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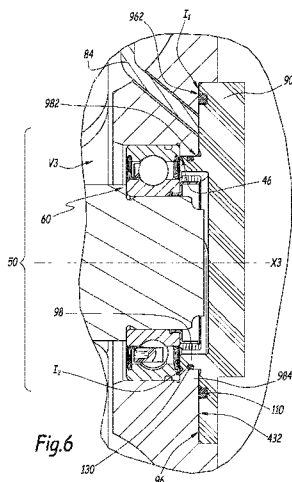
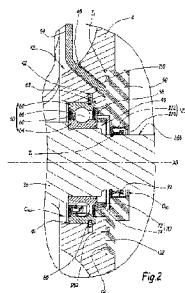
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(54) Title: INSTRUMENTED BEARING ASSEMBLY AND MACHINE COMPRISING SUCH AN ASSEMBLY



(57) Abstract: This instrumented bearing assembly (50) comprises a bearing (60) with an inner ring (64) and an outer ring (62), an encoder washer (70) rotatably connected with a rotatable ring (62) and sensing means including a sensor body (90) and at least a sensor mounted on or within the sensor body and adapted to detect a rotation parameter of the encoder washer (70). The sensor body (90) is adapted to be mounted on a fixed member (4). At least one first gasket (110) seals an axial interface (I₁) between the sensor body (90) and the fixed member (4). At least one second gasket (120) seals a radial interface (I₂) between the sensor body (90) and a fixed or rotatable member (36).

INSTRUMENTED BEARING ASSEMBLY AND MACHINE COMPRISING SUCH AN ASSEMBLY

5 TECHNICAL FIELD OF THE INVENTION

This invention relates to an instrumented bearing assembly which includes, amongst others, a bearing, an encoder washer and sensing means adapted to detect a rotation parameter of the encoder washer. Such an instrumented bearing is particularly useful for sustaining a rotating shaft and detecting its rotation.

10 This invention also relates to a machine, such as an electric motor, which includes, amongst others, a rotating shaft sustained by an instrumented bearing assembly as mentioned here-above.

BACKGROUND OF THE INVENTION

15 It is known to use an electric machine such as an electric motor next to a device, such as a gearbox, which incorporates oil. This can, in particular, be the case in hybrid vehicles where an electric motor/generator is coupled to a gearbox. Under such circumstances, it is essential to prevent oil potentially leaking out of the gearbox to enter the electric motor. In order to fulfill this function, it is known for an operator to add
20 manually a seal at an interface between the gearbox and the electric motor. The provision of such a seal is of the responsibility of the motor manufacturer or the gearbox manufacturer who has the burden of designing and purchasing such a seal.

From a more general point of view, a machine, such as electric motor or another type of machine, must be protecting against dust, water or any other pollution. This
25 generally requires dedicated sealing means which must be designed and/or purchased by the designer/manufacture of the machine.

SUMMARY OF THE INVENTION

This invention aims at solving these problems with a new instrumented bearing
30 which includes a fully effective sealing function, thus relieving the designer/manufacture of a machine from designing and purchasing specific seal means.

To this end, the invention concerns an instrumented bearing assembly comprising a bearing, with an inner ring and an outer ring, one of the rings being rotatable with respect to the other ring, an encoder washer rotatably connected with the rotatable ring and
35 sensing means including a sensor body and at least a sensor mounted on or within the sensor body and adapted to detect a rotation parameter of the encoder washer, the

sensor body being designed to be mounted on a fixed member. According to the invention, the sensor body is equipped with at least one first gasket, adapted to seal an axial interface between the sensor body and the fixed member, and at least one second gasket, adapted to seal a radial interface between the sensor body and a fixed or rotatable member.

Thanks to the invention, the sealing function which is necessary between the instrumented bearing and its environment is provided with the first gasket and the second gasket respectively mounted on the sensor body. Thus, the designer or manufacturer of a machine incorporating such a bearing assembly does not have to bother designing and/or purchasing a specific seal arrangement and the manufacturing process of a machine incorporating such a bearing assembly does not need to incorporate a step where a sealing gasket is mounted on the machine. Indeed, as soon as the bearing assembly is mounted in the machine, the sealing function is obtained via the first and second gaskets. Since the first gasket seals an axial interface and the second gasket seals a radial interface, a double sealing effect is obtained, in two different interfaces, which increases the safety of operation of a machine equipped with such a bearing assembly and prevents pollution of its inside volume.

In the present description, unless otherwise specified, the words « axial », « radial », « axially » and « radially » relate to the rotation axis of the encoder washer. A direction is « axial » when it is parallel this axis. A direction or an axis is « radial » when it is perpendicular to and secant with this axis. An interface is « axial » when it is defined between two axial surfaces and an interface is « radial » when it is defined between two radial surfaces.

Moreover, a rotation parameter can be a position, a speed, an acceleration or any other parameter representative of the rotation of the encoder washer around its rotation axis.

According to further aspects of the invention which are advantageous but not compulsory, the instrumented bearing assembly might incorporate one or several of the following features, taken in any technically admissible combination:

- The first gasket is an O-ring.
- The second gasket is a lip seal. Alternatively, the second seal is an O-ring.
- The sensor body has a planar axial surface and the first gasket is mounted on this planar surface.
- The sensor body defines a through hole for the passage of a shaft rotatably connected to the rotatable ring and the second gasket is mounted within this through hole.

- The sensor body includes a sleeve portion and the second gasket is mounted radially around the sleeve portion.

- The instrumented bearing includes at least one axial spacer mounted in the sensor body for preventing an axial deformation of the sensor body upon tightening of at least one mounting screw used for immobilizing the sensor body on the fixed member.

- An axial spacer is arranged around each mounting screw, inside a through hole of the sensor body.

- The first gasket forms a closed loop around a rotation axis of the rotatable ring and includes an intermediate band dividing the loop into two zones.

The invention also concerns a machine, in particular an electric motor, which comprises a stationary structure and a mobile structure rotating around a rotation axis and comprising a rotating shaft. According to the invention, the rotating shaft is sustained by an instrumented bearing assembly as mentioned here-above.

According to further advantageous aspects of the invention, such a machine might incorporate one or several of the following features taken in any technically admissible combination:

- The second gasket is in sliding contact with the rotating shaft. Alternatively, the second gasket is in static contact against a fixed casing of the machine.

- The rotating shaft goes axially through the sensor body. Alternatively, the sensor body closes a volume of the machine which accommodates the rotating shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be well understood on the basis of the following description which is given in correspondence with the annexed figures and as an illustrative example, without restricting the object of the invention. In the annexed figures:

- figure 1 is an axial cut view of a driving set comprising a gearbox and an electric motor according to the invention,
- figure 2 is an enlarged view of detailed II on figure 1,
- figure 3 is an exploded perspective view of an instrumented bearing assembly used in the driving set of figure 1 and represented on figure 2,
- figure 4 is a partially exploded perspective view of a portion of the driving set of figure 1, during an assembly operation of this driving set,
- figure 5 is a cut view, at a smaller scale, corresponding to the left part of figure 1 for an electric motor according to a second embodiment of the invention,
- figure 6 is an enlarged view of detail VI on figure 5,

- figure 7 is a partly exploded perspective view of a gearbox according to the invention, during an assembly operation,
- figure 8 is a perspective view of the gearbox of figure 7, when assembled,
- figure 9 is an enlarged and partial cut view along plane IV on figure 8 and
- figure 10 is a perspective exploded view of an instrumented bearing assembly belonging to the gearbox of figures 7 to 9.

DESCRIPTION OF SOME EMBODIMENTS

A driving set 1 is represented on figure 1 and includes a gearbox 2 and an electric motor 3. Gearbox 2 comprises a casing 22 and a set of pinions 24 mounted within casing 22 and rotating around a main axis X2 of gearbox 2. Gearbox 2 is provided with an output shaft which rotates around axis X2 when gearbox 2 is powered via electric motor 3. Thus, driving set 1 can be used to drive a non represented mechanical device in rotation around axis X2.

Electric motor 3 includes a stator 32 and a rotor 34 which rotates around a central axis X3 of motor 3. In the assembled configuration of driving set 1 represented on figure 1, axes X2 and X3 are aligned.

Rotor 34 includes a rotor shaft 36 which is sustained within a casing 38 of motor 3 by two bearing assemblies.

A first bearing assembly 5 is located near first end 362 of rotor shaft 36 oriented away from gearbox 2. Shaft end 362 is equipped with a ventilator 35. Bearing assembly 5 is made of a rolling bearing.

A second bearing assembly 50 is located next to a second end 364 of rotor shaft 36 which is located in the inside volume V2 of gearbox 2. Bearing assembly 50 is mounted on a flange 4 which is made of a single piece of metal and belongs both to the casing 22 of gearbox 2 and to the casing 38 of electric motor 3.

Metallic flange 4 is provided with a central opening O_{40} and shaft 36 goes through this opening, between the inside volume V3 of electric motor 3 and the inside volume V2.

Bearing assembly 50 includes a bearing 60 which comprises an outer ring 62 immobilized on flange 4, an inner ring 64 fixedly mounted on shaft 36 and a series of balls 66 held in position by a cage 68 in a rotation chamber defined between facing raceways respectively defined on outer and inner rings 62 and 64. Alternatively, rolling assembly 50 can include another type of rolling bearing, e.g. a roller bearing or a needle bearing, or a plain bearing.

Bearing assembly 50 also includes an encoder washer 70 made of a metallic flange 72 and a magnetic body 74. Encoder washer 70 is rotatably connected with inner ring 64

and rotates with this ring together with shaft 36. Encoder washer rotates around axis X3, like shaft 36.

On the other hand, outer ring 62 is housed within an annular recess 41 of flange 4 and fast in rotation with this flange. Ring 62 is immobilized axially with respect to flange 4 along axis X3 by a circlip or spring retaining ring 63 which is engaged within a groove 42 of metallic flange 4 and a groove 65 of outer ring 62.

A sensor 80 is embedded within a sensor body 90 of rolling assembly 50 in order to detect a rotation parameter of encoder washer 70. Sensor 80 is connected to a printed circuit board 82 which bears electronic components adapted to treat electric signals received from sensor 80. An electric cable 84 connects PCB 82 to the outside of driving set 1. Items 80 and 82 and the end of cable 84 connected to PCB 82 are embedded within sensor body 90. For the sake of simplicity, only sensor body 90 is represented on figures 1 and 2.

Sensor body 90 is immobilized, within an annular recess 43 of metallic flange 4 oriented towards volume V2, by three screws 100 which cross three through holes 92 of sensor body 90 respectively aligned with three threaded holes 44 of metallic flange 4 when sensor body 90 is mounted within recess 43.

Recesses 41 and 42 are provided on two opposite sides of flange 4, around central opening O_{40} .

In order to avoid that screwing of screws 100 within threaded holes 44 result in an over-compression of sensor body 90, which could be damageable for sensor 80 or PCB 82, three axial spacers 94 are used, one spacer 94 being located within each hole 92 around the stem of a screw 100, in order to resist a compression effort exerted by the head of this screw.

Sensor body 90 has a planar face 96 which is supposed to lie against the planar bottom 432 of recess 43 when sensor body is mounted on metallic flange 4. Bottom 432 is planar and perpendicular to axis X3. Thus, it is an axial surface with respect to axis X3. Sensor body 90 also includes a sleeve portion 98 which projects from planar surface 96 towards bearing 60 and which radially surrounds encoder washer 70. Actually, sensor 80 is located within sleeve portion 98 and is aligned, along axis X3, with encoder washer 70, in order to efficiently detect, along an axial direction, the rotation of encoder washer 70.

Alternatively, several sensors 80 can be used. Irrespective of the number of sensors 80, they can be located outside sleeve portion 98, in particular if they detect the rotation of encoder washer along a direction parallel to axis X3. Sensor(s) 80 can also be mounted on sensor body 90 instead of being embedded within this body.

Planar face 96 is provided with a groove 962 which accommodates an O-ring 110 adapted to lie against the bottom 432 of recess 43. Thus, O-ring 110 forms a gasket which seals an axial interface I_1 between metallic flange 4 and sensor body 90, at the level of planar surface 96 and planar bottom 432.

5 Sensor body 90 has a central opening O_{90} which forms a through hole for the passage of shaft 36, from volume V3 to volume V2.

A lip seal 120 is installed within trough hole O_{90} and includes a mounting portion 122, immobilized on an inner radial surface 91 of sensor body 90 which defines opening O_{90} , and a lip 124 which is in sliding contact with the outer radial surface 366 of shaft 36.
10 Thus, lip seal 120 forms a second gasket which closes a radial interface I_2 between sensor body 90 and shaft 36, at the level of radial surfaces 91 and 366.

Thanks to O-ring 110 and lip seal 120, a double sealing function is obtained, at the level of axial interface I_1 and at the level of radial interface I_2 , which efficiently prevents oil contained within volume V2 from entering volume V3.

15 As shown on figure 3, the geometry of O-ring 110 does not have to be circular around axis X3. It might be adapted to the geometry of flange 4 and sensor body 90.

As shown on figure 4, when it is necessary to assemble driving set 1, bearing 60 is first mounted around shaft 36 as shown by arrow A1. Then, metallic flange 4 and circlip 63 are mounted around bearing 60, with the result that outer ring 62 is axially immobilized with respect to metallic flange 4. This is shown by arrows A2 and A3.
20

It is then possible to mount sensor body 90 onto flange 4 as shown arrow A4. This is obtained by screwing screws 100 within threaded holes 44 and by introducing cable 84 within a through hole 45 of flange 4 which connects recess 43 with volume V3. Mounting of sensor body 90 onto flange 4 occurs via a translation parallel to axis X3 up to the point where surface 96 bears against bottom 432. In this configuration, O-ring 110 and lip seal 120 fulfill the double sealing function mentioned here-above.
25

Thus, the simple fact of installing sensor body 90 onto metallic flange 4 induces a sealing function. Provided that he uses bearing assembly 50, the designer or manufacturer of driving set 1 does not have to care about specific sealing means and does not have to purchase any specific gasket, apart from the ones already provided on the sensor body 90 of bearing assembly 50.
30

Alternatively, sensor body 90 can be mounted on flange 4 before this flange is mounted around shaft 36.

In the second and third embodiments of the invention represented on figures 5 to 10, the same elements as in the first embodiment bear the same references. Here-after,
35

mainly the differences between these two embodiments and the first embodiment are mentioned.

In the embodiment of figures 5 and 6, shaft 36 does not cross sensor body 90 which closes the inside volume V3 of electric motor 3. Bearing 60 is also immobilized within flange 4 and O-ring 110 fulfils a sealing function at the level of an axial interface I_1 between surfaces 432 and 96 of items 4 and 90, defined as in the first embodiment. Items 60 and 90 belong to a bearing assembly 50, as in the first embodiment.

A second O-ring 130 is mounted radially around sleeve portion 98 of sensor body 90 and provides a second sealing function at the level of a radial interface I_2 defined between the outer radial surface 982 of sleeve portion 98 and an inner radial surface 46 of metallic flange 4.

O-rings 110 and 130 are received within grooves 962 and 984 respectively provided on surfaces 96 and 98.

In the third embodiment of the invention, a gearbox includes a shaft 36 which rotates around an axis X3 and bears a pinion 37 meshing with a toothed crown 39. As in the first two embodiments, a rolling assembly 50 is provided which includes a rolling bearing 60, an encoder washer 70, a non represented sensor and a sensor body 90 comprising a stepped sleeve portion 98.

A first O-ring 110 is provided in a groove 962 of a planar surface 96 of sensor body 90. A second O-ring 130 is also provided, in a way similar to the second embodiment, in a peripheral groove 984 provided on the outer radial surface 982 of sleeve portion 98. Thus, a double sealing function is automatically obtained when sensor body 90 is mounted onto a flange 4 which belongs to the casing of machine 3.

Flange 4 is provided with a planar surface 47 visible on figure 7. When sensor body 90 is immobilized on flange 4 by six screws 100, surfaces 47 and 96 define an axial interface I_1 which is sealed by O-ring 110. On the other hand, flange 4 has an inner circular and radial surface 48 which define with surface 982 a radial interface I_2 sealed by O-ring 120 when sensor body 90 is mounted on flange 4.

In this embodiment, a screw 140 and a washer 150 are used to rotatably connect the inner ring 64 of bearing 60 with shaft 36. Screwing of screw 150 within a threaded hole 368 of shaft 36 results in an axial effort which blocks both the flange 72 of encoder washer 70 and inner ring 64 against an outer shoulder 369 of shaft 36.

As shown on figure 9, O-ring 110 forms, as in the first embodiment, a closed loop around axis X3. O-ring 110 also includes an intermediate band 112 which divides the closed loop into two zones Z_1 , Z_2 which respectively correspond to sleeve 98 and a fully

planar portion of sensor body 90. In other words, the geometry of O-ring 100 is adapted to the geometry of sensor body 90 and to its interaction with flange 4.

The assembly 50 of the third embodiment doesn't include a cable similar to cable 84 of the first two embodiments. Instead, electrical conductors are embedded in the sensor
5 body 90 until a connector 99 attached to the sensor body and suitable for receiving a counterpart customer connector.

In the second and third embodiments, O-ring 130 is in static contact with flange 4 which belongs to the casing of motor or machine 3.

According to a non represented alternative approach which can be applied to all
10 embodiments of the invention, two gaskets can be provided in order to seal the axial interface I_1 and/or the radial interface I_2 . If such is a case, the two first gaskets are advantageously located one around the other, whereas the two second gaskets are offset along the rotation axis of the encoder washer.

The embodiments and alternative embodiments considered here-above can be
15 combined in order to generate new embodiments of the invention.

CLAIMS

1.- Instrumented bearing assembly (50) comprising:

- a bearing (60) with an inner ring (64) and an outer ring (62), one of the rings (62) being rotatable with respect to the other ring,
- an encoder washer (70) rotatably connected with the rotatable ring,
- sensing means (80, 82, 90) including a sensor body (90) and at least a sensor (80) mounted on or within the sensor body and adapted to detect a rotation parameter of the encoder washer, the sensor body being designed to be mounted on a fixed member (4),

wherein the sensor body is equipped with:

- at least one first gasket (110) adapted to seal an axial interface (I_1) between the sensor body (90) and the fixed member (4) and
- at least one second gasket (120; 130) adapted to seal a radial interface (I_2) between the sensor body and a fixed or rotatable member (36; 4).

2.- An instrumented assembly according to claim 1, wherein the first gasket is an O-ring (110).

3.- An instrumented assembly according to any preceding claim, wherein the second gasket is a lip seal (120).

4.- An instrumented assembly according to one of claims 1 and 2, wherein the second seal is an O-ring (130).

5.- An instrumented bearing assembly according to any preceding claim, wherein the sensor body has a planar axial surface (96) and the first gasket is mounted on this planar surface.

6.- An instrumented bearing assembly according to any preceding claim, wherein the sensor body defines a through hole (O_{90}) for the passage of a shaft (36) rotatably connected to the rotatable ring (62) and the second gasket (120) is mounted within this through hole.

7.- An instrumented bearing according to any one of claims 1 to 5, wherein the sensor body includes a sleeve portion (98) and the second gasket (130) is mounted radially around the sleeve portion.

5 8.- An instrumented bearing according to any preceding claim, wherein it includes at least one axial spacer (94) mounted in the sensor body (90) for preventing an axial deformation of the sensor body upon tightening of at least one mounting screw (100) used for immobilizing the sensor body on the fixed member (4).

10 9.- An instrumented bearing according to claim 8, wherein an axial spacer (94) is arranged around each mounting screw (100), inside a through hole (92) of the sensor body.

15 10.- An instrumented bearing according to any preceding claim, wherein the first gasket (110) forms a closed loop around a rotation axis (X3) of the rotatable ring (62) and includes an intermediate band (112) dividing the loop into two zones (Z_1 , Z_2).

20 11.- Machine (3) comprising a stationary structure (4, 32) and a mobile structure (34, 36) rotating around a rotation axis (X3) and comprising a rotating shaft (36), wherein the rotating shaft (36) is sustained by an instrumented bearing assembly (50) according to any preceding claim.

25 12.- A machine according to claim 11, wherein the second gasket (120) is in sliding contact with the rotating shaft (36).

 13.- A machine according to claim 11, wherein the second gasket (130) is in static contact against a fixed casing (4) of the machine (3).

30 14.- A machine according to one of claims 11 to 13, wherein the rotating shaft (36) goes axially through the sensor body (90).

 15.- A machine according to one of claims 11 to 13, wherein the sensor body (90) closes a volume (V3) of the machine which accommodates the rotating shaft (36).

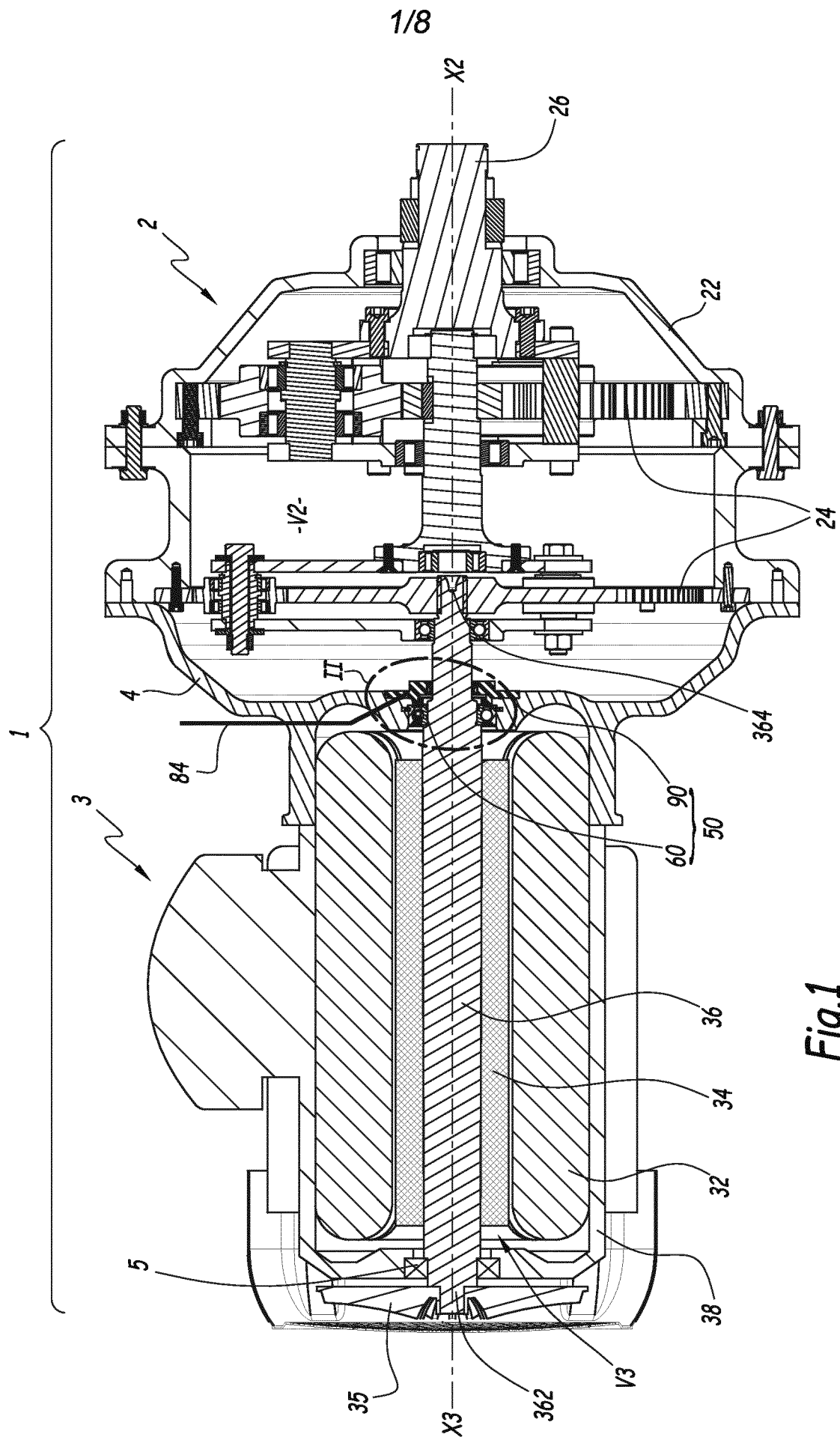
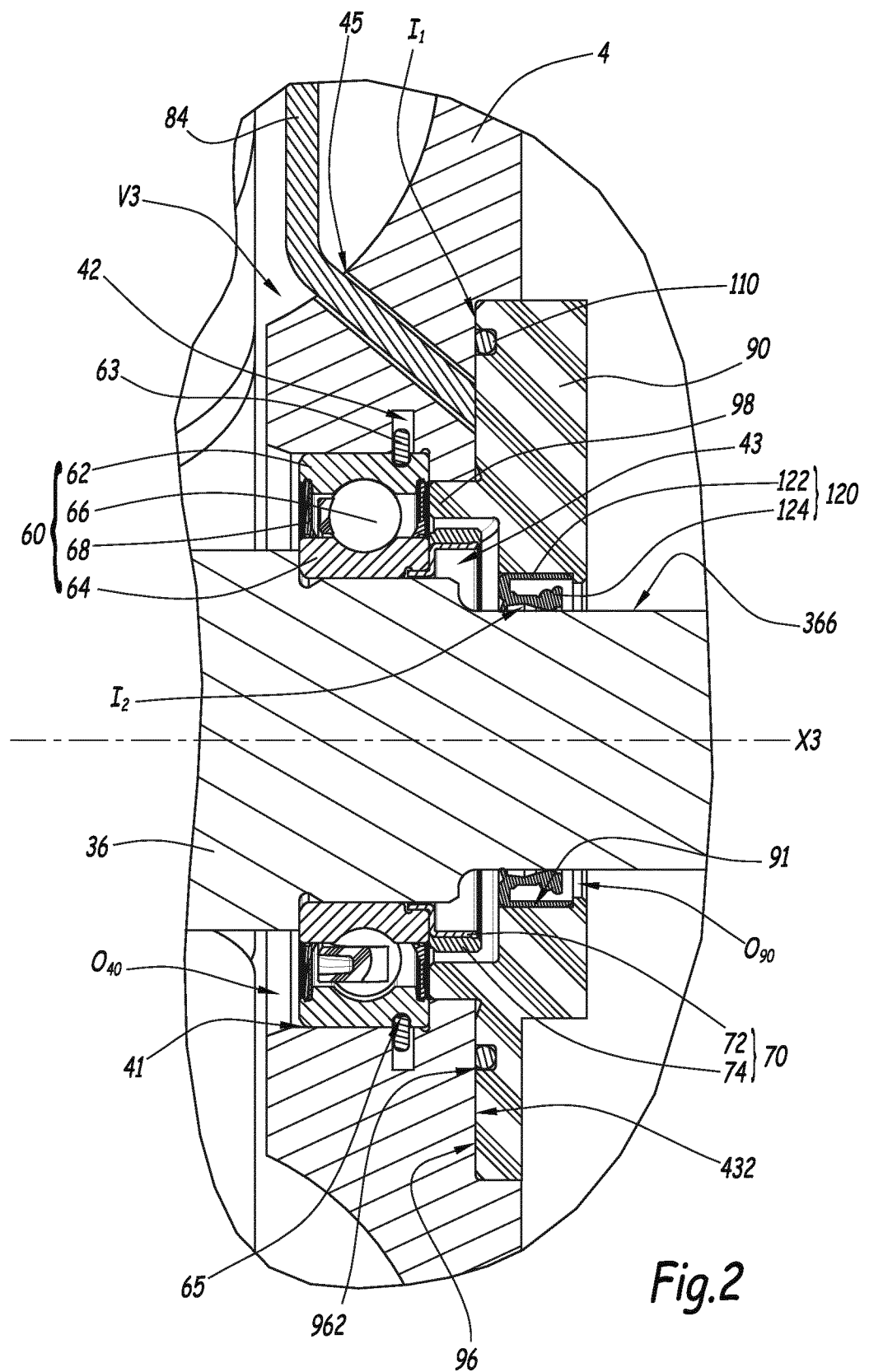


Fig.1



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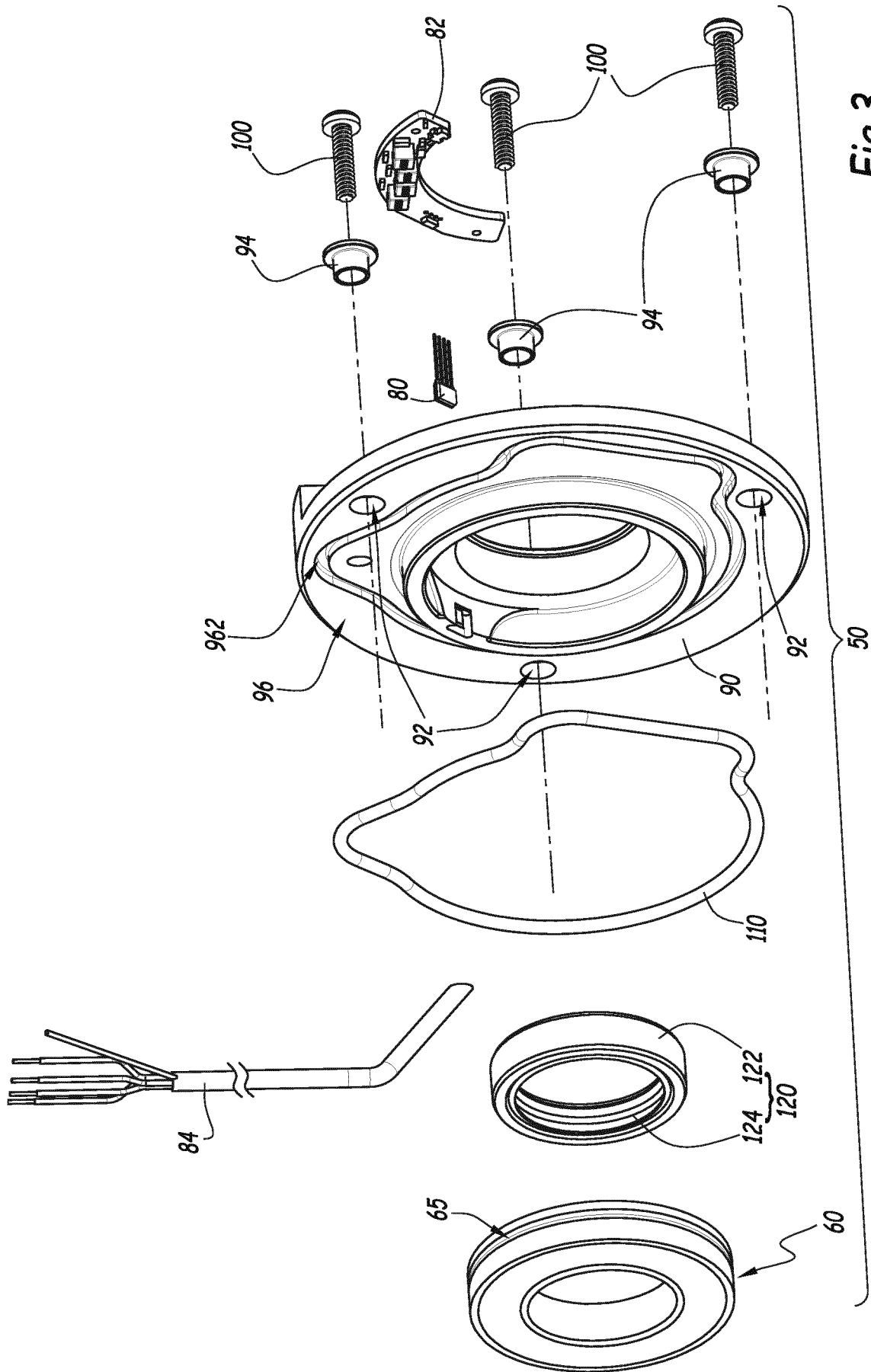


Fig.3

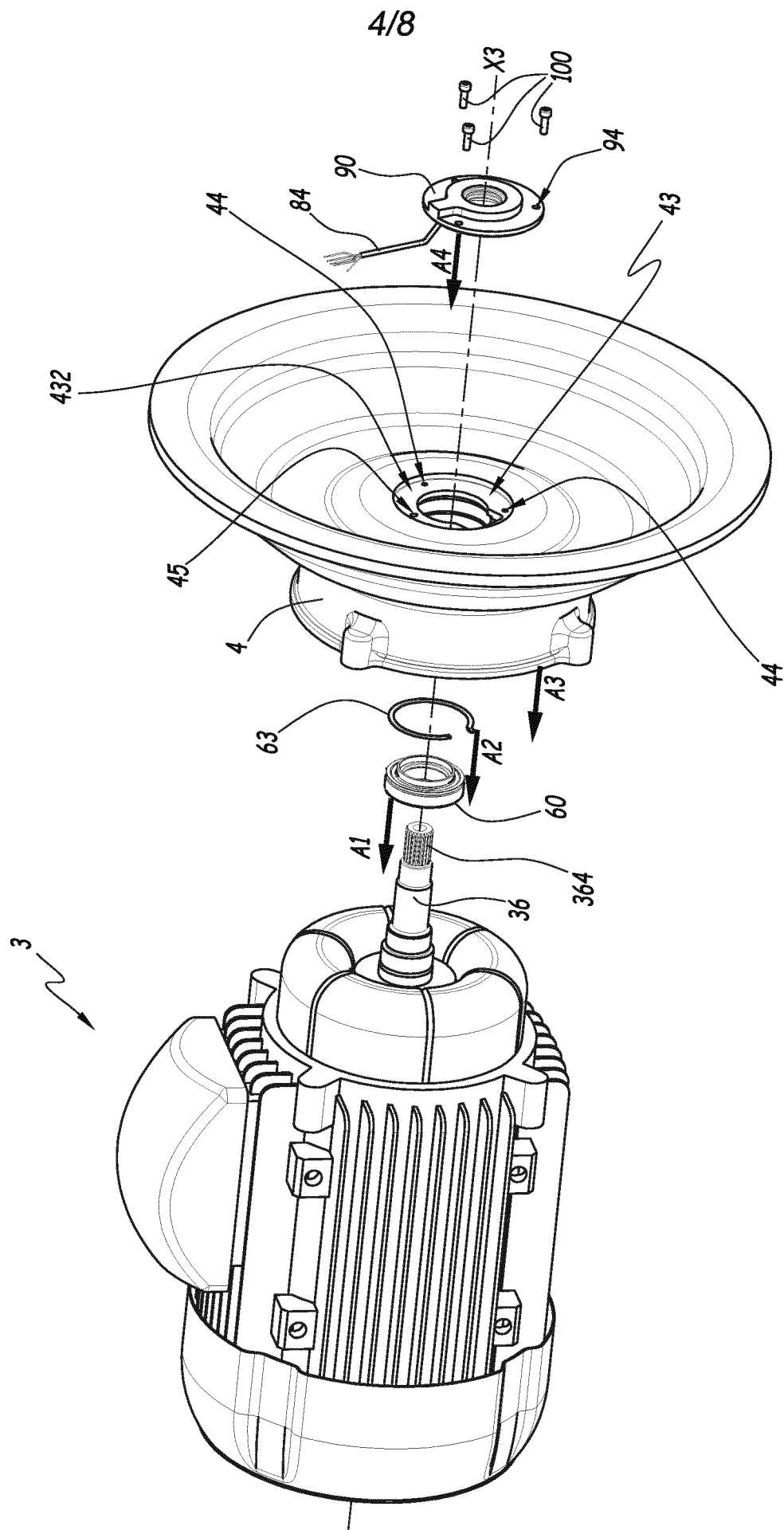


Fig.4

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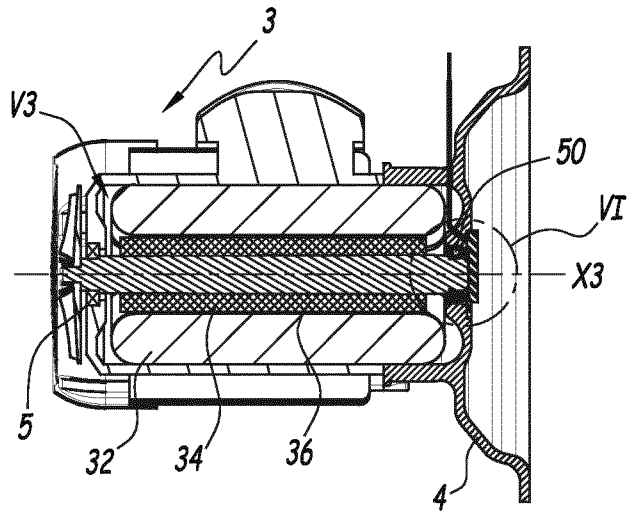


Fig.5

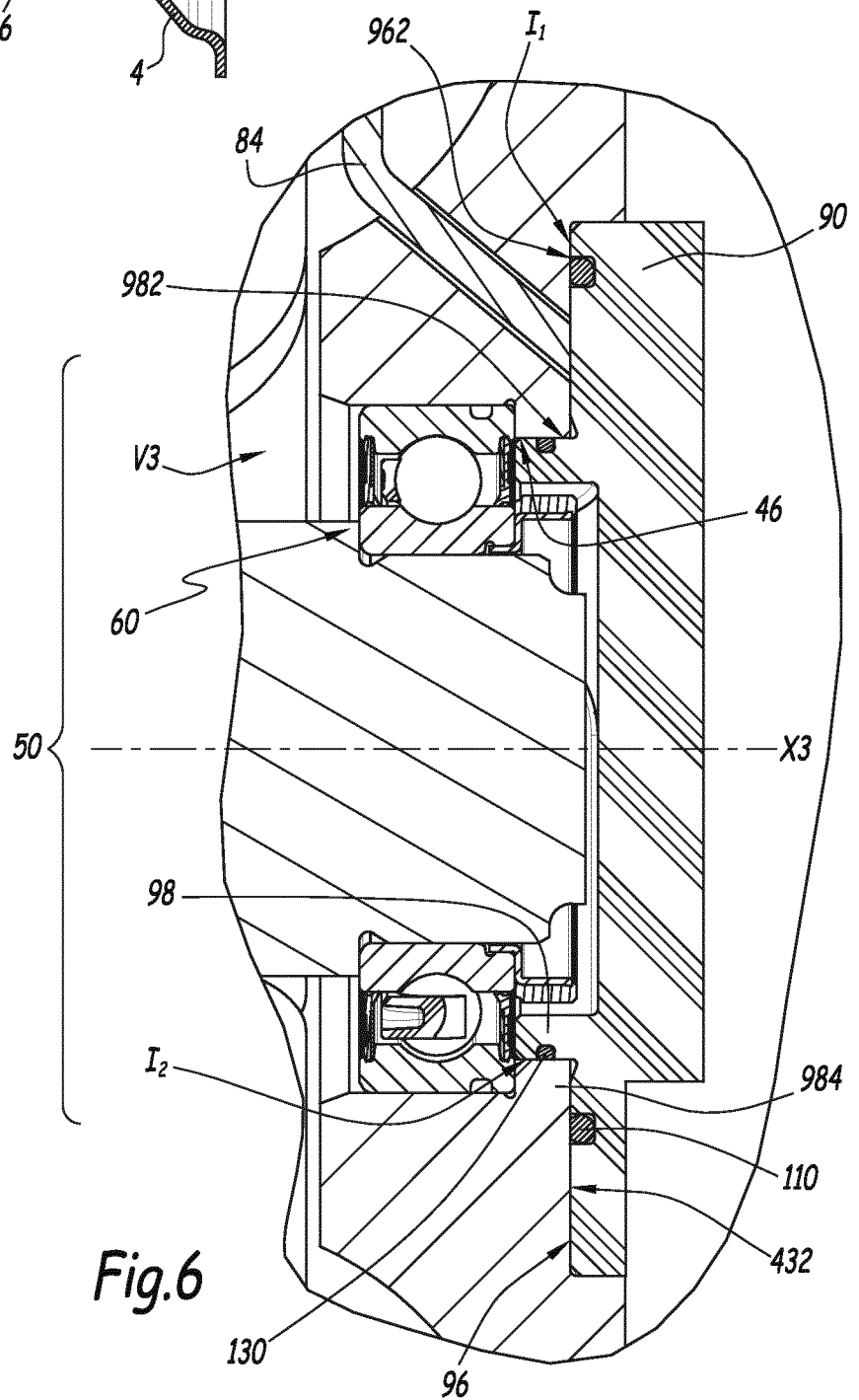


Fig.6

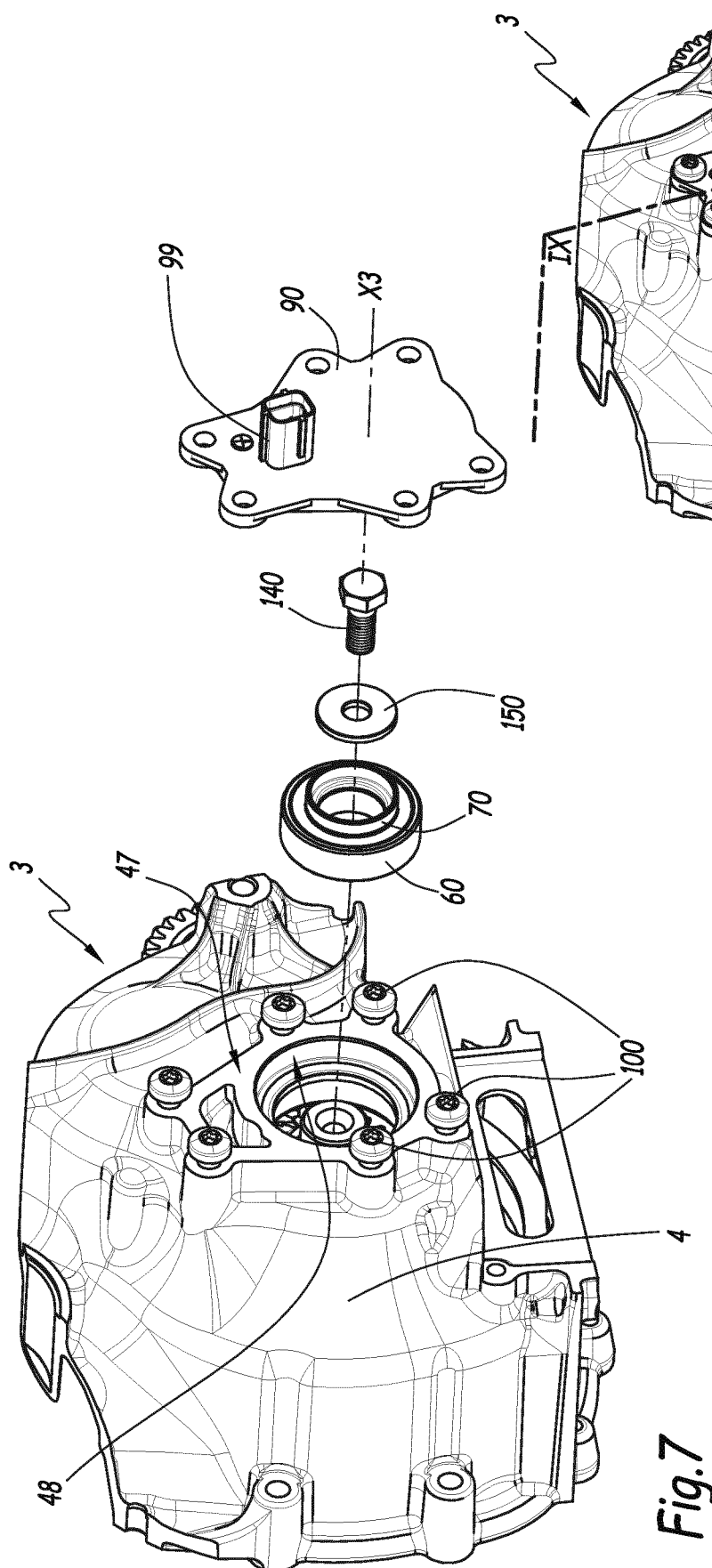


Fig. 7

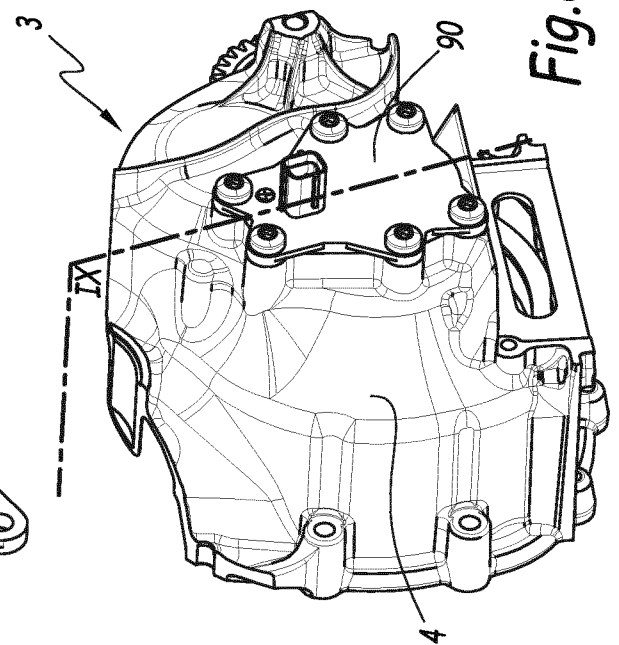


Fig. 8

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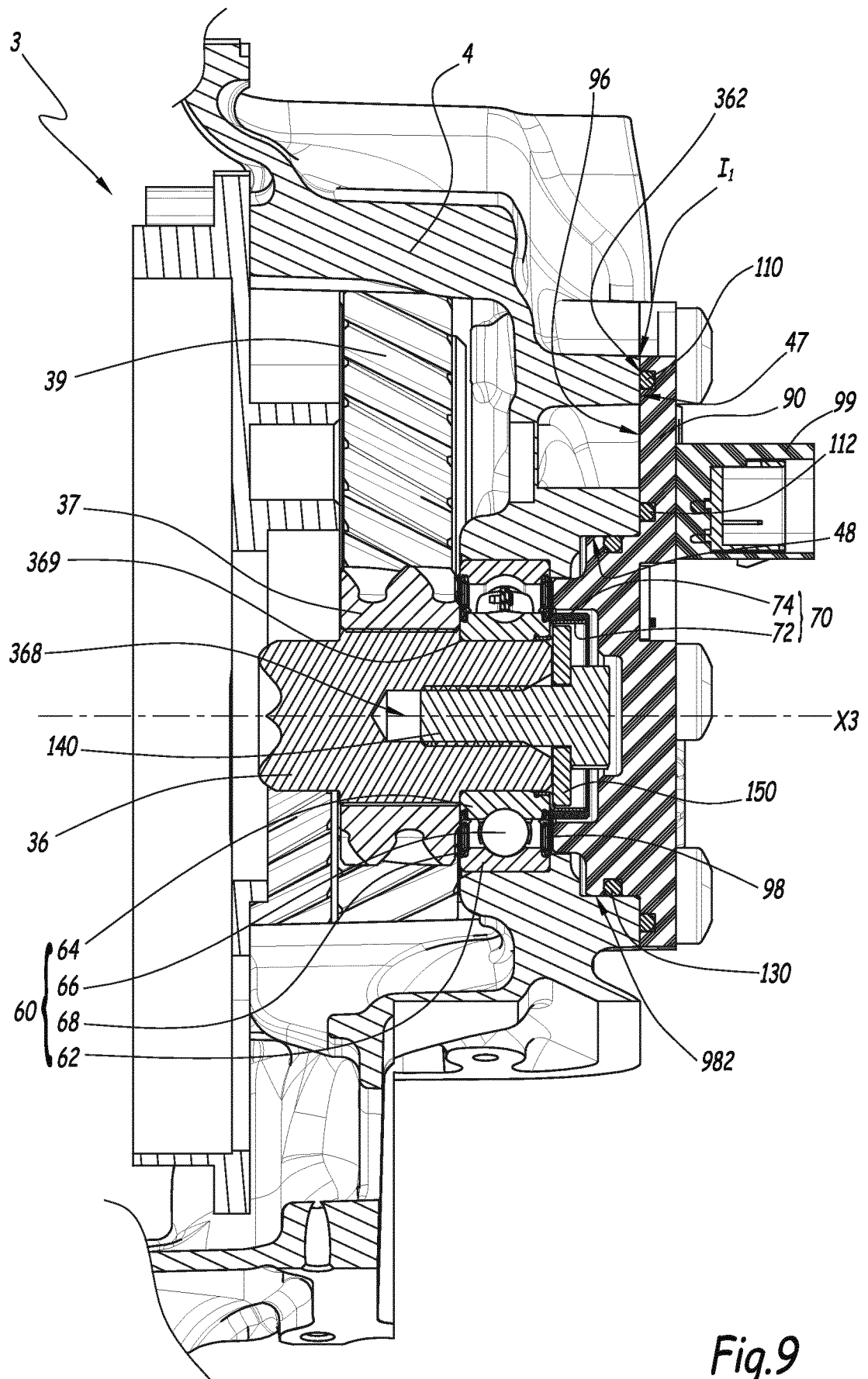
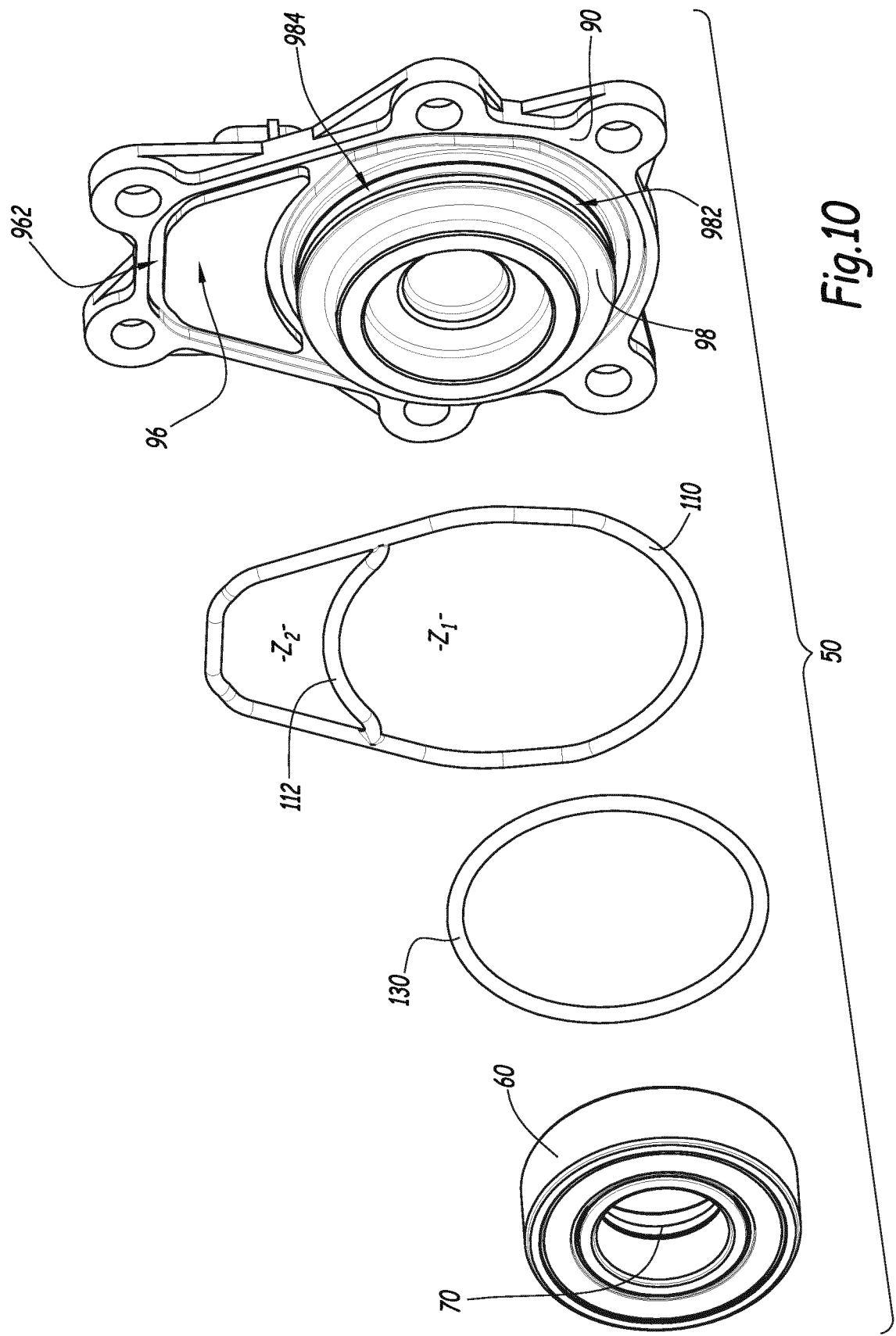


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/068756

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-7, 11-15

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/068756

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01P3/44 G01P3/487 G01P1/02
ADD.

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)

G01P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/124389 A1 (NORIMATSU TAKAYUKI [JP] ET AL) 20 May 2010 (2010-05-20)	1-3,5,6, 11,12,14
Y	paragraphs [0077] - [0087]; figures 1-4-6,8,10	1-7, 11-15
X	JP 2006 183712 A (JTEKT CORP; UCHIYAMA MFG) 13 July 2006 (2006-07-13)	1-3,5,6, 11,12,14
Y	figures 1-3	1-7, 11-15
Y	US 5 814 984 A (OHMI HAYATO [JP] ET AL) 29 September 1998 (1998-09-29) column 13, line 41 - column 14, line 30; figures 1-5,13-17 column 15, line 32 - column 15, line 49 column 21, line 53 - column 23, line 15	1-7, 11-15
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/068756

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP H09 88945 A (NIPPON SEIKO KK) 31 March 1997 (1997-03-31)	1,2,4,5, 7
Y	paragraph [0021]; figure 7	1-7, 11-15
Y	----- US 2007/268013 A1 (YAMAMOTO KAZUNARI [JP] ET AL) 22 November 2007 (2007-11-22) figures 6-9 -----	1-7, 11-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/068756

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010124389 A1	20-05-2010	CN 101688878 A DE 112008001279 T5 US 2010124389 A1 WO 2008139739 A1	31-03-2010 15-04-2010 20-05-2010 20-11-2008
JP 2006183712 A	13-07-2006	NONE	
US 5814984 A	29-09-1998	US 5814984 A US 6218827 B1	29-09-1998 17-04-2001
JP H0988945 A	31-03-1997	NONE	
US 2007268013 A1	22-11-2007	EP 1790985 A1 EP 2161583 A2 US 2007268013 A1 WO 2006030669 A1	30-05-2007 10-03-2010 22-11-2007 23-03-2006

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7, 11-15

Instrumented bearing assembly with sensor body having sealing means sealing a radial and an axial interface. Dependent claims 2-7,11-15 relating to details of the sealing elements.

2. claims: 8, 9

Instrumented bearing assembly with sensor body having sealing means sealing a radial and an axial interface. Dependent claims 8 and 9 relating to an axial spacer for preventing a deformation of the sensor body during tightening of a mounting screw

3. claim: 10

Instrumented bearing assembly with sensor body having sealing means sealing a radial and an axial interface. Dependent claim 10 relating to a sealing ring having an intermediate band defining two sealing zones
