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(71) Applicant: **Zi Yi Electrical Engineering Co., Ltd.**
Taichung City 408 (TW)

(72) Inventor: **HUANG, Ting-Tsai**
414 Taichung City (TW)

(74) Representative: **Würmser, Julian**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 86 06 24
81633 München (DE)

(54) CANNED MOTOR PUMP WITH LEAK SENSOR

(57) A magnetic drive pump (1) includes a motor unit (3) and a leak detector (4). The motor unit (3) includes an inner case body (32) and an outer case body (33). The inner case body (32) has an inner end wall (322) . The outer case body (33) is sleeved on the inner case body (32) and has an outer end wall (332). The outer end wall (332) cooperates with the inner end wall (322) to define a liquid-receiving space (337) therebetween. The leak detector (4) is disposed on one side of the outer end wall (332) opposite to the liquid-receiving space (337) and includes a sensor (41) for detecting a change in electrostatic capacity between the liquid-receiving space (337) and the sensor (41).

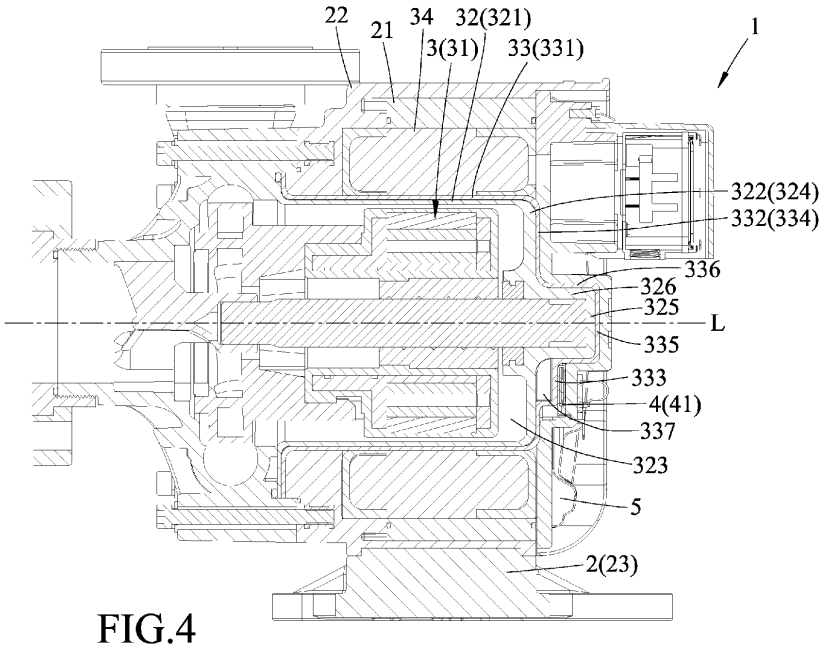


FIG.4

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Description

[0001] The disclosure relates to a pump, and more particularly to a magnetic drive pump.

[0002] A conventional magnetic drive pump disclosed in Taiwanese Patent No. 1424661 includes a front cover, a support frame, an impeller, a cup-shaped rear cover, an inner rotor, an outer rotor, a stationary shaft and a handling frame. The rear cover has a double-layered structure, and includes an inner lining made of a fluoroplastic material, and a reinforced layer.

[0003] The inner lining and the reinforced layer abut against one another to form the double-layered structure of the rear cover. As such, when the magnetic drive pump is used in a piece of chemical processing equipment, if the inner lining is damaged, chemical liquid may leak through a crack in the inner lining into the gap between the inner lining and the reinforced layer. However, the leakage through the inner lining cannot be detected by the conventional magnetic pump, which may allow the chemical liquid to leak further into the outer rotor and corrode the outer rotor. As a result, the magnetic drive pump could malfunction.

[0004] Therefore, an object of the disclosure is to provide a magnetic drive pump that can alleviate the drawback of the prior art.

[0005] According to the disclosure, the magnetic drive pump includes a seat unit, a motor unit and a leak detector. The seat unit includes a fixed seat, a surrounding seat and a seat base. The fixed seat surrounds an axis. The surrounding seat is sleeved on the fixed seat. The seat base is where the surrounding seat is disposed on. The motor unit includes a rotor, an inner case body, an outer case body and a stator. The rotor is rotatable about the axis. The inner case body surrounds the rotor. The outer case body is sleeved on the inner case body. The stator surrounds the outer case body and is surrounded by the fixed seat about the axis. The inner case body has an inner surrounding wall and an inner end wall. The inner surrounding wall surrounds the rotor and has two inner opposite ends spaced apart from each other in the direction of the axis. The inner end wall is connected to one of the inner opposite ends. The inner surrounding wall and the inner end wall cooperatively define a disposing space that opens at the other one of the inner opposite ends and that is where the rotor is disposed within. The outer case body has an outer surrounding wall and an outer end wall. The outer surrounding wall is sleeved on the inner surrounding wall, is surrounded by the stator and has two outer opposite ends that are spaced apart from each other in the direction of the axis. The outer end wall is connected to one of the outer opposite ends and is located at one side of the inner end wall opposite to the disposing space. The outer end wall cooperates with the inner end wall to define a liquid-receiving space therebetween. The leak detector is disposed on one side of the outer end wall that is opposite to the liquid-receiving space, and includes a sensor that is for detecting a change in electrostatic capacity between the liquid-receiving space and the sensor.

[0006] Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiment with reference to the accompanying drawings, of which:

Figure 1 is a perspective view of an embodiment of a magnetic drive pump according to the disclosure;
Figure 2 is a fragmentary, exploded perspective view of the embodiment;
Figure 3 is a perspective view of an outer case body of the embodiment;
Figure 4 is a sectional view of the embodiment; and
Figure 5 is a fragmentary, enlarged view of Figure 4.

[0007] Referring to Figures 1, 2 and 4, an embodiment of a magnetic drive pump 1 according to the disclosure includes a seat unit 2, a motor unit 3, a leak detector 4 and a cover 5.

[0008] The seat unit 2 includes a fixed seat 21, a surrounding seat 22 and a seat base 23. The fixed seat 21 surrounds an axis (L). The surrounding seat 22 is sleeved on the fixed seat 21. The seat base 23 is where the surrounding seat 22 is disposed on.

[0009] The motor unit 3 is disposed in the seat unit 2, and includes a rotor 31, an inner case body 32, an outer case body 33 and a stator 34. The rotor 31 is rotatable about the axis (L). The inner case body 32 surrounds the rotor 31. The outer case body 33 is sleeved on the inner case body 32. The stator 34 surrounds the outer case body 33 and is surrounded by the fixed seat 21 of the seat unit 2 about the axis (L).

[0010] The inner case body 32 of the motor unit 3 has an inner surrounding wall 321 and an inner end wall 322. The inner surrounding wall 321 surrounds the rotor 31 of the motor unit 3 and has two inner opposite ends spaced apart from each other in the direction of the axis (L). The inner end wall 322 is connected to one of the inner opposite ends of the inner surrounding wall 321. The inner surrounding wall 321 and the inner end wall 322 cooperatively define a disposing space 323 that opens at the other one of the inner opposite ends and that is where the rotor 31 is disposed within. The inner end wall 322 has an inner annular section 324, an inner end section 325 and an inner connecting section 326. The inner annular section 324 is annular, is connected to the inner surrounding wall 321 of the inner case body 32 and extends radially and inwardly from the one of the inner opposite ends of the inner surrounding wall 321 toward the axis (L). The inner end section 325 is spaced apart from the inner annular section 324 in the direction of the axis (L). The inner connecting section 326 surrounds the axis (L) and interconnects an inner edge of the inner annular section 324 that is approximate to the axis (L) with the inner end section 325 in the direction of the axis (L).

[0011] Referring further to Figures 3 and 5, the outer case body 33 of the motor unit 3 has an outer surrounding

wall 331 and an outer end wall 332. The outer surrounding wall 331 is sleeved on the inner surrounding wall 321 of the inner case body 32, is surrounded by the stator 34 of the motor unit 3 and has two outer opposite ends that are spaced apart from each other in the direction of the axis (L). The outer end wall 332 is connected to one of the outer opposite ends and is located at one side of the inner end wall 322 opposite to the disposing space 323. Furthermore, the outer end wall 332 has an outer annular section 334, an outer end section 335, an outer connecting section 336, and a protruding wall section 333 that is proximate to the seat base 23 of the seat unit 2. The outer annular section 334 is connected to the outer surrounding wall 331. The outer end section 335 is spaced apart from the outer annular section 334 in the direction of the axis (L). The outer connecting section 336 surrounds the axis (L) and interconnects an inner edge of the outer annular section 334 that is approximate to the axis (L) with the outer end section 335 in the direction of the axis (L) . The protruding wall section 333 protrudes from the outer annular section 334 and away from the inner annular section 324 of the inner end wall 322 of the inner case body 32, and is connected to the outer connecting section 336. In addition, the protruding wall section 333 cooperates with the inner annular section 324 and the inner connecting section 326 of the inner end wall 322 to define a liquid-receiving space 337. The liquid-receiving space 337 is located below the axis (L), and the volume thereof ranges from 2 to 5 cubic centimeters. The outer case body 33 further has an annular groove 338 and a plurality of guiding grooves 339. The annular groove 338 is formed in the outer annular section 334 and surrounds the axis (L). Each of the guiding grooves 339 extends from the outer surrounding wall 331 to the outer end wall 332, and has an axial groove part 339' formed in the outer surrounding wall 331, and a radial groove part 339" formed in the outer annular section 334 and communicating with the axial groove part 339'. The guiding grooves 339 are disposed about the axis (L) and are spaced apart from each other. The annular groove 338 and each of the guiding grooves 339 intersect. The annular groove 338 and the guiding grooves 339 are adjacent to the inner case body 32. The annular groove 338 communicates with the liquid-receiving space 337 and each of the guiding grooves 339.

[0012] The leak detector 4 is disposed on one side of the protruding wall section 333 of the outer end wall 332 that is opposite to the liquid-receiving space 337, and includes a sensor 41. The sensor 41 is for detecting a change in electrostatic capacity between the liquid-receiving space 337 and the sensor 41. In this embodiment, the sensor 41 is a capacitive proximity sensor that can be short-circuited or open-circuited when detecting a certain level of electrostatic capacity.

[0013] The cover 5 abuts against the outer end wall 332 of the outer case body 33 of the motor unit 3 and is bolted to the fixed seat 21 of the seat unit 2 such that the leak detector 4 is located between the protruding wall section 333 of the outer end wall 332 and the cover 5.

[0014] When the motor unit 3 is in operation of a piece of chemical processing equipment, the sensor 41 continuously detects a leakage according to a change in electrostatic capacity between the liquid-receiving space 337 and the sensor 41. If the inner case body 32 of the motor unit 3 is damaged by being in frequent contact with chemical liquid over a long period of time, the chemical liquid may leak through a crack in the inner case body 32. However, the leaked chemical liquid between the inner case body 32 and the outer case body 33 will be directed by the axial groove part 339' and the radial groove part 339" of each of the guiding grooves 339 to flow into the annular groove 338 and then into the liquid-receiving space 337. Because the liquid-receiving space 337 is capable of collecting the chemical liquid, the stator 34 of the motor unit 3 can be prevented from being immediately exposed to the leaked chemical liquid. Moreover, the presence of the chemical liquid in the liquid-receiving space 337 causes a change in electrostatic capacity between the liquid-receiving space 337 and the sensor 41, and this change can be detected by the sensor 41. As soon as the sensor 41 detects the change, a control member (not shown) that is electronically connected to the sensor 41 is able to alert a user about the leakage or to cease the operation of the motor unit 3. Thus, the stator 34 is prevented from being corroded by the chemical liquid, and the motor unit 3 will not malfunction.

[0015] In summary, by virtue of the liquid-receiving space 337 being defined by the protruding wall section 333, the inner annular section 324 and the inner connecting section 326 of the motor unit 3 and being capable of collecting leaked chemical liquid between the inner case body 32 and the outer case body 33 of the motor unit 3, and by virtue of the sensor 41 being capable of detecting a change in electrostatic capacity between the liquid-receiving space 337 and the sensor 41, the magnetic drive pump 1 can be prevented from malfunctioning. Therefore, the purpose of the disclosure is certainly fulfilled.

[0016] In the description above, for the purposes of explanation, numerous specific details have been set forth in order to provide a thorough understanding of the embodiment. It will be apparent, however, to one skilled in the art, that one or more other embodiments may be practiced without some of these specific details. It should also be appreciated that reference throughout this specification to "one embodiment," "an embodiment," an embodiment with an indication of an ordinal number and so forth means that a particular feature, structure, or characteristic may be included in the practice of the disclosure. It should be further appreciated that in the description, various features are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of various inventive aspects, and that one or more features or specific details from one embodiment may be practiced together with one or more features or specific details from another embodiment, where

appropriate, in the practice of the disclosure.

Claims

1. A magnetic drive pump (1) including:

a seat unit (2) including

a fixed seat (21) that surrounds an axis (L),
a surrounding seat (22) that is sleeved on said fixed seat (21), and
a seat base (23) that is where said surrounding seat (22) is disposed on;

a motor unit (3) including

a rotor (31) that is rotatable about the axis (L),
an inner case body (32) that surrounds said rotor (31),
an outer case body (33) that is sleeved on said inner case body (32), and
a stator (34) that surrounds said outer case body (33) and that is surrounded by said fixed seat (21) about the axis (L), said inner case body (32) having an inner surrounding wall (321) that surrounds said rotor (31) and that has two inner opposite ends spaced apart from each other in the direction of the axis (L), and an inner end wall (322) that is connected to one of said inner opposite ends, said inner surrounding wall (321) and said inner end wall (322) cooperatively defining a disposing space (323) that opens at the other one of said inner opposite ends and that is where said rotor (31) is disposed within, said outer case body (33) having an outer surrounding wall (331) that is sleeved on said inner surrounding wall (321), that is surrounded by said stator (34) and that has two outer opposite ends which are spaced apart from each other in the direction of the axis (L), and an outer end wall (332) that is connected to one of said outer opposite ends and that is located at one side of said inner end wall (322) opposite to said disposing space (323); and

a leak detector (4);
said magnetic drive pump (1) **characterized in that**:

said outer end wall (332) cooperating with said inner end wall (322) to define a liquid-receiving space (337) therebetween; and
said leak detector (4) disposed on one side of said outer end wall (332) that is opposite to said liquid-receiving space (337), and including
a sensor (41) that is for detecting a change in electrostatic capacity between said liquid-receiving space (337) and said sensor (41).

2. The magnetic drive pump (1) as claimed in claim 1, **characterized in that**:

said inner end wall (322) of said inner case body (32) of said motor unit (3) has

an inner annular section (324) connected to said inner surrounding wall (321),
an inner end section (325) spaced apart from said inner annular section (324) in the direction of the axis (L), and
an inner connecting section (326) surrounding the axis (L) and interconnecting an inner edge of said inner annular section (324) that is proximate to the axis (L) with said inner end section (325) in the direction of the axis (L); and

said outer end wall (332) of said outer case body (33) of said motor unit (3) has

an outer annular section (334) connected to said outer surrounding wall (331),
an outer end section (335) spaced apart from said outer annular section (334) in the direction of the axis (L), and
an outer connecting section (336) surrounding the axis (L) and interconnecting an inner edge of said outer annular section (334) that is proximate to the axis (L) with said outer end section (335) in the direction of the axis (L).

3. The magnetic drive pump (1) as claimed in claim 2, **characterized in that**:

said outer end wall (332) of said outer case body (33) of said motor unit (3) further has a protruding wall section (333) protruding from said outer annular section (334) of said outer end wall (332) and away from said inner annular section (324) of said inner end wall (322) and being connected to said outer connecting section (336) of said outer end wall (332);
said protruding wall section (333) cooperates with said inner annular section (324) and said inner connecting section (326) of said inner end wall (322) to define said liquid-receiving space (337); and
said leak detector (4) is disposed on one side of said protruding wall section (333) opposite to said liquid-receiving space (337).

4. The magnetic drive pump (1) as claimed in claim 3, **characterized in that**:

said protruding wall section (333) of said outer end wall (332) of said outer case body (33) is proximate to said seat base (23) of said seat unit (2); and
said liquid-receiving space (337) is located below the axis (L).

5. The magnetic drive pump (1) as claimed in claim 4, **characterized by**: further including a cover (5) that abuts against said outer end wall (332) of said outer case body (33) of said motor unit (3) and that is bolted to said fixed seat (21) of said seat unit (2), said leak detector (4) being located between said protruding wall section (333) of said outer end wall (332) and said cover (5).

6. The magnetic drive pump (1) as claimed in claim 5, **characterized in that** the volume of said liquid-receiving space (337) ranges from 2 to 5 cubic centimeters.

7. The magnetic drive pump (1) as claimed in claim 3, **characterized in that** said outer case body (33) of said motor unit (3) further has an annular groove (338) formed in said outer annular section (334) and surrounding the axis (L), and a plurality of guiding grooves (339) each extending from said outer surrounding wall (331) to said outer end wall (332), said guiding grooves (339) being disposed about the axis (L), and spaced apart from each other, said annular groove (338) and each of said guiding grooves (339) intersecting, said annular groove (338) and said guiding grooves (339) being adjacent to said inner case body (32) of said motor unit (3), said annular groove (338) communicating with said liquid-receiving space (337) and each of said guiding grooves (339).

8. The magnetic drive pump (1) as claimed in claim 7, **characterized in that** each of said guiding grooves (339) of said outer case body (33) has an axial groove part (339') formed in said outer surrounding wall (331), and a radial groove part (339") formed in said outer annular section (334) of said outer end wall (332) and communicating with said axial groove part (339').

9. The magnetic drive pump (1) as claimed in claim 1, **characterized in that** the volume of said liquid-receiving space (337) ranges from 2 to 5 cubic centimeters.

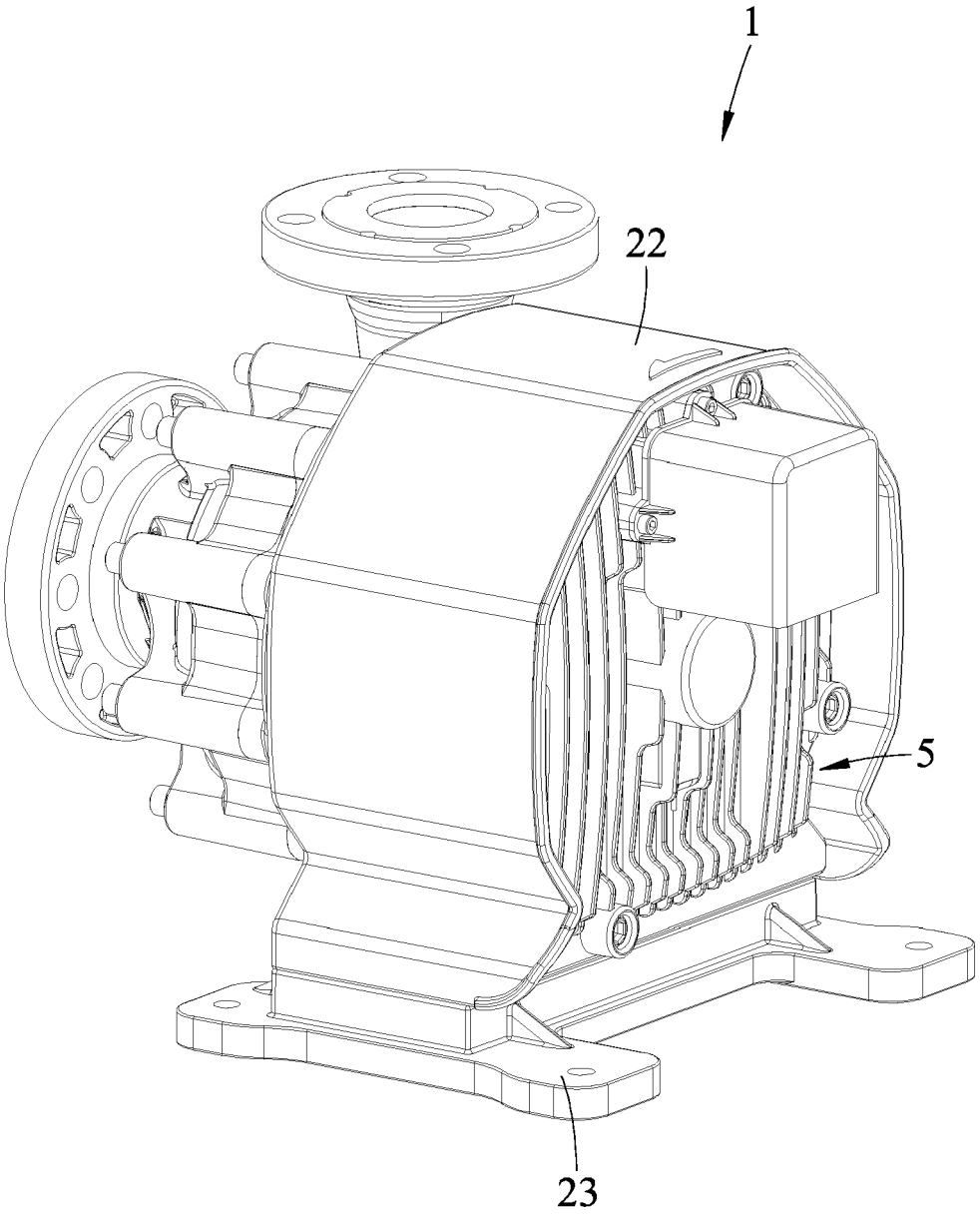


FIG.1

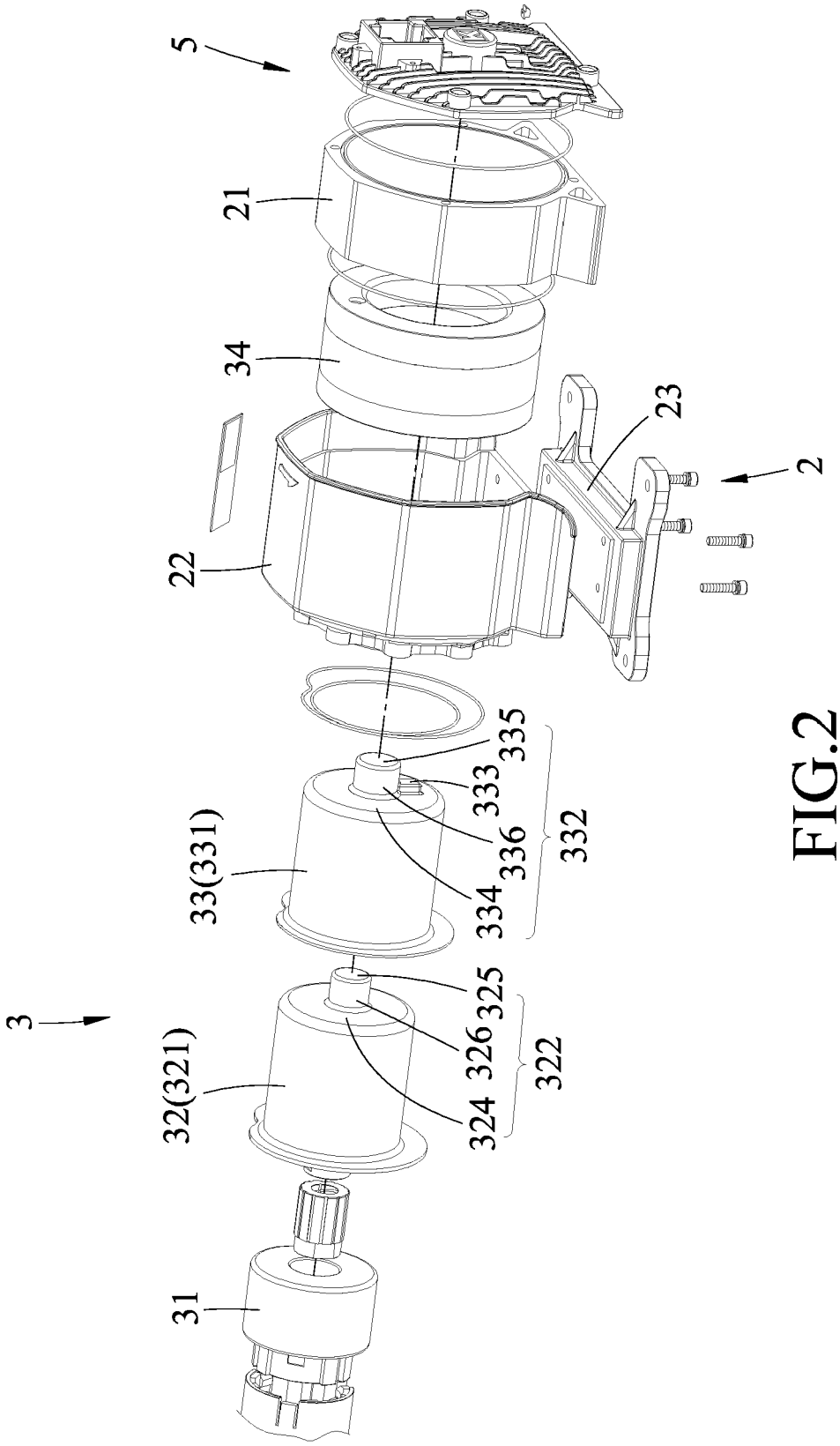

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FIG.2

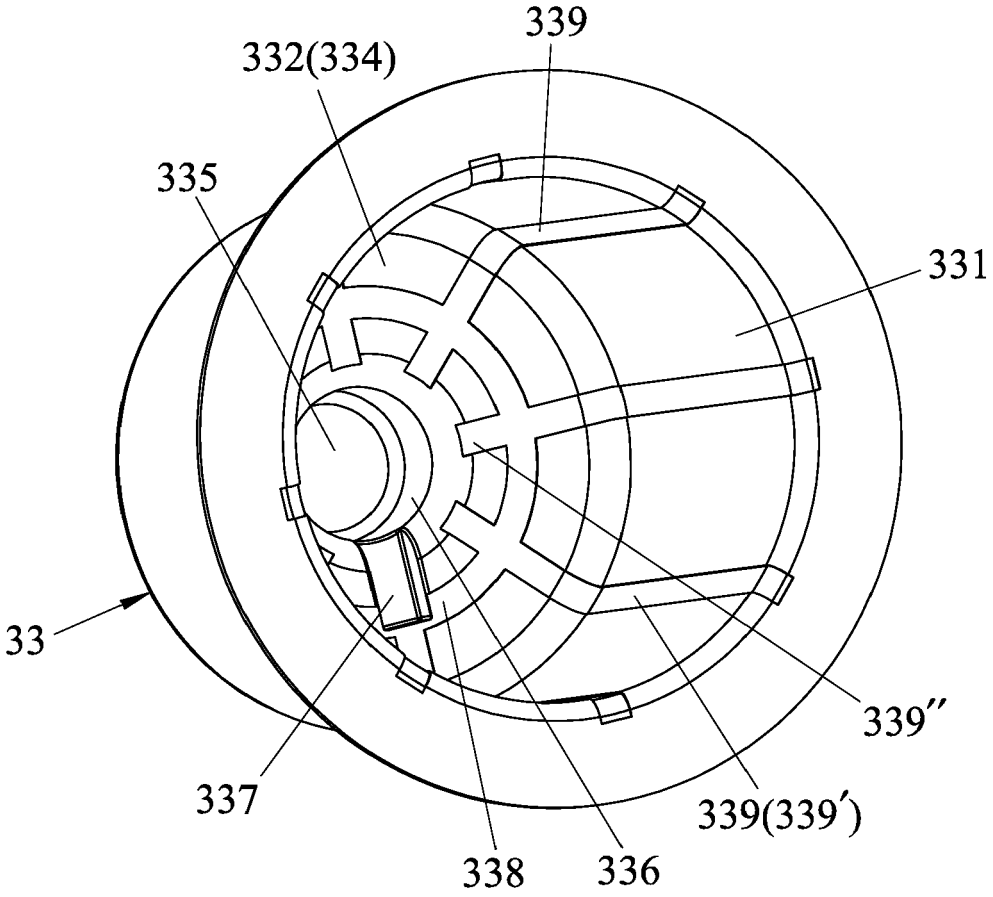


FIG.3

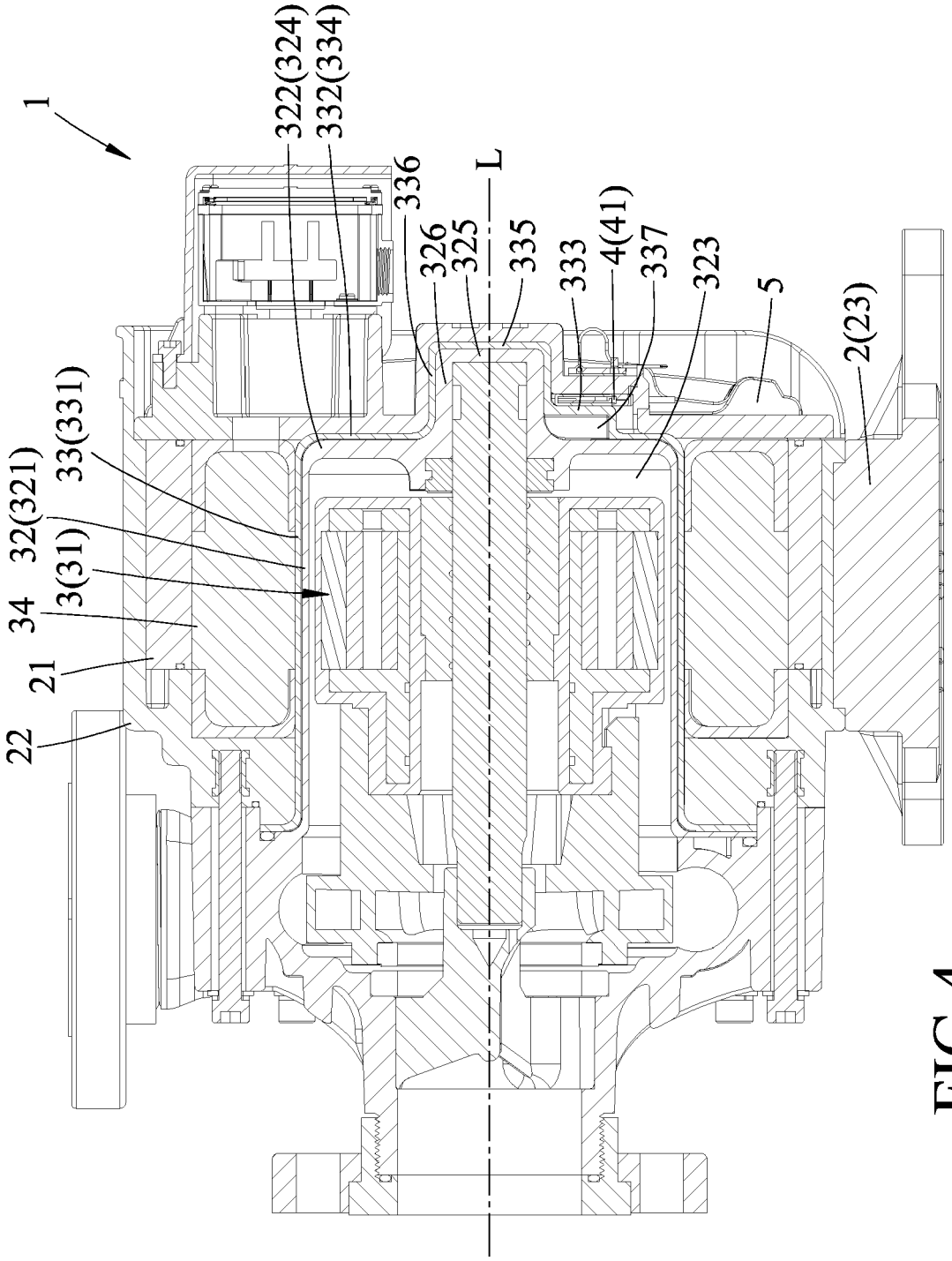

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FIG.4

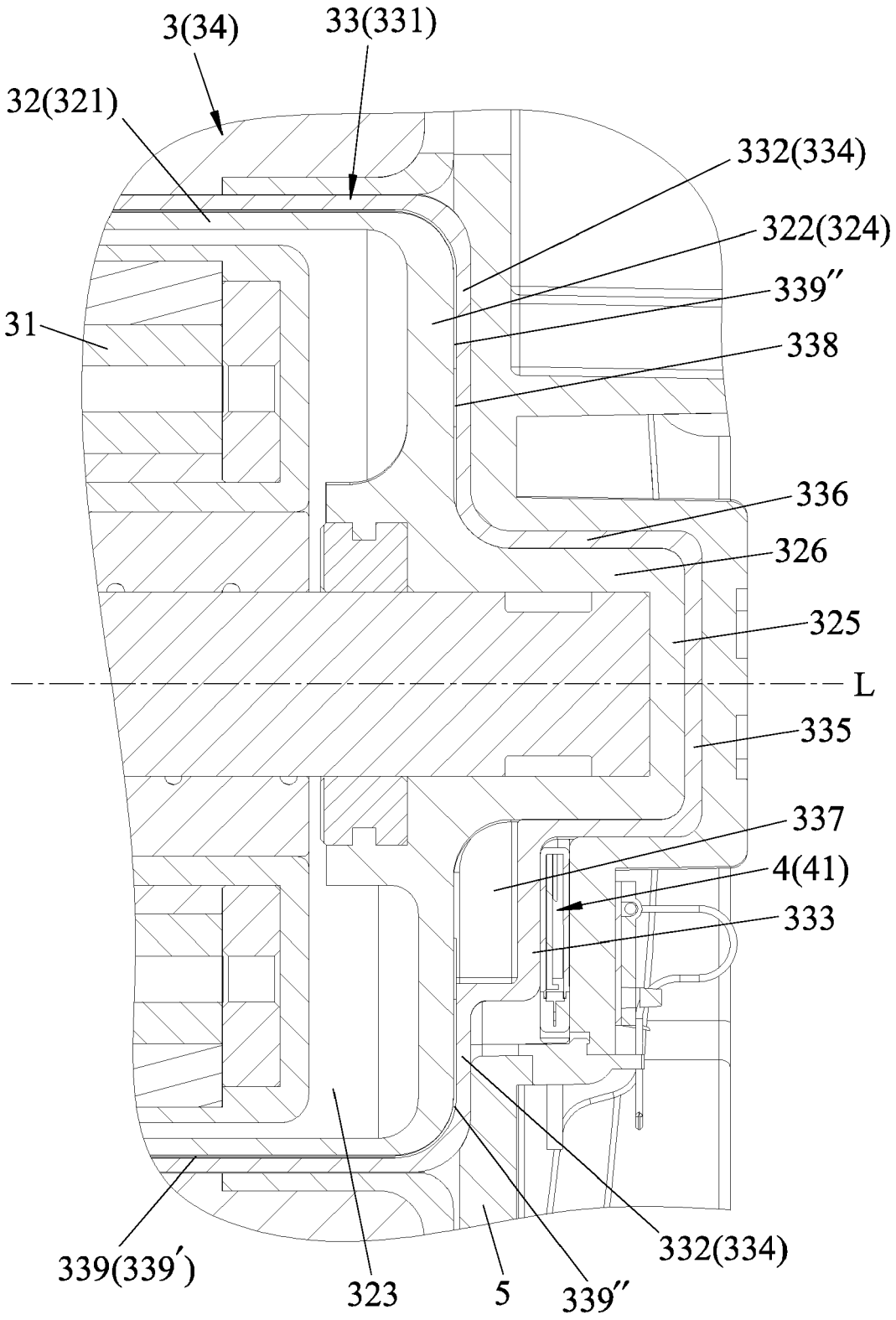

3(34)
33(331)
32(321)
332(334)
322(324)
339″
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4(41)
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332(334)

FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 0838

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	CN 212 055 146 U (ZI YI ELECTRICAL ENG CO LTD) 1 December 2020 (2020-12-01) * abstract * * figures 1-5 *	1-9	INV. F04D13/06 F04D15/00 F04D15/02 F04D29/62
Y	TW M 600 801 U (ZI YI ELECTRICAL ENGINEERING CO LTD [TW]) 1 September 2020 (2020-09-01) * abstract * * figures 1-3 *	1-9	
Y	US 4 998 863 A (KLAUS FRANZ [DE]) 12 March 1991 (1991-03-12) * column 4, line 53 - column 5, line 25 * * figure 1 *	7,8	
A	EP 2 292 932 A2 (KSB AG [DE]) 9 March 2011 (2011-03-09) * paragraph [0037] * * figure 1 *	1-9	
A	US 2011/293450 A1 (GRIMES DAVID J [US] ET AL) 1 December 2011 (2011-12-01) * paragraph [0013] - paragraph [0014] * * paragraph [0044] - paragraph [0045] * * figures 10-12 *	1-9	TECHNICAL FIELDS SEARCHED (IPC) F04D H02K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 November 2021	Oliveira, Damien

CATEGORY OF CITED DOCUMENTS

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11-11-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 212055146 U	01-12-2020	NONE	
TW M600801 U	01-09-2020	NONE	
US 4998863 A	12-03-1991	AT 65584 T	15-08-1991
		DE 3712459 A1	27-10-1988
		EP 0286822 A2	19-10-1988
		ES 2024570 B3	01-03-1992
		US 4998863 A	12-03-1991
EP 2292932 A2	09-03-2011	DE 102009033111 A1	03-02-2011
		EP 2292932 A2	09-03-2011
US 2011293450 A1	01-12-2011	BR 112012030665 A2	13-06-2017
		CA 2801495 A1	08-12-2011
		EP 2417353 A1	15-02-2012
		JP 2013530669 A	25-07-2013
		KR 20140074789 A	18-06-2014
		US 2011293450 A1	01-12-2011
		WO 2011153367 A1	08-12-2011

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Patent documents cited in the description

- TW 1424661 **[0002]**