



(51) International Patent Classification:

G01P 1/00 (2006.01) *G01P 3/44* (2006.01)
G01P 1/02 (2006.01) *F16C 41/00* (2006.01)

(21) International Application Number:

PCT/EP2013/065653

(22) International Filing Date:

24 July 2013 (24.07.2013)

(25) Filing Language:

English

(26) Publication Language:

English

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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

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

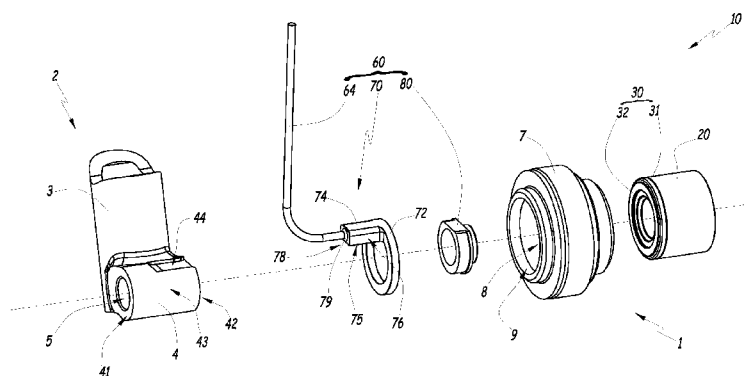


Fig.3

(57) Abstract: The invention relates to a sensor-bearing unit (10), comprising: a bearing (20) including at least one non-rotating ring and at least one rotating ring movable in rotation around a rotation axis; an impulse ring (30) and a sensor device (60) for tracking the rotation of the rotating ring around the rotation axis, the impulse ring (30) being fixed to the rotating ring, the sensor device (60) being fixed to the non-rotating ring and including a sensor body (70) housing a detection cell. The sensor body (70) also includes an anti-rotating cable output (74) guiding a cable (64) from the detection cell to outside the sensor body (70) and comprising anti-rotating means (75, 76) for preventing rotation of the sensor body (70) and the cable (64) around the rotation axis (XI) of the bearing by cooperation with a support part (2) fixed relative to the rotation axis. The anti-rotating means can comprise an elongate body containing the cable and having flat surfaces which cooperate with a groove formed in a support part (2), e.g. the fork of a motorcycle.

A SENSOR-BEARING UNIT, A MECHANICAL SYSTEM COMPRISING AT LEAST ONE SUCH UNIT AND A 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 in such mechanical system.

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.

15 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.

20 WO-A-2012 023 000 and WO-A-2012 023 001 describe examples of sensor-bearing units equipping a mechanical system, precisely a motorcycle axle. The non-rotating ring is mounted on a shaft fixed to a fork, while the rotating ring is mounted inside a hub supporting a wheel. The detection means are fixed to the fork by a flexible flange. However, compactness of the mechanical system and precision of the detection may be
25 further improved.

SUMMARY OF THE INVENTION

The aim of the invention is to provide an improved sensor-bearing unit.

To this end, the invention concerns a sensor-bearing unit, comprising:

- 30 -
- a bearing including at least one non-rotating ring and at least one rotating ring movable in rotation around a rotation axis;
 - an impulse ring and a sensor device for tracking the rotation of the rotating ring around the rotation axis, the impulse ring being fixed to the rotating ring, the sensor device being fixed to the non-rotating ring and including a sensor body housing a
35 detection cell.

According to the invention, the sensor body also includes an anti-rotating cable output guiding a cable from the detection cell to outside the sensor body and comprising anti-rotating means for preventing rotation of the sensor body and the cable around the rotation axis by cooperation with a support part fixed relative to the rotation axis.

5 The invention also concerns a mechanical system, for example a motorcycle axle, comprising at least one sensor-bearing unit as mentioned here-above and a support part which is fixed relative to the rotation axis and which includes a groove for receiving the anti-rotating cable output of the sensor body.

10 Thanks to the invention, sensor device can be locked tangentially to the support part, which is for example a fork belonging to a motorcycle axle. Anti-rotating cable output provides both the functions of guiding cable and of preventing rotation of sensor body and cable around rotation axis, thus efficiently protecting sensor device. Position of anti-rotating cable output is predetermined and stable. Moreover, sensor-bearing unit is compact and adapted to be implemented in narrow environments.

15 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 anti-rotating means are adapted for fitting in a groove formed in the support part.

20 - The anti-rotating means comprise two plane lateral surfaces for resting contact with two plane borders of a groove formed in the support part.

- The anti-rotating means comprise a plane bottom surface perpendicular to a plane including the rotating axis.

25 - The anti-rotating cable output extends parallel to the rotation axis opposite the bearing.

- The sensor device also includes a spacer fixed to the sensor body and to the non-rotating ring.

- The spacer and the sensor body comprise conjunct anti-rotating means

30 - The conjunct anti-rotating means comprise a plane surface formed on the spacer and a plane surface formed on the sensor body, both plane surfaces being perpendicular to a plane including the rotation axis and being positioned in resting contact against each other.

- The spacer has a first face for resting contact against the support part and a second face for resting contact against the non-rotating ring of the bearing.

35 - The spacer has a first cylindrical surface for fitting inside the sensor body and a second cylindrical surface for fitting inside the non-rotating ring of the bearing.

- The impulse ring comprises a target assembly fixed to the rotating ring and a seal assembly fixed to the target assembly and located in a chamber delimited radially to the rotation axis between the rotating ring and the non-rotating ring.

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

5 According to further aspects of the mechanical system which are advantageous but not compulsory:

- The groove comprises two plane borders receiving two plane lateral surfaces of the anti-rotating cable output in resting contact.

10 - The groove comprises a plane bottom surface which is perpendicular to a plane including the rotating axis and which faces a plane bottom surface of the anti-rotating cable output, these plane bottom surfaces being separated by a gap radial to the rotation axis when the anti-rotating cable output is received into the groove and adapted to come at least partly in resting contact when the anti-rotating cable output is subjected to a torsional torque.

15 - The anti-rotating cable output is force-fitted into the groove.

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

20 a) forming the sensor-bearing unit by fastening, on the one hand, the impulse ring to the rotating ring of the bearing and, on the other hand, the sensor device to the fixed ring of the bearing;

b) fastening the sensor-bearing unit to the mechanical system, with the anti-rotating cable output of the sensor body fitted into the groove of the support part.

Step a) is realized before step b).

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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:

30 - figure 1 is a partial perspective view of a mechanical system according to the invention, of the motorcycle axle type, comprising a support part, a hub and a sensor-bearing unit also according to the invention;

- figure 2 is a side view of the axle along arrow II of figure 1;

- figure 3 is a partial exploded perspective view of the axle of figure 1;

35 - figure 4 is another partial exploded perspective view of the axle of figure 1, showing the support part and a sensor device belonging to the sensor-bearing unit;

- figure 5 is a view similar to figure 4, showing the sensor device in an assembled configuration;
- figure 6 is a sectional view along line VI-VI of figure 2;
- figure 7 is a sectional view at a larger scale of detail VII from figure 6; and
- figure 8 is a sectional view at a larger scale along line VIII-VIII of figure 7.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

Figures 1 to 8 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 and 2. Axle 1 is equipped with a sensor-bearing unit 10 according to the invention.

Axle 1 comprises a fork 2 having a vertical part 3 and a horizontal part 4 delimiting an inner housing 5. Axle 1 also comprises a shaft 6, shown only on figure 2 for simplification purpose, 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. Axle 1 also comprises a hub 7, shown on figures 2, 3 and 6, 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.

Sensor-bearing unit 10 comprises a bearing 20, an impulse ring 30 and a sensor device 60. Impulse ring 30 comprises a target assembly 31 and a seal assembly 32. Sensor device 60 comprises a detection cell 62, a cable 64, a sensor 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 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 device 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 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 chamber 28 and impulse ring 30, bearing 20 comprises a seal assembly 29 which is fixed to outer ring 24 and has sealing lips 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 32 and at least partly the target assembly 31 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 31 and 32 and only four parts 33, 34, 35 and 36, allowing easy manufacturing and assembly.

Target assembly 31 comprises a magnetic target 33 and a target holder 34. Target 33 extends substantially radially to axis X1. Target 33 comprises a face oriented toward sensor device 60 and a face fixed to holder 34. Holder 34 comprises a tubular axial portion for fixation to surface 25 of outer ring 24 and for fixation of seal assembly 32. Holder 34 also comprises an annular radial portion having a face receiving target 33 and a face oriented toward seal assembly 32. Holder 34 is preferably made of metal or plastic. Target 33 and holder 34 may be connected by bonding, vulcanization or by any suitable means.

Seal assembly 32 comprises a radial seal 35 and a seal holder 36. Seal 35 comprises a base fixed to seal holder 36 and a sealing lip which is substantially radial and adapted to be positioned in dynamic sealing contact with surface 23 of inner ring 22. In other words, seal 35 is a radial seal. Seal 35 is advantageously made of elastically deformable material, for example elastomer or thermoplastic. Holder 36 comprises a tubular axial portion for fixation to holder 34. Holder 36 also comprises an annular radial portion having a face oriented toward target assembly 31 and a face oriented toward rollers 21. Holder 36 is preferably made of metal or plastic. Seal 35 and holder 36 may be connected by molding of seal 35 on holder 36, by bonding, vulcanization or by any suitable means.

Alternatively, seal assembly 32 may comprise only seal 35 but not seal holder 36. Seal 35 is fixed to target holder 34. 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 may be removed from surface 25, which receives impulse ring 30. Alternatively, this seal assembly may be removed from surface 25 and mounted on a target assembly, while surface 25 or surface

26 may be machined to receive holder 34 of impulse ring 30. 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.

Part 4 of fork 2 supports sensor device 60. Part 4 comprises two lateral faces 41 and 42, oriented respectively opposite and toward unit 10. Inner housing 5 extends inside part 4 along axis X1 through faces 41 and 42. Part 4 comprises a substantially cylindrical outer surface 43 rejoining part 3 of fork 2. Part 4 includes a groove 44 formed at surface 43. Groove 44 opens at surface 43 along a top direction located in a plane P1 including axis X1. Plane P1 corresponds to sectional plane of figures 6 and 7. Groove 44 opens at face 42 toward unit 10. Groove 44 comprises a bottom plane surface 45, two plane borders 46 and a curved surface 47. Surface 45 is perpendicular to plane P1, while borders 46 are parallel to plane P1. Surface 47 connects surface 45 to surface 43 by going up from surface 45 between borders 46. Groove 44 receives sensor body 70, as detailed here-below.

Sensor device 60 is partly located inside housing 8 of hub 7, without contact of body 70 or spacer 80 with hub 7. Cell 62 is housed inside body 70 and is schematically represented on figures 6 to 8. Cell 62 detects magnetic field variations induced by magnetic target 33. Cell 62 is positioned as close as possible with respect to magnetic target 33. 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 33.

Body 70 is made of plastic or in metal. Body 70 comprises an annular portion 72 centered around axis X1 and a cable output 74 extending from annular portion 72 parallel to axis X1 opposite bearing 20. Cable 64 extends from cell 62 to the outside of body 70 through cable output 74.

Annular portion 72 comprises a face 721 oriented toward impulse ring 30 and a face 722 oriented toward face 42 of part 4. Cell 62 is located as close as possible to face 721. Annular portion 72 comprises an outer cylindrical surface 723 oriented toward housing 9 of hub 7. Thanks to the particular arrangement of annular portion 72 within axle 1, without contact between face 721 and impulse ring 30, without contact between face 722 and part 4 and without contact between surface 723 and housing 9, cell 62 is well protected inside body 70. Annular portion 72 also comprises an inner cylindrical surface 724 cut by a plane inner surface 725. Surface 724 is centered on axis X1, while surface 725 is perpendicular to plane P1. Surfaces 721, 724 and 725 receive spacer 80, as detailed here-below.

Cable output 74 guides cable 64 from cell 62 to the outside of body 70. At its extremity 78 opposed to portion 72, cable output 74 comprises means 79 for fastening

cable 64, by instance glue, solder, or by an additional elastomeric member. Cable output 74 comprises a plane bottom surface 75 perpendicular to plane P1 and two plane lateral surfaces 76 parallel to plane P1. When cable output 74 is fitted into groove 44 of fork 2, lateral surfaces 76 come in resting contact with borders 46 of groove 44, while bottom surface 75 faces bottom surface 45 of groove 44, these bottom surfaces 45 and 75 being separated by a gap G radial rotation axis X1, as shown on figures 7 and 8. Since body 70 is elastically deformable, surfaces 45 and 75 come at least partly in resting contact when cable output 74 is subjected to a torsional torque which is above a particular torque value.

In practice, surfaces 75 and 76 of cable output 74 form anti-rotating means of body 70 around axis X1 relative to support fork 2. In other words, the anti-rotating means 75 and 76 are adapted for preventing rotation of body 70 and cable 64 around axis X1 when cooperating with support fork 2. Preferably, cable output 74 may be force-fitted into groove 44.

Thus, anti-rotating cable output 74 provides both the functions of guiding cable 64 and of preventing rotation of body 70 and cable 64 around axis X1, consequently protecting sensor device 60.

Spacer 80 is made of plastic or metal. Spacer 80 is fixed to annular portion 72 of body 70 and to inner ring 22 of bearing 20. Spacer 80 comprises three cylindrical portions 82, 84 and 86, among which portions 82 and 84 are cut by a plane surface 85. In other words, portions 82 and 84 are truncated cylindrical portions. An inner cylindrical housing 88 is formed through spacer 80 for receiving shaft 6. Portion 82 has a face 821 oriented toward face 42 of part 4 and a cylindrical surface 822 cut by surface 85. When portion 82 is fitted inside body, surface 822 is resting against surface 724, while surface 85 is resting against surface 725. Portion 84 has a face 841 resting against face 721 of body 70, without contact with cell 62. Portion 84 has a face 842 resting against inner ring 22 of bearing 20. Portion 86 has an outer cylindrical surface 862 for fitting in inner cylindrical housing 15 of inner ring 22.

In practice, spacer 80 is compressed along axis X1 between part 4 of fork 2 and inner ring 22 of bearing 20. Then face 821 is compressed against face 42 of part 4 and face 842 is compressed against inner ring 22. Thanks to its particular form and arrangement, spacer 80 protects sensor housing 70 and specifically cell 62. Moreover, the presence of surface 85 allows freeing space within sensor device 60 to integrate cell 62 as close as possible to impulse ring 30. Furthermore, surface 85 of spacer 80 and surface 725 of body 70 positioned in resting contact against each other form conjunct anti-rotating means between spacer 80 and body 70.

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 and/or of the sensor device 60 may be different from figures 1 to 8.

5 Whatever the embodiment, sensor body 70 includes an anti-rotating cable output 74, on the one hand, guiding cable 64 from the detection cell 62 to the outside of sensor body 70 and, on the other hand, comprising anti-rotating means 75 and 76 for preventing rotation of sensor body 70 and cable 64 around axis X1 when cooperating with a support

10 part 2 which is fixed relative to axis X1.

 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) including at least one non-rotating ring (22) and at least one rotating ring (24) movable in rotation around a rotation axis (X1);
- an impulse ring (30) and a sensor device (60) for tracking the rotation of the rotating ring (24) around the rotation axis (X1), the impulse ring (30) being fixed to the rotating ring (24), the sensor device (60) being fixed to the non-rotating ring (22) and including a sensor body (70) housing a detection cell (62);

wherein the sensor body (70) also includes an anti-rotating cable output (74) guiding a cable (64) from the detection cell (62) to outside the sensor body (70) and comprising anti-rotating means (75, 76) for preventing rotation of the sensor body (70) and the cable (64) around the rotation axis (X1) by cooperation with a support part (2) fixed relative to the rotation axis (X1).

2. Sensor-bearing unit (10) according to claim 1, wherein the anti-rotating means (75, 76) are adapted for fitting in a groove (44) formed in the support part (2).

3. Sensor-bearing unit (10) according to any one of the previous claims, wherein the anti-rotating means (75, 76) comprise two plane lateral surfaces (76) for resting contact with two plane borders (46) of a groove (44) formed in the support part (2).

4. Sensor-bearing unit (10) according to any one of the previous claims, wherein the anti-rotating means (75, 76) comprise a plane bottom surface (75) perpendicular to a plane (P1) including the rotating axis (X1).

5. Sensor-bearing unit (10) according to any one of the previous claims, wherein the anti-rotating cable output (74) extends parallel to the rotation axis (X1) opposite the bearing (20).

6. Sensor-bearing unit (10) according to any one of the previous claims, wherein the sensor device (60) also includes a spacer (80) fixed to the sensor body (70) and to the non-rotating ring (22).

7. Sensor-bearing unit (10) according to previous claim 6, wherein the spacer (80) and the sensor body (70) comprise conjunct anti-rotating means (85, 725)
- 5 8. Sensor-bearing unit (10) according to previous claim 7, wherein the conjunct anti-rotating means (85, 725) comprise a plane surface (85) formed on the spacer (80) and a plane surface (725) formed on the sensor body (70), both plane surfaces (85, 725) being perpendicular to a plane (P1) including the rotation axis (X1) and being positioned in resting contact against each other.
- 10 9. Sensor-bearing unit (10) according to any one of claims 6 to 8, wherein the spacer (80) has a first face (821) for resting contact against the support part (2) and a second face (842) for resting contact against the non-rotating ring (22) of the bearing (20).
- 15 10. Sensor-bearing unit (10) according to any one of claims 6 to 9, wherein the spacer (80) has a first cylindrical surface (822) for fitting inside the sensor body (70) and a second cylindrical surface (862) for fitting inside the non-rotating ring (22) of the bearing (20).
- 20 11. Sensor-bearing unit (10) according to any one of the previous claims, wherein the impulse ring (30) comprises:
- a target assembly (40) fixed to the rotating ring (24) and
 - a seal assembly (50) fixed to the target assembly (40) and located in a chamber (28) delimited radially to the rotation axis (X1) between the rotating
- 25 ring (24) and the non-rotating ring (22).
12. 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).
- 30 13. 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 12 and
 - a support part (2) which is fixed relative to the rotation axis (X1) and which
- 35 includes a groove (44) for receiving the anti-rotating cable output (74) of the sensor body (70).

14. Mechanical system (1) according to claim 13, wherein the groove (44) comprises two plane borders (46) receiving two plane lateral surfaces (76) of the anti-rotating cable output (74) in resting contact.

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15. Mechanical system (1) according to any one of claims 13 and 14, wherein the groove (44) comprises a plane bottom surface (45) which is perpendicular to a plane (P1) including the rotating axis (X1) and which faces a plane bottom surface (75) of the anti-rotating cable output (74), these plane bottom surfaces (45, 75) being separated by a gap (G) radial to the rotation axis (X1) when the anti-rotating cable output (74) is received into the groove (44) and adapted to come at least partly in resting contact when the anti-rotating cable output (74) is subjected to a torsional torque.

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16. Mechanical system (1) according to any one of claims 13 to 15, wherein the anti-rotating cable output (74) is force-fitted into the groove (44).

17. A method for mounting a sensor-bearing unit (10) in a mechanical system according to any one of claims 13 to 16, wherein the method comprises at least the following steps:

20

a) forming the sensor-bearing unit (10) by fastening, on the one hand, the impulse ring (30) to the rotating ring (24) of the bearing (20) and, on the other hand, the sensor device (60) to the non-rotating ring (22) of the bearing (20);

25

b) fastening the sensor-bearing unit (10) to the mechanical system (1), with the anti-rotating cable output (74) of the sensor body (70) fitted into the groove (44) of the support part (2).

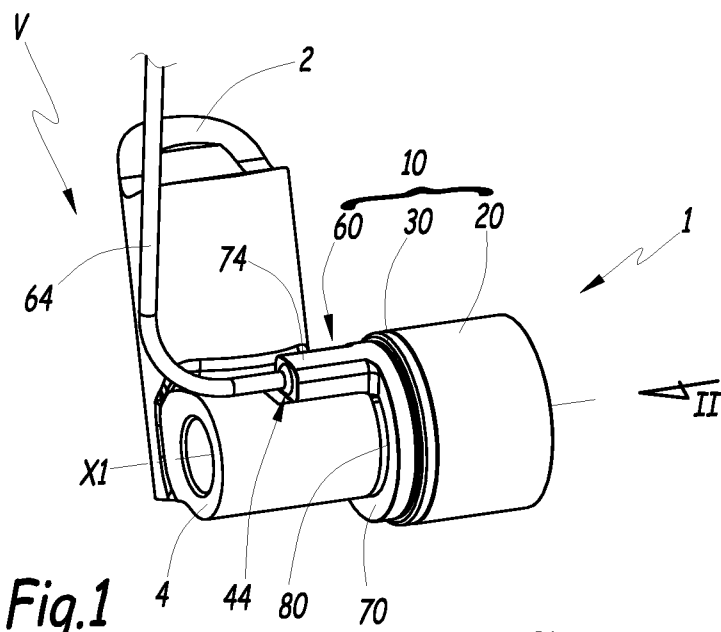


Fig.1

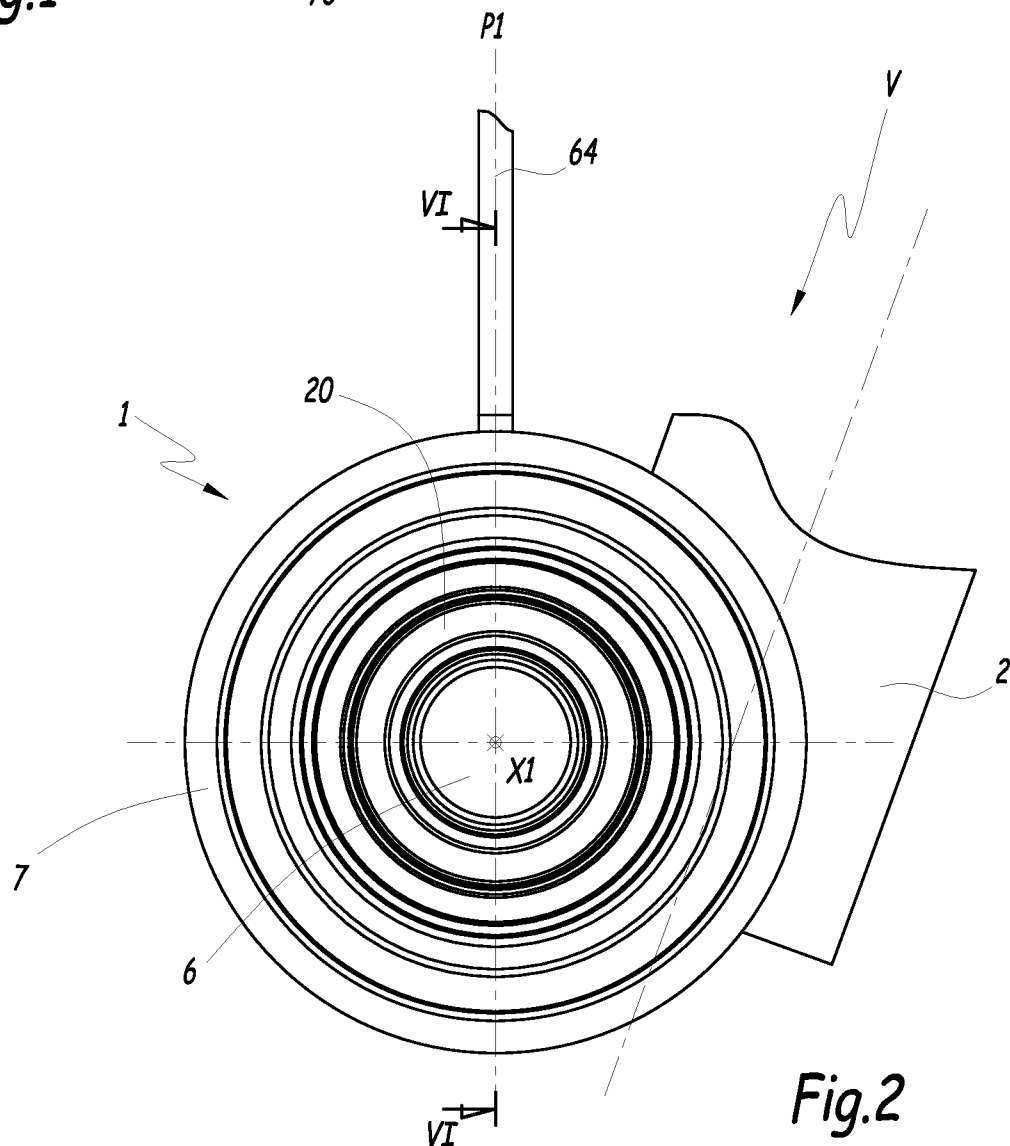


Fig.2

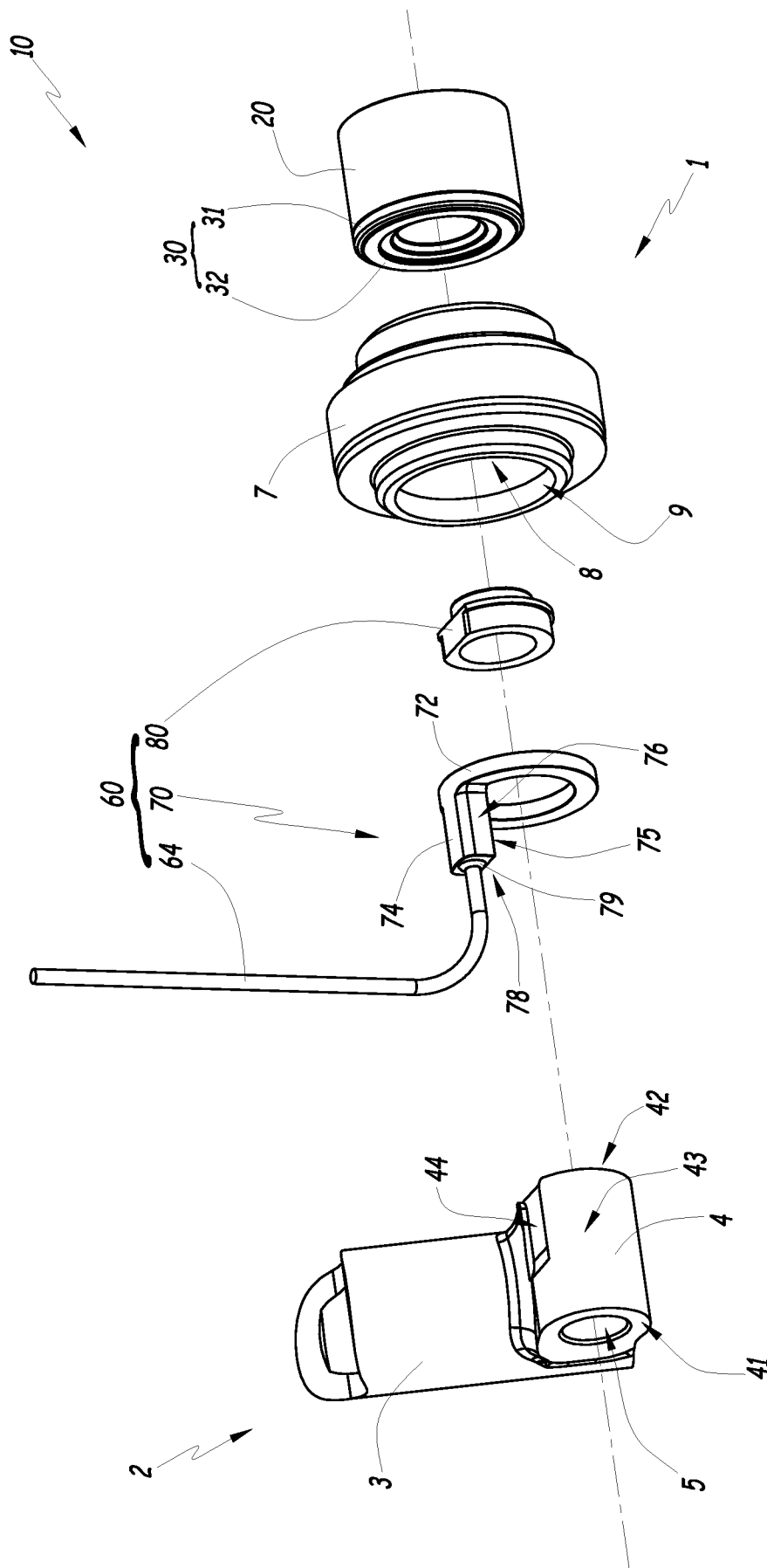
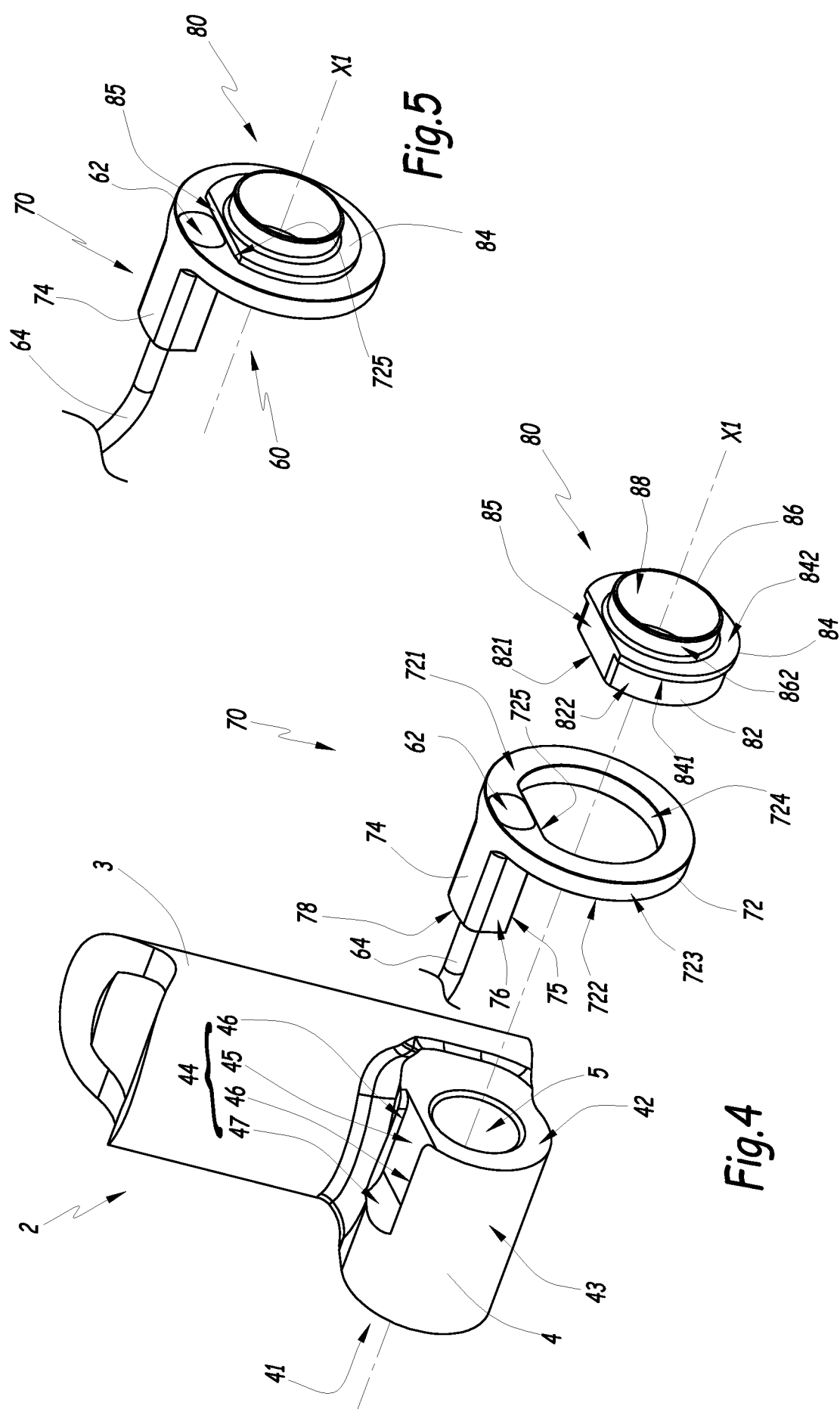


Fig.3



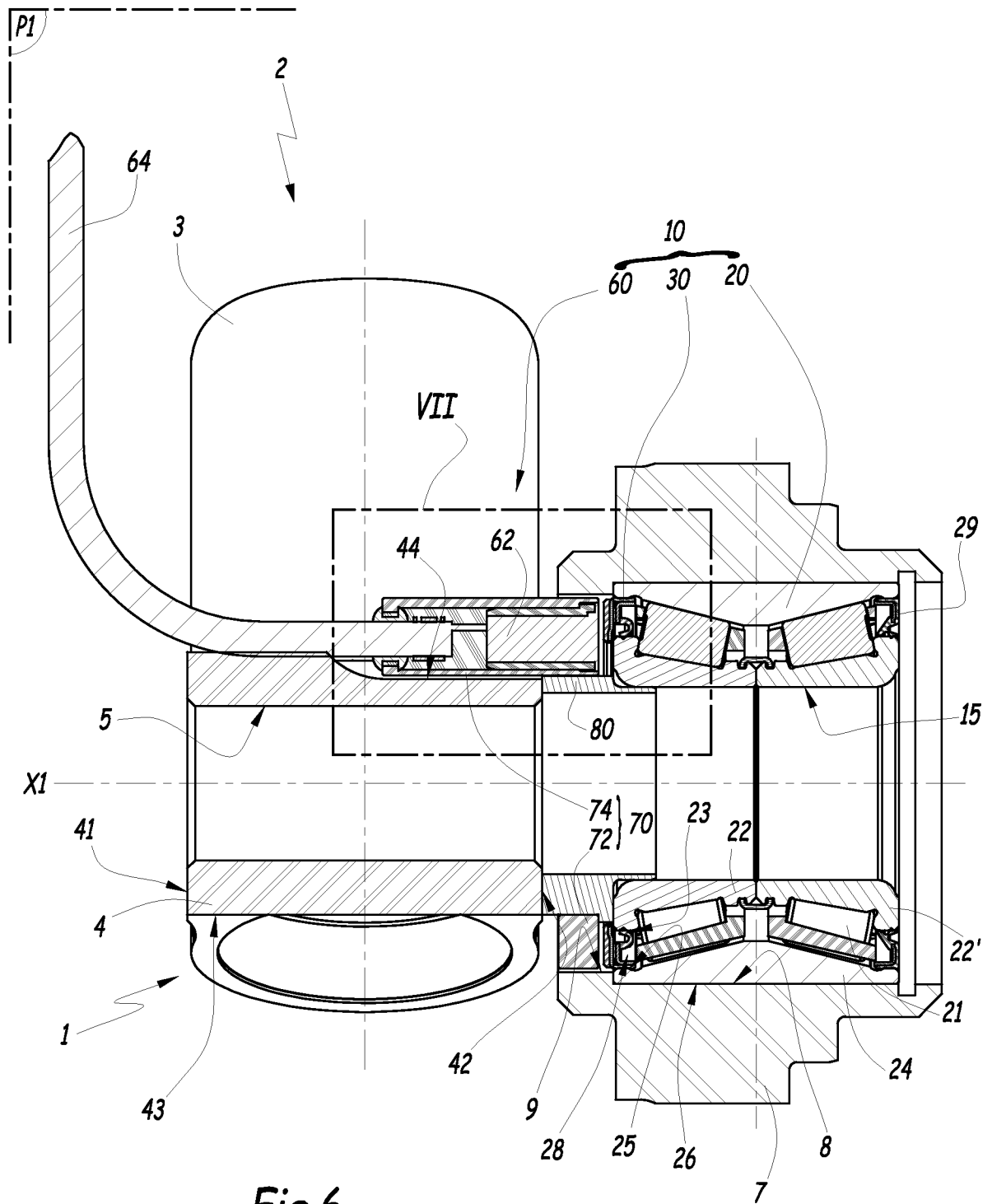
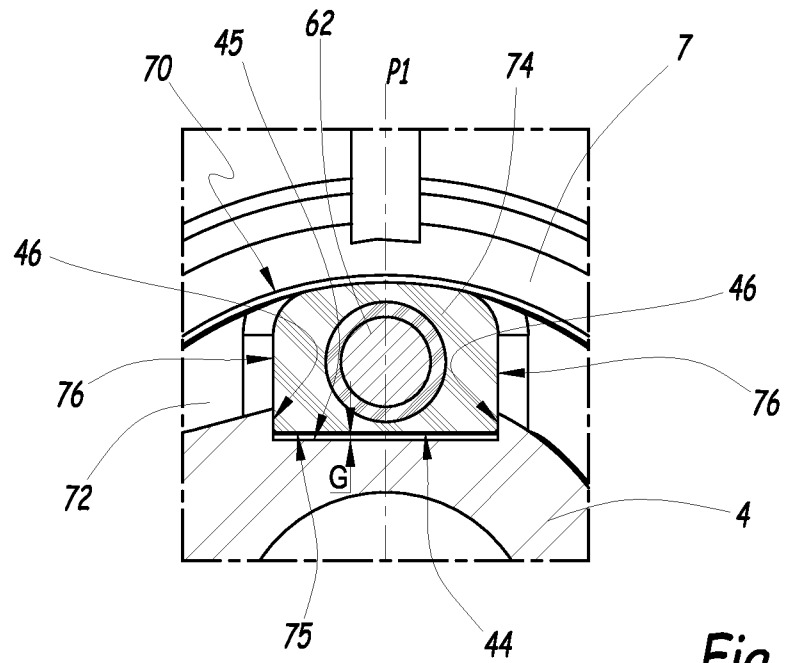
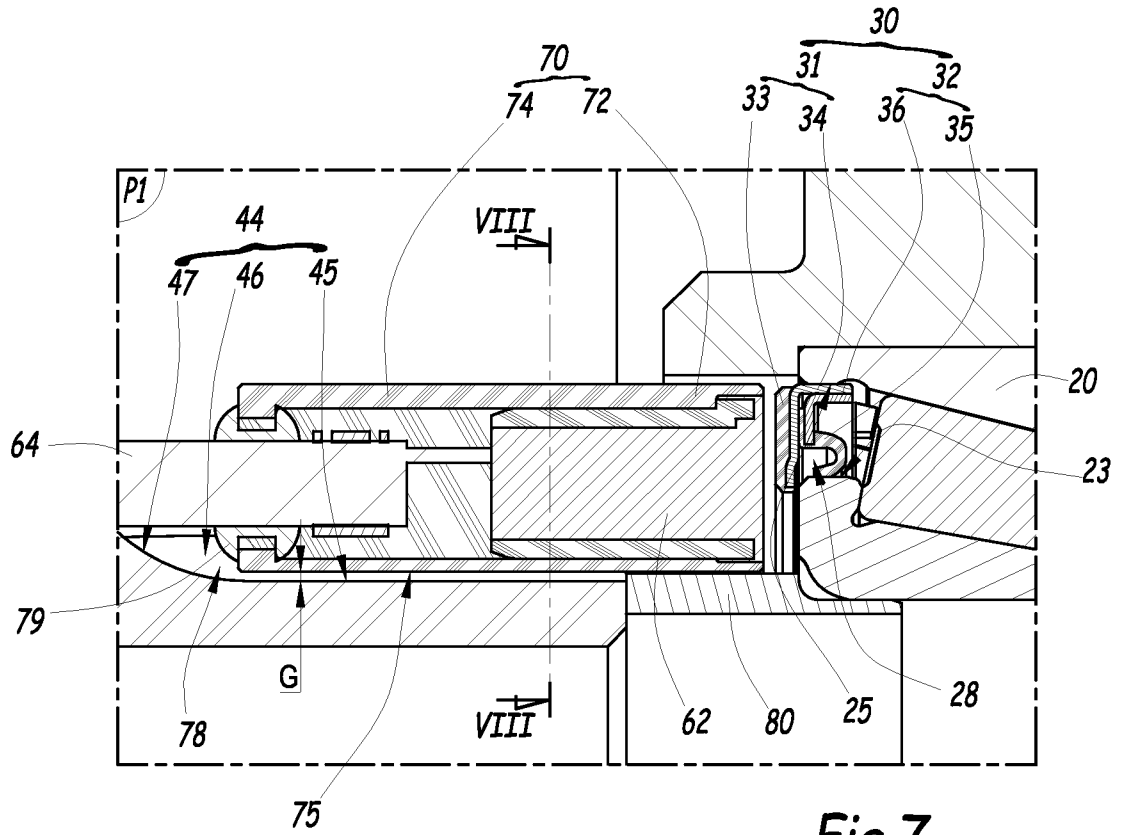


Fig. 6

5/5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/065653

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.:
1-5, 13-17

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/EP2013/065653

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01P1/00 G01P1/02 G01P3/44 F16C41/00
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 2007/278851 A1 (NAKAMURA YUJI [JP] ET AL) 6 December 2007 (2007-12-06)	1-5, 13-15,17
Y	paragraphs [0143] - [0149]; figures 7,8	1-5, 13-17
X	US 4 946 295 A (HAJZLER CHRISTIAN [FR]) 7 August 1990 (1990-08-07)	1-3,13, 14,17
Y	column 2, line 16 - column 2, line 31; figures 1,2	1-5, 13-17
X	JP 2000 142341 A (NSK LTD) 23 May 2000 (2000-05-23)	1-3,13, 14,17
Y	abstract; figures 1-3	1-5, 13-17
X	US 2008/101740 A1 (AOKI MAMORU [JP] ET AL) 1 May 2008 (2008-05-01)	1-3,13, 14,17
Y	paragraphs [0128] - [0134]; figures 1-5	1-5, 13-17



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

25 March 2014

Date of mailing of the international search report

25/06/2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/065653

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007278851 A1	06-12-2007	EP 1679518 A1 JP 2005140320 A US 2007278851 A1 WO 2005036183 A1	12-07-2006 02-06-2005 06-12-2007 21-04-2005
US 4946295 A	07-08-1990	DE 68900839 D1 EP 0376771 A1 ES 2029559 T3 FR 2640706 A1 US 4946295 A	26-03-1992 04-07-1990 16-08-1992 22-06-1990 07-08-1990
JP 2000142341 A	23-05-2000	JP 4348756 B2 JP 2000142341 A	21-10-2009 23-05-2000
US 2008101740 A1	01-05-2008	EP 1557676 A1 US 2006039639 A1 US 2008101740 A1 WO 2004038426 A1	27-07-2005 23-02-2006 01-05-2008 06-05-2004

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-5, 13-17

Sensor bearing unit with sensor body and anti-rotating cable output.

Dependent claims relating to details of the anti-rotating means

2. claims: 1, 6-10

Sensor bearing unit with sensor body and anti-rotating cable output.

Dependent claims 6-10 relating to details of a spacer between the sensor body and the non-rotating ring.

3. claims: 1, 11, 12

Sensor bearing unit with sensor body and anti-rotating cable output.

Dependent claims 11 and 12 relating to details of an impulse ring.
