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(54) Title: SENSOR-BEARING UNIT, MECHANICAL SYSTEM COMPRISING AT LEAST ONE SUCH UNIT AND MOUNT-
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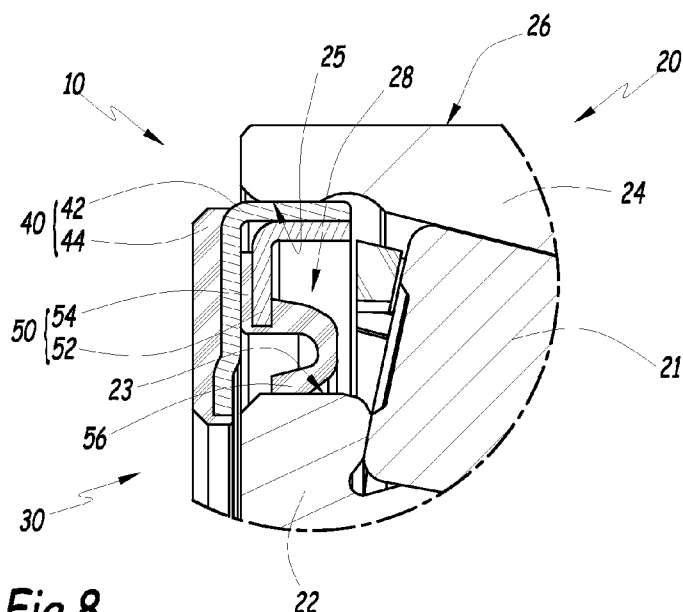


Fig. 8

(57) Abstract: The invention relates to a sensor-bearing unit (10), comprising a bearing (20) and an impulse ring (30), the bearing (20) including at least one fixed ring (22) and at least one rotating ring (24) movable in rotation around a rotation axis, the impulse ring (30) including a target assembly (40) fixed to the rotating ring (24) for tracking its rotation around the rotation axis (X1), wherein the impulse ring (30) also includes a seal assembly (50) fixed to the target assembly (40) and having at least one sealing lip (56) in contact with a sealing surface (23) of the fixed ring (22). The invention also relates to a mechanical system comprising such sensor-bearing unit (10) and a mounting method.

SENSOR-BEARING UNIT, MECHANICAL SYSTEM COMPRISING AT LEAST ONE SUCH UNIT AND MOUNTING METHOD

TECHNICAL FIELD OF THE INVENTION

5 The invention concerns a sensor-bearing unit. The invention also concerns a mechanical system, for example a motorcycle axle, comprising at least one such sensor-bearing unit. The invention also concerns a mounting method of such sensor-bearing unit.

BACKGROUND OF THE INVENTION

10 Today, sensor-bearing units are commonly used in automotive, aeronautics and other technical fields. These units provide high quality signals and transmissions, while allowing integration in simpler and more compact mechanical systems.

Such a sensor-bearing unit generally comprises a bearing, an impulse ring and detection means facing the impulse ring. The impulse ring may comprise a target holder and a target including alternating north and south poles, whose number depends on bearing size and particular application. The impulse ring may be fixed to a rotating ring of the bearing, while detection means may be fixed to a non-rotating ring of the bearing or to another part supporting this non-rotating ring.

15 WO-A-2012 023 000 and WO-A-2012 023 001 describe examples of sensor-bearing units. However, compactness may be further improved.

When an impulse ring is mounted on a non-instrumented bearing to form a sensor-bearing unit, this impulse ring is generally mounted on a seal groove and said seal is removed. Alternatively, the seal is magnetized but the efficiency of each sealing and impulse function is reduced. According to another alternative, the impulse ring is mounted on the seal groove and the bearing is unsealed. According to another alternative, bearing is modified to receive both impulse ring and seal.

SUMMARY OF THE INVENTION

20 The aim of the invention is to provide an improved sensor-bearing unit. To this end, the invention concerns a sensor-bearing unit, comprising a bearing and an impulse ring, the bearing including at least one fixed ring and at least one rotating ring movable in rotation around a rotation axis, the impulse ring including a target assembly fixed to the rotating ring for tracking its rotation around the rotation axis, wherein the impulse ring also includes a seal assembly fixed to the target assembly and having at least one sealing lip in contact with a sealing surface of the fixed ring.

Thanks to the invention, both sealing and impulse function are realized with no modification or only slight modifications of the bearing. Seal assembly has better sealing properties than a magnetized seal. Impulse ring is easy to manufacture and mount on the bearing. Sensor-bearing unit is compact and adapted to be implemented in narrow environments.

According to further aspects of the invention which are advantageous but not compulsory, such a sensor-bearing unit may incorporate one or several of the following features:

- The seal assembly is located in a chamber delimited radially to the rotation axis between the rotating ring and the sealing surface of the fixed ring.

- The target assembly is at least partly located in the chamber.

- The impulse ring extends radially to the rotation axis at most up to the rotating ring.

- The sealing surface is an axial surface centered on the rotation axis and wherein the or each sealing lip is substantially radial to axis.

- The target assembly includes a target for tracking the rotation of the rotating ring around the rotation axis and a target holder which is fixed directly on the rotating ring.

- The seal assembly includes a seal comprising the at least one sealing lip and fixed to the target assembly directly and/or by using an intermediate seal holder.

- The sensor-bearing unit also comprises at least one sensor fixed relative to the fixed ring and associated with the impulse ring for tracking the rotation of the rotating ring around the rotation axis.

- The sensor reads the impulse ring parallelly to the rotation axis.

- The target assembly is fixed to: an inner support surface of the rotating ring previously supporting another seal assembly without target assembly; or an inner support surface of the rotating ring previously supporting the seal assembly without target assembly, this inner support surface being machined to receive the impulse ring; and/or an outer support surface of the rotating ring machined to receive the impulse ring.

The invention also concerns a mechanical system, for example a motorcycle axle, comprising at least one sensor-bearing unit as mentioned here-above.

The invention also concerns a method for mounting a sensor-bearing unit as mentioned here-above, wherein the method comprises at least the following steps:

- a) preparing the bearing to receive the impulse ring;
- b) fastening the seal assembly to the target assembly to form the impulse ring;
- c) fastening the impulse ring to the bearing to form the sensor-bearing unit.

Step a) and b) may be realized in any suitable order. Step c) is realized after steps a) and b).

According to further aspects of the method which are advantageous but not compulsory:

- In step a), an existing seal assembly without target assembly is removed from the bearing.

5 - In step c), the target assembly is fixed to a support surface which is formed on the rotating ring and which previously supported the seal assembly removed in step a).

- In step b), the existing seal assembly without target assembly is fixed to the target assembly.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention will now be explained in correspondence with the annexed figures, and as an illustrative example, without restricting the object of the invention. In the annexed figures:

- 15 - figure 1 is a perspective view partially showing a mechanical system according to the invention, of the motorcycle axle type;
- figure 2 is a side view of the axle along arrow II of figure 1;
- figure 3 is a sectional view along line III-III of figure 2, showing a sensor-bearing unit according to the invention equipping the axle;
- figure 4 is a sectional view similar to figure 3, at a larger scale, showing only the
20 sensor-bearing-unit, comprising a bearing, a target assembly and a seal assembly;
- figure 5 is a sectional view similar to figure 4, at a larger scale, partially showing the target assembly;
- figure 6 is a sectional view similar to figure 4, at a larger scale, partially showing the seal assembly;
- 25 - figure 7 is an exploded perspective view of the sensor-bearing unit shown on figures 3 and 4;
- figure 8 is a sectional view at a larger scale of detail VIII from figure 4;
- figure 9 is a sectional view similar to figure 8, partially showing a sensor-bearing unit according to a second embodiment of the invention; and
- 30 - figure 10 is a sectional view similar to figures 8 and 9, partially showing a sensor-bearing unit according to a third embodiment of the invention.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

Figures 1 to 3 show a motorcycle axle 1 according to the invention.

Axle 1 equips a vehicle V according to the invention, of the motorcycle type, partially shown on figures 1 to 3. Axle 1 is equipped with a sensor-bearing unit 10 according to the invention, shown on figures 3 to 8.

Axle 1 comprises a fork 2 having a vertical part 3 and a horizontal part 4 delimiting a
5 inner housing 5. Axle 1 also comprises a shaft 6, shown on figure 3 but not on figures 1 and 2, extending along a central axis X1 of axle 1. Shaft 6 is fitted in housing 5 of fork 2 and in an inner housing 15 of unit 10. Shaft 6 is fixed to part 4 of fork 2 and to a fixed part of unit 10 by fixation means, not shown for simplification purpose. Axle 1 also comprises a
10 hub 7, shown on figures 2 and 3 but not on figure 1, mounted on a movable part of unit 10. Hub 7 is adapted to receive a wheel not shown. Hub 7 comprises inner housings 8 and 9 for receiving unit 10. Shaft 6 is not movable in rotation around axis X1, while hub 7 is movable in rotation around axis X1.

Instead of axle 1, unit 10 may equip any suitable mechanical system, preferably belonging to a vehicle V such as a motorcycle, an automotive or a truck.

15 Sensor-bearing unit 10 comprises a bearing 20, an impulse ring 30 and a sensor 60. Impulse ring 30 comprises a target assembly 40 and a seal assembly 50. Sensor 60 comprises a detection cell 62, a cable 64, a body 70 and a spacer 80.

Bearing 20 comprises two rows of rollers 21, two inner rings 22 and 22' and an outer ring 24. Inner rings 22 and 22' are mounted on shaft 6 and fixed relative to fork 2, shaft 6
20 and around axis X1. Outer ring 24 of bearing 20 is fitted inside housing 8 of the hub 7 and movable in rotation around axis X1. Impulse ring 30 is fixed to outer ring 24, while sensor 60 is fixed to inner ring 22 located on the same side of bearing 20 receiving impulse ring 30. This inner ring 22 has an external cylindrical surface 23 for receiving seal assembly 50 in dynamic sealing contact. Inner rings 22 and 22' each have an internal cylindrical
25 surface delimiting housing 15 for receiving shaft 6. Outer ring 24 has an internal cylindrical surface 25 for fixation of the impulse ring 30 and an external cylindrical surface 26 for fitting inside housing 8. Surfaces 23 and 25 are axial surfaces centered on rotation axis X1, facing each other and delimiting a chamber 28 radially to axis X1 inside bearing 20. Chamber 28 receives at least partly impulse ring 30 fixed to surface 25. Opposite
30 chamber 28 and impulse ring 30, bearing 20 comprises a seal assembly 29 including a seal 29a having two sealing lips and a seal holder 29b. Seal assembly 29 is fixed to outer ring 24 and the sealing lips are positioned in dynamic sealing contact with inner ring 22'.

Thanks to the design of impulse ring 30, unit 10 has an important compactness. When impulse ring 30 is mounted on bearing 20, the seal assembly 50 and at least partly
35 the target assembly 40 are received in chamber 28. Impulse ring 30 extends radially to rotation axis X1 not beyond rotating ring 24. Impulse ring 30 comprises only two

assemblies 40 and 50 and only four parts 42, 44, 52 and 54, allowing easy manufacturing and assembly.

Target assembly 40 comprises a magnetic target 42 and a target holder 44. Target 42 extends substantially radially to axis X1. Target 42 comprises a face 45 oriented toward sensor 60 and a face 46 fixed to holder 44. Holder 44 comprises a tubular axial portion 47 and an annular radial portion 48. Portion 47 has an outer cylindrical surface 471 for fixation to surface 25 of outer ring 24 and an inner cylindrical surface 472 for fixation of seal assembly 50. Portion 48 has a face 481 receiving face 46 of target 42 and a face 482 oriented toward seal assembly 50. Holder 44 is preferably made of metal or plastic. Target 42 and holder 44 may be connected by bonding, vulcanization or by any suitable means.

Seal assembly 50 comprises a radial seal 52 and a seal holder 54. Seal 52 comprises a base 55 fixed to seal holder 54 and a sealing lip 56 adapted to be positioned in dynamic sealing contact with surface 23 of inner ring 22. Holder 54 comprises a tubular axial portion 57 and an annular radial portion 58. Portion 57 has an outer cylindrical surface 571 for fixation to surface 472 of holder 44. Portion 58 has a face 581 oriented toward target assembly 40 and a face 582 oriented toward rollers 21. Base 55 comprises a portion 551 intended to be positioned between face 581 of seal holder 54 and face 482 of target holder 44. Base 55 also comprises a portion 552 extending from portion 551 around portion 58 up to face 582. Sealing lip 56 extends from portion 552 toward axis X1 and is substantially radial. In other words, seal 52 is a radial seal. Seal 52 is advantageously made of elastically deformable material, for example elastomer or thermoplastic. Holder 54 is preferably made of metal or plastic. Seal 52 and holder 54 may be connected by molding of seal 52 on holder 54, by bonding, vulcanization or by any suitable means.

Alternatively, seal assembly 50 may comprise only seal 52 but not seal holder 54. Seal 52 is fixed to target holder 44. Impulse ring 30 comprises only three parts.

According to a possible embodiment, impulse ring 30 may be integrated to bearing 20 previously comprising a seal assembly which is similar to seal assembly 29 and which is fitted in chamber 28 without target assembly. This seal assembly is removed from surface 25, which receives impulse ring 30 and more precisely surface 471 of holder 44.

Sensor 60 is partly located inside housing 8 of hub 7, without contact of body 70 or spacer 80 with hub 7. Body 70 is fixed to part 4 of fork 2, while spacer 80 is fitted inside body 70 and fixed to inner ring 22 of bearing 20. Cell 62 is located inside body 70 and is schematically represented on figure 3. Cable 64 extends from cell 62 to outside body 70.

Cell 62 detects magnetic field variations induced by magnetic target 42. Cell 62 is positioned as close as possible with respect to magnetic target 42. The accuracy of rotation speed, rotation angle and other data measured by the sensor-bearing unit 10 are highly related to the accuracy of the mounting of the detection cell 62 and the magnetic target 42.

Other embodiments of the invention are shown on figures 9 and 10. In these embodiments, elements identical to the first embodiment have the same references. Only the differences with respect to the first embodiment are described hereafter. Elements working in the same way but having a structure different from first embodiment have references increased by 100 on figure 9 and by 200 on figure 10.

Figure 9 shows an outer ring 124, a target assembly 140 and a seal assembly 150. Outer ring 124 comprises an inner cylindrical surface 125 having a diameter superior to surface 25 radially to axis X1. Target assembly 140 comprises a magnetic target 142 and a target holder 144 substantially similar to target 42 and holder 44. Seal assembly 150 is preferably identical to seal assembly 29. Seal assembly 150 includes a seal 152 and a seal holder 154. Seal 152 has a base 155 and two sealing lips 156a and 156a.

According to a possible embodiment, impulse ring 30 of figure 9 may be integrated to bearing 20 previously comprising a seal assembly 150 which is similar to seal assembly 29 and which is fitted in chamber 28 without target assembly. This seal assembly 150 is removed from surface 25 and mounted on target assembly 140. Surface 125 is machined from surface 25 then receives impulse ring 30, more precisely outer surface of holder 144.

Figure 10 shows an outer ring 224, a target assembly 240 and the seal assembly 150 described here-above. Outer ring 224 comprises inner cylindrical surface 25 and an outer cylindrical surface 226 having a diameter inferior to surface 26 radially to axis X1. Target assembly 240 comprises magnetic target 142 and a target holder 244 having a tubular axial portion 247 and an annular radial portion 248. Portion 247 is similar to portion 47 and intended to be fixed on surface 226. Portion 248 is longer than portion 48 radially to axis X1. Surface 226 and holder 244 are designed such that impulse ring 30 extends radially to rotation axis X1 not beyond rotating ring 224.

According to a possible embodiment, impulse ring 30 of figure 10 may be integrated to bearing 20 previously comprising a seal assembly 150 which is similar to seal assembly 29 and which is fitted in chamber 28 without target assembly. This seal assembly 150 is removed from surface 25 and mounted on target assembly 240. Then the impulse ring 30 is mounted on bearing 20, with surface 226 receiving holder 244 and surface 25 receiving seal assembly 150.

Other non-shown embodiments of vehicle V, mechanical system 1 and/or sensor-bearing unit 10 can be implemented without leaving the scope of the invention. For example, constitutive parts of the impulse ring 30 may be different from figures 1 to 10.

5 Whatever the embodiment, impulse ring 30 includes a target assembly fixed to the rotating ring and a seal assembly fixed to the target assembly and having at least one sealing lip in contact with a sealing surface 23 of the fixed ring of bearing 20. Advantageously, when impulse ring 30 is integrated to an existing bearing 20 without target assembly, sealing surface 23 of the fixed ring 22 is not modified, for example by machining.

10 In addition, technical features of the different embodiments can be, in whole or part, combined with each other. Thus, mechanical system 1 and/or sensor-bearing unit 10 can be adapted in terms of cost or to any specific requirements of the application.

CLAIMS

1. A sensor-bearing unit (10), comprising a bearing (20) and an impulse ring (30), the bearing (20) including at least one fixed ring (22) and at least one rotating ring (24; 124; 224) movable in rotation around a rotation axis (X1), the impulse ring (30) including a target assembly (40; 140; 240) fixed to the rotating ring (24; 124; 224) for tracking its rotation around the rotation axis (X1), wherein the impulse ring (30) also includes a seal assembly (50; 150) fixed to the target assembly (40; 140; 240) and having at least one sealing lip (56; 156a, 156b) in contact with a sealing surface (23) of the fixed ring (22).
5
2. Sensor-bearing unit (10) according to claim 1, wherein the seal assembly (50; 150) is located in a chamber (28; 128) delimited radially to the rotation axis (X1) between the rotating ring (24; 124; 224) and the sealing surface (23) of the fixed ring (22).
10
3. Sensor-bearing unit (10) according to claim 2, wherein the target assembly (40; 140) is at least partly located in the chamber (28; 128).
15
4. Sensor-bearing unit (10) according to any one of the previous claims, wherein the impulse ring (30) extends radially to the rotation axis (X1) at most up to the rotating ring (24; 124; 224).
20
5. Sensor-bearing unit (10) according to any one of the previous claims, wherein the sealing surface (23) is an axial surface centered on the rotation axis (X1) and wherein the or each sealing lip (56; 156a, 156b) is substantially radial to axis (X1).
25
6. Sensor-bearing unit (10) according to any one of the previous claims, wherein the target assembly (40) includes a target (42) for tracking the rotation of the rotating ring (24; 124; 224) around the rotation axis (X1) and a target holder (44) which is fixed directly on the rotating ring (24).
30
7. Sensor-bearing unit (10) according to any one of the previous claims, wherein the seal assembly (50; 150) includes a seal (52; 152) comprising the at least one sealing lip (56; 156a, 156b) and fixed to the target assembly (40; 140; 240) directly and/or by using an intermediate seal holder (54; 154).
35

8. Sensor-bearing unit (10) according to any one of the previous claims, also comprising at least one sensor (60) fixed relative to the fixed ring (22) and associated with the impulse ring (30) for tracking the rotation of the rotating ring (24; 124; 224) around the rotation axis (X1).

9. Sensor-bearing unit (10) according to the previous claim 8, wherein the sensor (60) reads the impulse ring (30) parallelly to the rotation axis (X1).

10. Sensor-bearing unit (10) according to any one of the previous claims, wherein the target assembly (40) is fixed to:

- an inner support surface (25) of the rotating ring (24) previously supporting another seal assembly without target assembly; or
- an inner support surface (125) of the rotating ring (124) previously supporting the seal assembly (150) without target assembly, this inner support surface (125) being machined to receive the impulse ring (30); and/or
- an outer support surface (226) of the rotating ring (124) machined to receive the impulse ring (30).

11. A mechanical system (1), for example a motorcycle axle, comprising at least one sensor-bearing unit (10) according to any one of the previous claims 1 to 10.

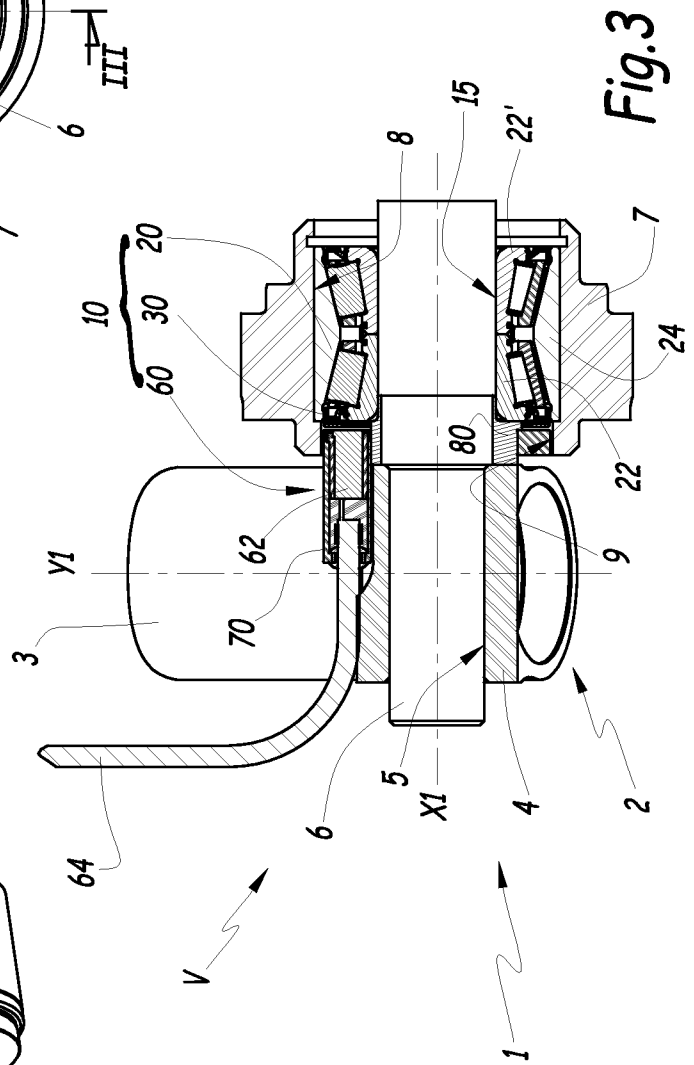
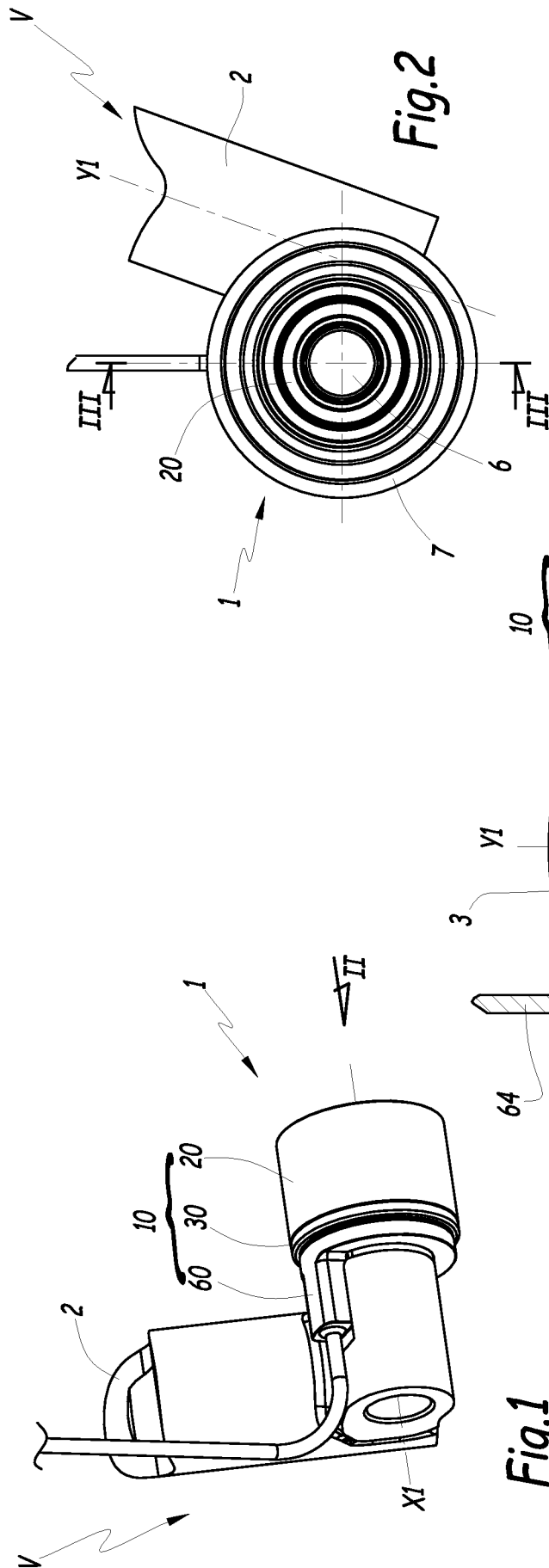
12. A method for mounting a sensor-bearing unit (10) according to any one of claims 1 to 10, wherein the method comprises at least the following steps:

- a) preparing the bearing (20) to receive the impulse ring (30);
- b) fastening the seal assembly (50; 150) to the target assembly (40; 140; 240) to form the impulse ring (30);
- c) fastening the impulse ring (30) to the bearing (20) to form the sensor-bearing unit (10).

13. Method according to claim 12, wherein in step a), an existing seal assembly without target assembly is removed from the bearing (20).

14. Method according to claim 13, wherein in step c), the target assembly (40) is fixed to a support surface (25) which is formed on the rotating ring (24) and which previously supported the seal assembly removed in step a).

15. Method according to claim 13, wherein in step b), the existing seal assembly (150) without target assembly is fixed to the target assembly (140; 240).



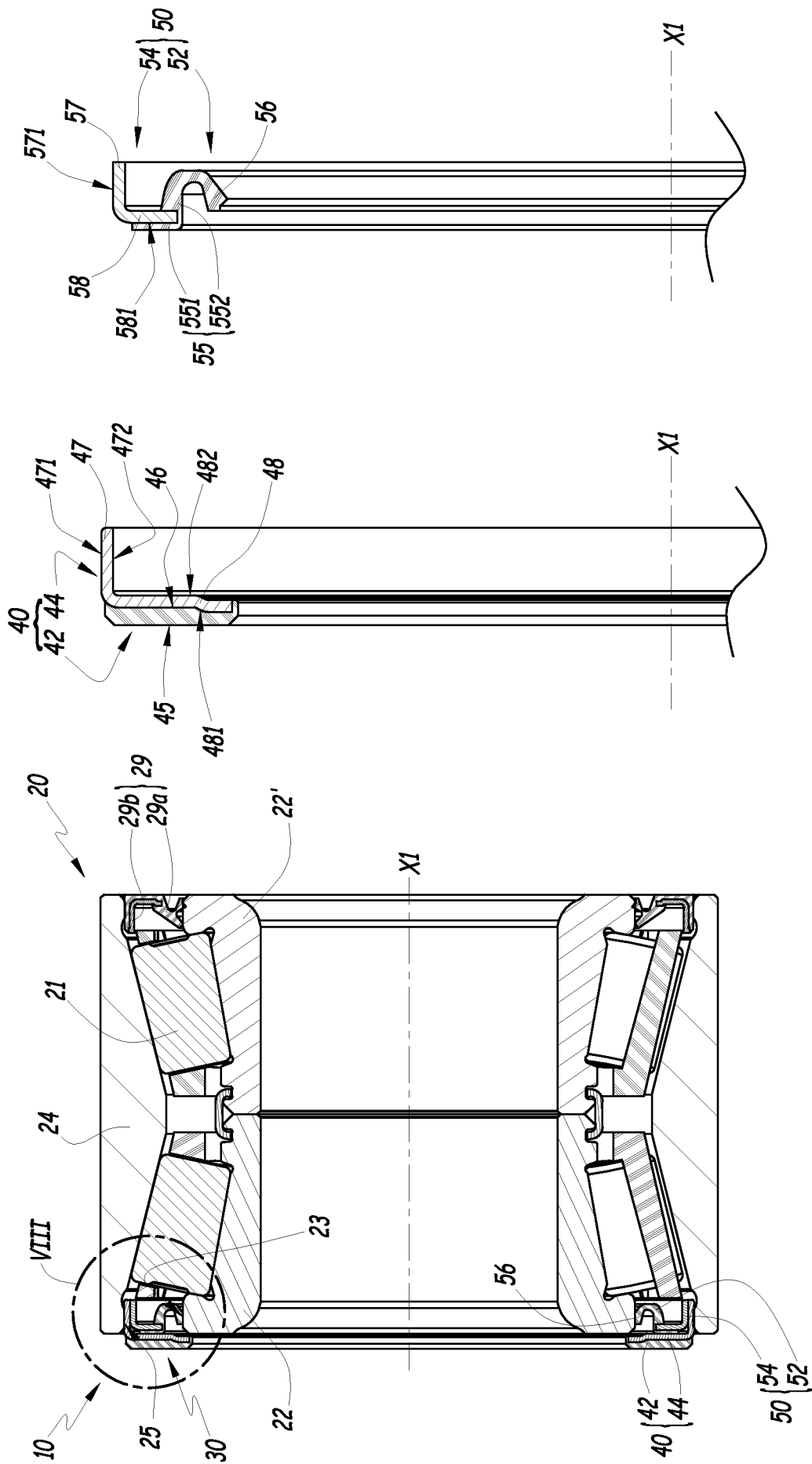
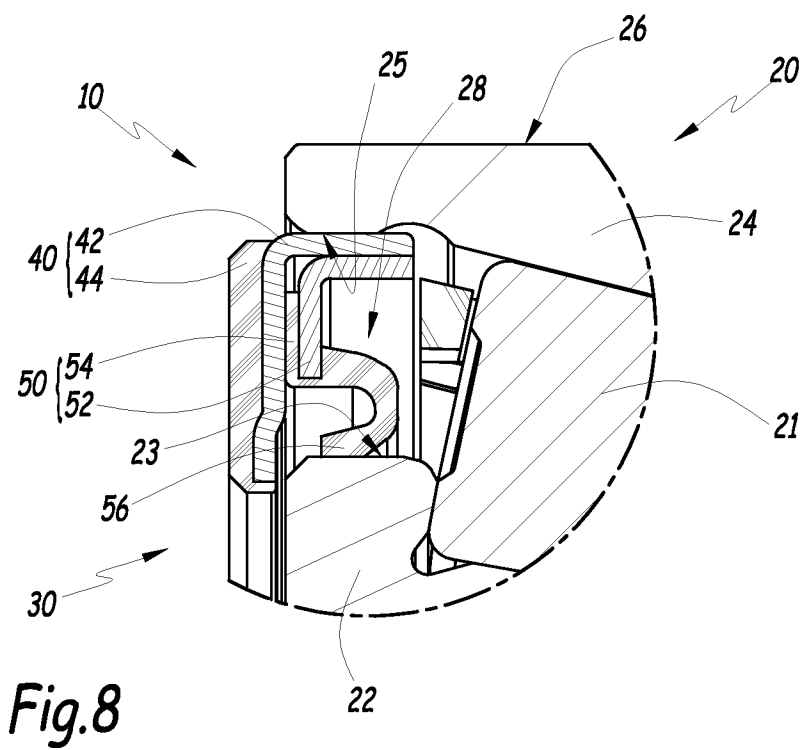
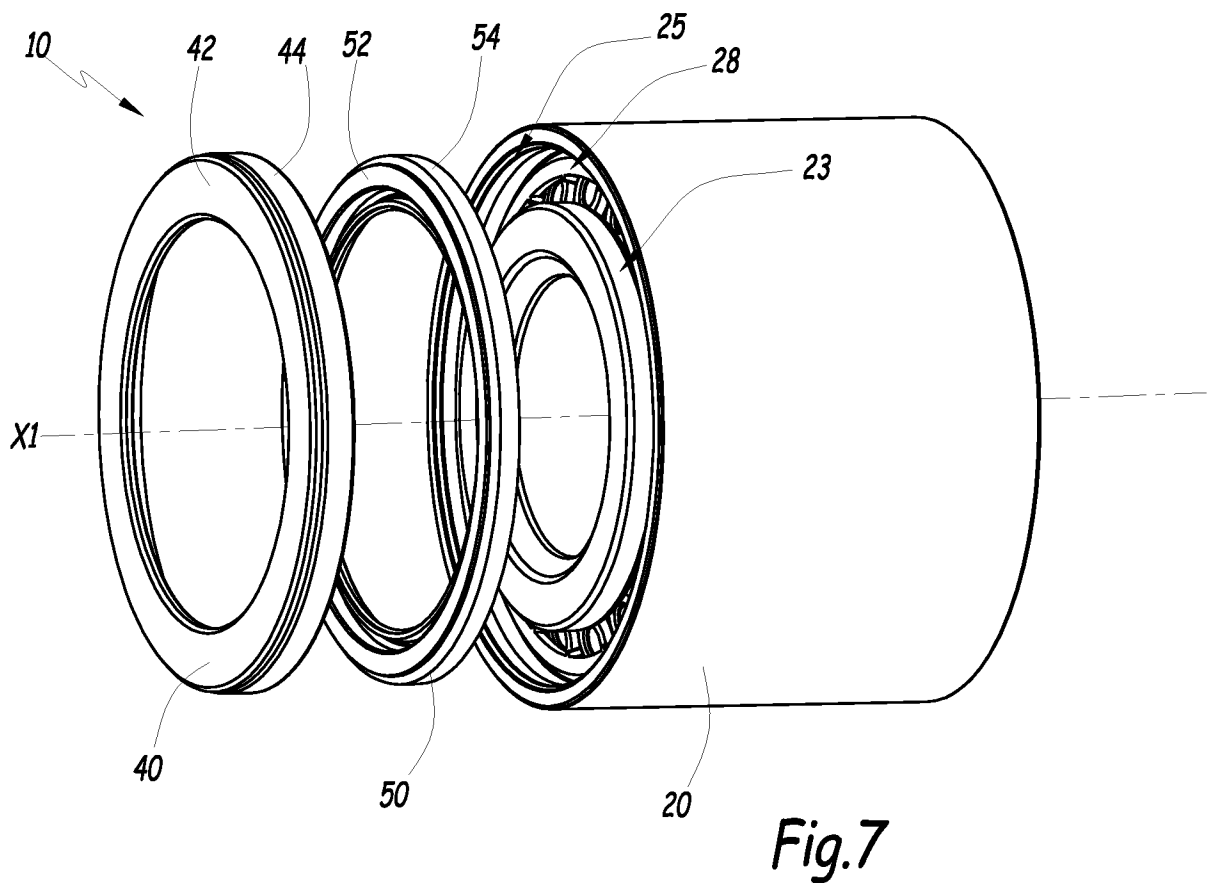


Fig.6

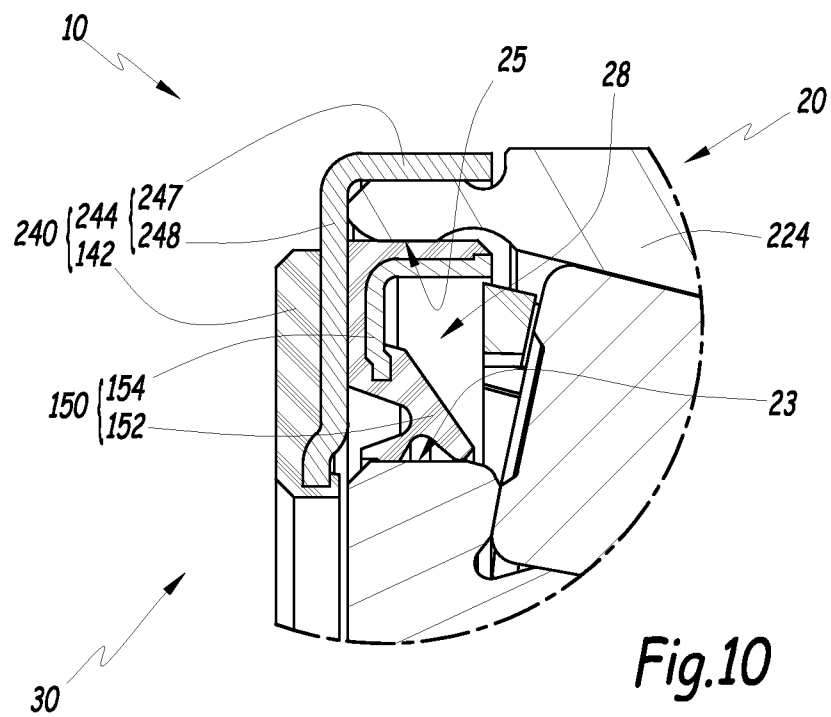
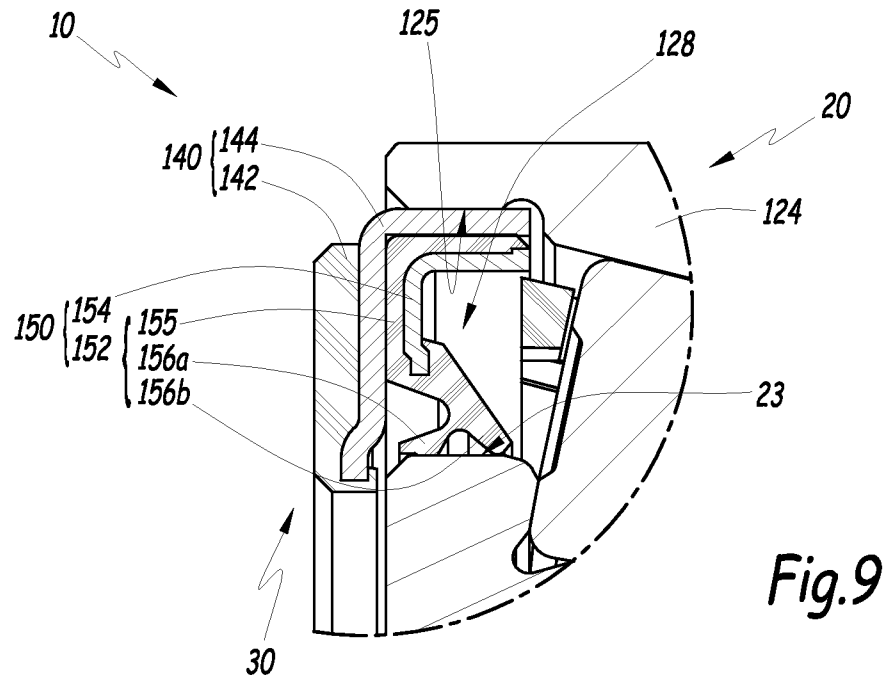
Fig.5

Fig.4

3/4



4/4



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/065651

A. CLASSIFICATION OF SUBJECT MATTER
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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)
F16C 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 2002/140418 A1 (ICHIMAN SHINZABURO [JP]) 3 October 2002 (2002-10-03) paragraph [0009] - paragraph [0011] paragraphs [0019], [0030], [0031]; figure 4	1-15
X	US 2012/204638 A1 (KAKUDA KOUICHI [JP] ET AL) 16 August 2012 (2012-08-16) paragraph [0032] - paragraph [0056] paragraph [0089] - paragraph [0110]; figures 3,5	1-12
X	EP 2 003 425 A1 (NOK CORP [JP]) 17 December 2008 (2008-12-17) paragraph [0008] - paragraph [0014]; figure 1	1-12
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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

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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