983 (09.12.1983), page 3, upper right column, lines 14 to 16; fig. 1 to 2 & US 4549849 A & GB 2121241 A & DE 3220448 C1 & FR 2527704 A1	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007278195 A [0002]