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(54) Title: ROLLING BEARING ASSEMBLY WITH A TARGET AND A SENSOR, AND METHOD FOR MOUNTING SUCH A ROLLING BEARING ASSEMBLY ONTO A STRUCTURE

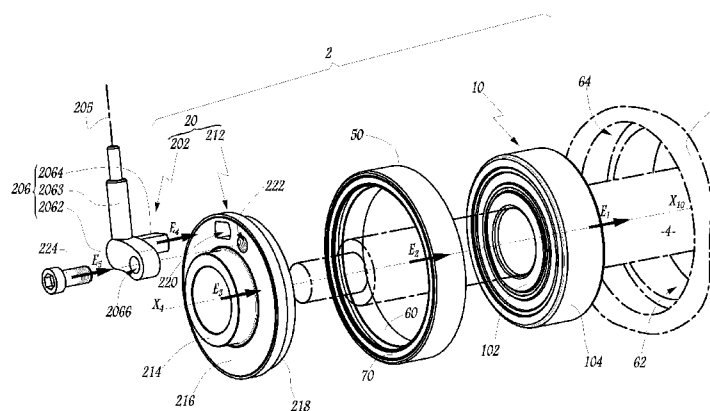


Fig. 4

(57) Abstract: This rolling bearing assembly (2) comprises a rolling bearing (10), having an inner ring (102) and an outer ring (104), a target (60) adapted to rotate with the outer ring and a sensor unit (20) including at least one sensor (202) having a sensor body (206) supporting at least one sensing element (204) adapted to read the target. The sensor unit (20) also includes a supporting member (212) for the sensor (202), this supporting member being fast in rotation with the inner ring (102) of the rolling bearing (10) and provided with a housing (220) for removably accommodating at least a part (2064) of the sensor body (206).

ROLLING BEARING ASSEMBLY WITH A TARGET AND A SENSOR, AND METHOD FOR MOUNTING SUCH A ROLLING BEARING ASSEMBLY ONTO A STRUCTURE

TECHNICAL FIELD OF THE INVENTION

5 This invention relates to a rolling bearing assembly comprising, amongst others, a target fast in rotation with the outer ring of a rolling bearing and adapted to cooperate with a sensor unit, in order to determine a rotation parameter of the rolling bearing assembly. The invention also relates to a method for mounting such a rolling bearing assembly onto a supporting structure.

BACKGROUND OF THE INVENTION

10 A rolling bearing comprises an inner ring, an outer ring and several rolling bodies installed between these two rings. These rolling bodies can be balls, rollers or needles. In the sense of the present invention, a rolling bearing can be, for instance, a ball bearing, a roller bearing or a needle bearing.

15 It is known to use a tachometer in order to determine the rotation speed of a member supported by a rolling bearing. As considered in EP-A-1 251 354, one can use a sensor assembly including an active part, such as a magnetic multipolar ring, forming a target whose rotation is detected by a sensing element. This sensing element is embedded into a "sensor block" which must be specifically designed according to the dimensions and operating conditions of the rolling bearing. This substantially increases its cost.

SUMMARY OF THE INVENTION

25 This invention aims at solving the above-mentioned problem with a new rolling bearing assembly which is adapted to the use of a standard sensor, in conjunction with a rolling bearing, this standard sensor being accurately positioned with respect to the target, whereas the overall structure of the rolling bearing assembly facilitates its maintenance.

30 To this end, the invention concerns a rolling bearing assembly comprising a rolling bearing having an inner ring and an outer ring, a target adapted to rotate with the outer ring and a sensor unit including at least one sensor having a sensor body supporting at least one sensing element adapted to read the target. According to the invention, the sensor unit also includes a supporting member for the sensor, this supporting member being fast in rotation with the inner ring of the rolling bearing and provided with a housing for removably accommodating at least a part of the sensor body.

35

Thanks to the invention, a standard sensor can be used in a rolling bearing assembly of the invention. The supporting member realizes an interface between this standard sensor and the other components of the rolling bearing assembly. Thus, the sensor can be precisely located with respect to these other components which might include a sealing gasket protecting a gap of the rolling bearing assembly where reading of the target takes place. Since the sensor body is removably accommodated in the housing of the supporting member, the sensor can be easily accessed and removed, e.g. for maintenance

In the present description, the words "axial", "radial", "axially", "radially", "centrifugal", "centripetal" and similar words relate to the axis of rotation of one ring of the rolling bearing with respect to the other ring. A direction is "axial" when it is parallel to this axis and "radial" when it is perpendicular and secant to this axis. A surface is "axial" when it is perpendicular to this axis and "radial" when it surrounds this axis and perpendicular to a radial direction. For instance, an axial effort is parallel to the axis of rotation and an axial surface is annular and perpendicular to this axis. In the present description, the adverb "removably" qualifies a coupling or a connection that can be disassembled when needed.

According to further aspects of the invention, which are advantageous but not compulsory, the rolling bearing assembly might incorporate one or several of the following features:

- The rolling bearing assembly further includes a sealing gasket extending between the supporting member and a part fast in rotation with the target. This sealing gasket can be mounted on the part fast with the target and be in sliding contact with the supporting member. Alternatively, the sealing member is mounted on the supporting member and it is in sliding contact with the part fast in rotation with the target.

- The rolling bearing assembly includes holding means to hold the sensor body into the housing of the supporting member. These holding means can include a screw and a corresponding threaded hole in the supporting member. Alternatively, the holding means include cooperating reliefs respectively provided on the sensor body and in the housing.

- The supporting member is made of at least two parts fast in rotation with each other and at least one outer part radially surrounds an inner part of the supporting member.

- The supporting member is adapted to transmit an axial thrust effort to the rolling bearing. In particular, the supporting member can include at least one axially deformable part.

- The housing is made in a socket of the supporting member.

The invention also relates to a method for mounting a rolling bearing assembly, as mentioned here-above, onto a structure, This method comprises the steps of:

- a) installing the rolling bearing within a housing of the structure;
- b) fastening the target to the outer ring of the rolling bearing;
- 5 c) fastening the supporting member to the inner ring of the rolling bearing;
- d) mounting the part of the sensor body within the housing of the supporting member; and
- e) removably immobilizing the sensor body part within the housing.

In this method, step c) can occur before or after steps d) and e). Moreover, steps d) and e) can occur simultaneously, that is in one single step..

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better 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 a perspective view of a hub and a fork of a two-wheeled vehicle, the hub including a rolling bearing assembly according to the invention,
- figure 2 is a partial cross-section, at a larger scale and along plane II on figure 1, showing a rolling bearing assembly used in the device of figure 1,
- figure 3 is an enlarged view of detail III on figure 2,
- figure 4 is an exploded perspective view of the rolling bearing assembly represented on figures 2 and 3, showing how this assembly is mounted with respect to the shaft and hub shown on figures 1 to 3 which are partially represented in chain-dotted lines,
- figure 5 is an other exploded perspective view of the rolling bearing assembly and the shaft seen from another angle,
- figure 6 is a perspective view of a rolling bearing assembly according to a second embodiment of the invention,
- figure 7 is a sectional view, along plane VII, of the rolling bearing assembly of figure 6 and
- figure 8 is an enlarged view of detail VIII on figure 7.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

Figure 1 depicts the use of a rolling bearing assembly 2 in conjunction with a shaft 4 and a hub 6. The hub belongs to a non-represented wheel which is held by two fork

members 8 supporting shaft 4. The rolling bearing assembly 2 of the invention is used in conjunction with another rolling bearing assembly 3 in order to support, with a possibility of rotation, hub 6 around shaft 4 which is stationary when fork members 8 are stationary.

Rolling bearing assembly 2 includes a ball bearing 10 comprising an inner ring 102 and an outer ring 104 defining between them a rolling chamber where balls 106 are held in position by a cage 108. Ring 102 is fast with shaft 4 and ring 104 is rotatable around a central axis X_{10} of rolling bearing 10 which is superimposed with the central longitudinal axis X_4 of shaft 4 when rolling bearing 10 is mounted on shaft 4.

Rolling bearing assembly 2 also includes means to determine a rotation parameter of the outer ring 104, with respect to the inner ring 102. A rotation parameter is representative of the pivoting movement of one part with respect to another. Such a parameter can be an angle measuring the angular position of one part with respect to the other, around the central axis X_{10} of ball bearing 10. Such a parameter can also be a speed, a displacement, an acceleration or a vibration.

These detections means include a sensor unit 20 made of a sensor 202 and a supporting member 212. Sensor 202 is a standard product which can be bought from known sensor manufacturers. Sensor 202 includes one Hall effect cell 204 forming a sensing element and a sensor body 206 which surrounds and mechanically protects cell 204. An electric cable 205 connects cell 204 to an appropriate electronic control unit which is remote from rolling bearing assembly 2. Cable 205 extends through body 206, where it is not represented on the figures. Alternatively, some electronic components can be embedded in body 206 in order to treat the output signal of cell 204.

Body 206 has an arcuate part 2062, an elongated part 2063 surrounding cable 205 and a projection 2064 which extends axially, that is in a direction parallel to axis X_{10} when sensor 202 is in working configuration with respect to the other components of rolling bearing assembly 2.

Supporting member 212 is made of an annular shoe 214 adapted to be mounted and locked around shaft 4, an annular synthetic member 216 and a metallic ring 218. Member 216 radially surrounds shoe 214 and ring 218 radially surrounds member 216. Items 214, 215, 216 and 218 are fast in rotation with each other.

A housing 220 is provided within member 216 to accommodate projection 2064 of body 206. The shape of housing 220 is adapted to the cross-section of projection 2064 so that projection 2064 can be introduced within housing 220 with some play, which facilitates removal of body 206 with respect to support member 212 when necessary for maintenance operations. Actually, housing 220 is a hole extending through member 216.

Member 216 is also provided with a threaded hole 222 adapted to receive the stem of a screw 224 introduced within a through-hole 2066 of arcuate part 2062.

Thanks to this arrangement, it is possible to removably mount sensor body 206 on supporting member 212. The cooperation between projection 2064 and housing 220 induces a mechanical coupling between parts 206 and 212, whereas screw 224 and threaded hole 222 hold these parts together.

An annular metallic flange 50 acts as a cover for an encoder washer 60 which constitutes a target for Hall effect cell 204. Encoder washer 60 is magnetically active and includes several magnetic North and South poles regularly distributed around axis X_{10} in working configuration of rolling assembly 2. Encoder washer 60 is mounted on the radial inner face 502 of flange 50.

In working configuration of rolling bearing assembly 2, projection 2064 goes through housing 220, so that cell 204 is aligned, along axis X_{10} , with encoder washer 60. Then, sensing element 204 can detect encoder washer 60 in a radial direction.

Flange 50 and encoder washer 60 are fast in rotation with outer ring 104 of ball bearing 10 insofar as items 50 and 104 are blocked in rotation within respective housings 62 and 64 of hub 6. Thus, encoder washer 60 rotates with outer ring 104 and hub 6 around axis X_{10} .

On the other hand, a nut 40 mounted on shaft 4 exerts on shoe 214 an axial effort E_{40} which is transmitted to inner ring 102 as an axial effort E_{214} , whereas inner ring 202 is in abutment against a spacer 42 extending between rolling bearing assemblies 2 and 3. Thus, axial effort E_{40} firmly presses shoe 214 against inner ring 102, so that these elements are fast in rotation with each other and with shaft 4.

When it is necessary to mount rolling bearing assembly 2 onto shaft 4 and hub 6, rolling bearing 10 is first introduced within housing 62, thanks to a first axial thrust effort E_1 .

Then, flange 50 already equipped with encoder washer 60 is introduced within housing 64, thanks to a second axial thrust effort E_2 .

It is then possible to mount supporting member 212 onto shaft 4, and to push it against inner ring 102, thanks to a third axial thrust effort E_3 .

Sensor body 206 is then partly introduced within housing 220. More precisely, projection 2064 is pushed through housing 220, thanks to a fourth axial thrust effort E_4 , so that sensing cell 204 is axially aligned with encoder washer 60. Then projection 2064 extends through housing 220. It is then possible to immobilize body 206 with respect to supporting member 212 thanks to screw 224 which is pushed through hole 2066, with a fifth axial thrust effort E_5 , and screwed with hole 222.

A sealing gasket 70 is mounted on flange 50 and extends radially towards axis X_{10} . When supporting member 212 is pushed against inner ring 102, ring 218 is aligned along axis X_{10} with a sealing lip 72 of sealing gasket 70, so that an inner chamber 90 formed radially inside encoder washer 60 is protected against contaminants.

5 According to an alternative mounting method of the invention, mounting sensor body 206 on supporting member 212 and removable immobilization via screw 224 can occur prior to the mounting of supporting member 212 around shaft 4 and its fastening to inner ring 102.

10 Supporting member 212 works as an axial spacer between nut 40 and inner ring 102, in order to transmit locking efforts E_{40} - E_{214} to inner ring 102. This supporting member also holds sensor 202 in a correct position with respect to encoder washer 60. Finally, supporting member 212 contributes to the sealing function obtained with sealing gasket 70.

15 When it is necessary to work on rolling bearing assembly 2, e.g. for a maintenance operation on sensor 202, this sensor can be easily removed via unscrewing of screw 224 and pulling projection 2064 out of housing 220.

20 In the second embodiment of the invention represented on figures 6 to 8, the same elements as in the first embodiment have the same references. A ball bearing 10 belongs to a rolling bearing assembly 2 which also comprises a sensor unit 20. This sensor unit includes a sensor 202 having a sensor body 206 which includes a Hall effect cell 204 located in a projection 2064 of sensor body 206.

25 A supporting member 212 is made of an annular shoe 214, a deformable ring 215 radially surrounding shoe 214, an annular member 216 and a ring 218. Items 214, 215, 216 and 218 are fast in rotation with each other. Member 216 radially surrounds deformable ring 215. Ring 218 is press-fitted or crimped on annular member 216 and radially surrounds member 216. Ring 218 has an L cross-section with a first leg 2181, which is cylindrical with a circular cross-section, and a second leg 2182, which is annular and extends radially towards the central axis X_{10} of ball bearing 10.

30 Shoe 214 is provided with an annular skirt 2142 which is wedged into an annular radial groove or recess of the inner ring 102 of ball bearing 10, so that items 102 and 212 are fast in rotation with each other.

35 A sealing gasket 70 is mounted on the internal edge of ring 218 and comes into sliding contact with a flange 50. Flange 50 is fast in rotation with the outer ring of ball 104 of ball bearing 10 and supports an encoder washer 60 which forms a target for Hall effect cell 204.

In this embodiment, Hall effect cell 204 reads target 60 in an axial direction, whereas, in the first embodiment, Hall effect cell 204 reads the target in a radial direction.

Deformable ring 215 can be squeezed and deformed along an axial direction, as shown by arrow D on figure 8. This allows ring 215 to efficiently transmit a thrust effort to ball bearing 10 when this is necessary to push this ball bearing within a corresponding housing of a hub, like housing 62 in the first embodiment.

According to a non represented alternative embodiment of the invention, supporting member 212 can include several axially deformable parts similar to ring 215.

A socket 217 of annular member 216 defines a through-hole 220 which forms a housing adapted to accommodate a part of projection 2064 of sensor body 206. Socket 217 is rigid enough to accommodate projection 2064 with sensor body 206 in overhang.

Projection 2064 is provided with external shoulders and recesses 2068 which are complementary to corresponding shoulders and recesses 2208 made in a housing 220. Thus sensor body 206 can be held in position within housing 220 by cooperation of shapes.

The shoulders and recesses 2068 and 2208 respectively provided on the outer surface of the projection 2064 and on the peripheral surface of housing 220 removably hold sensor body 206 with respect to supporting member 212.

Mounting of the rolling bearing assembly 2 of the second embodiment on a structure such as the hub represented on figures 1 to 4 occurs in a way similar to the one mentioned for the first embodiment.. Mounting of projection 2064 on supporting member 212 and immobilizing of this projection within the housing occur simultaneously, thanks to shoulders and recesses 2068 and 2208.

According to non-represented alternative embodiments of the invention, the sensor 202 may include more than one Hall effect cell 204.

According to another non-represented alternative embodiment of the invention, supporting member 212 can support several sensors 202. In such a case, it is provided with several housings 220.

According to another non represented embodiment of the invention, the whole sensor body 206 can be accommodated in a housing 220 of the supporting member 212.

The features of the embodiments mentioned here-above can be combined.

As mentioned here-above, the invention is particularly adapted for realizing a tachometer of a two-wheeled vehicle. However, other applications can be considered.

CLAIMS

1. A rolling bearing assembly (2) comprising:

- a rolling bearing (10) having an inner ring (102) and an outer ring (104),
- a target (60) adapted to rotate with the outer ring and a sensor unit (20) including at least one sensor (202) having a sensor body (206) supporting at least one sensing element (204) adapted to read the target,

wherein said sensor unit (20) also includes a supporting member (212) for said sensor (202), this supporting member being fast in rotation with said inner ring (102) of said rolling bearing (10) and provided with a housing (220) for removably accommodating at least a part (2064) of said sensor body (206).

2. Rolling bearing assembly according to claim 1, wherein it includes a sealing gasket (70) extending between said supporting member (212) and a part (50) fast in rotation with said target (60)

3. Rolling bearing assembly according to claim 2, wherein said sealing gasket (70) is mounted on said part (50) fast in rotation with said target (60) and is in sliding contact with said supporting member (212).

4. Rolling bearing assembly according to claim 2, wherein said sealing gasket (70) is mounted on said supporting member (212) and it is in sliding contact with said part (50) fast in rotation with said target (60).

5. Rolling bearing assembly according to one of the previous claims, wherein it includes holding means (222, 224; 2068, 2208) to hold said sensor body (206) within said housing (220).

6. Rolling bearing assembly according to claim 5, wherein said holding means include a screw (224) and a corresponding threaded hole (222) in said supporting member (212).

7. Rolling bearing assembly according to claim 5, wherein said holding means include cooperating reliefs (2068, 2208) respectively provided on said sensor body (206) and in said housing (220).

8. Rolling bearing assembly according to one of the previous claims, wherein said supporting member (212) is made of at least two parts (214, 215, 216, 218) fast in rotation with each other and wherein at least one outer part (216) radially surrounds an inner part (214) of the supporting member (212).

5

9. Rolling bearing assembly according to one of the previous claims, wherein said supporting member (212) is adapted to transmit an axial thrust effort to said rolling bearing (10).

10

10. Rolling bearing assembly according to claim 9, wherein said supporting member (212) includes at least one axially deformable part (215).

11. Rolling bearing assembly according to one of the previous claims, wherein said housing (220) is made in a socket (217) of said supporting member (212).

15

12. A method for mounting a rolling bearing assembly (2) according to one of the previous claims onto a structure (6), wherein this method comprises the steps of:

20

- a) installing (E_1) the rolling bearing (10) within a housing (62) of the structure (6);
- b) fastening (E_2) the target (60) to the outer ring (104) of the rolling bearing;
- c) fastening (E_3) the supporting member (212) to the inner ring (102) of the rolling bearing;
- d) mounting (E_4) said part (2064) of said sensor body (206) within the housing (220) of the supporting member; and
- e) removably immobilizing (E_5) said part (2064) within the housing (220).

25

13. A method according to claim 12, wherein step c) occurs before steps d) and e).

14. A method according to claim 12, wherein step c) occurs after steps d) and e).

30

15. A method according to one of claims 12 to 14, wherein steps d) and e) occur simultaneously.

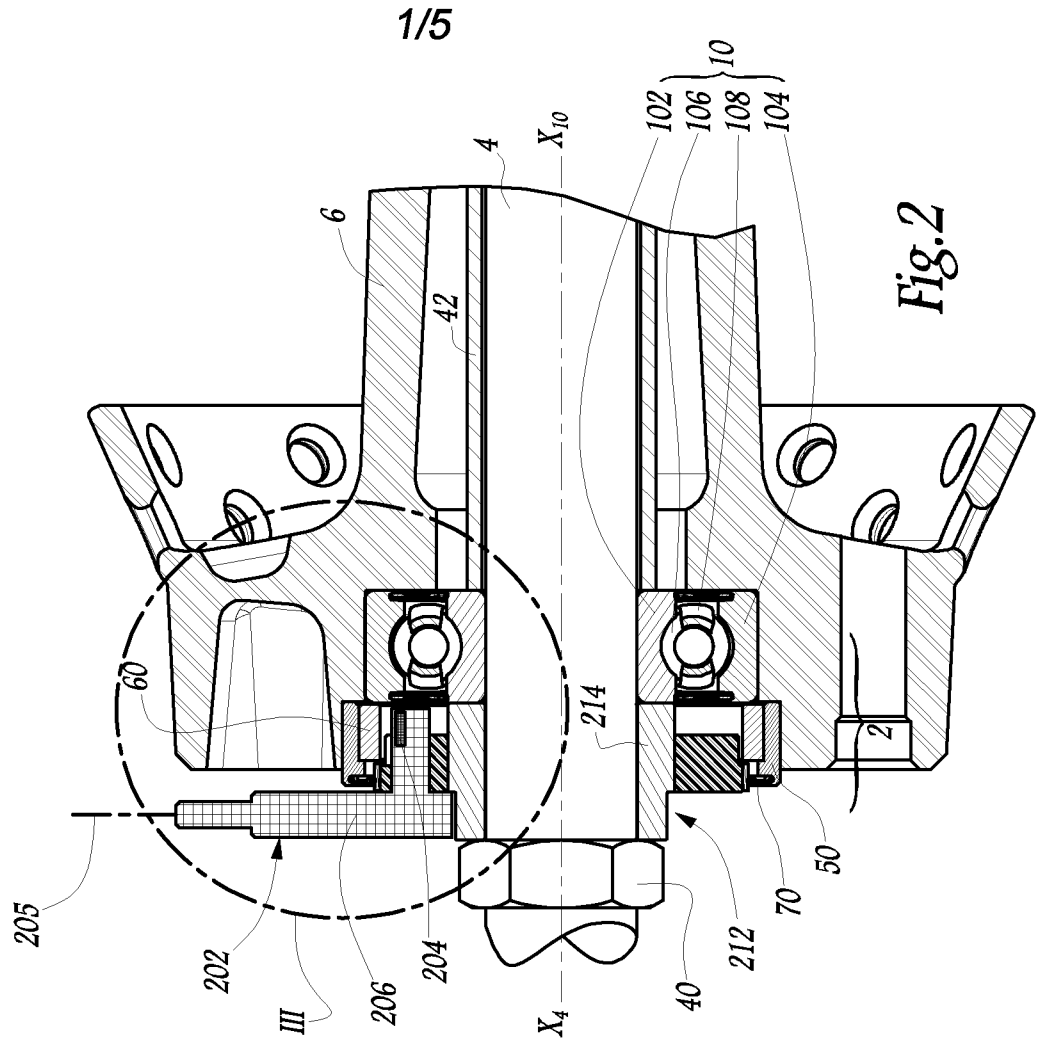
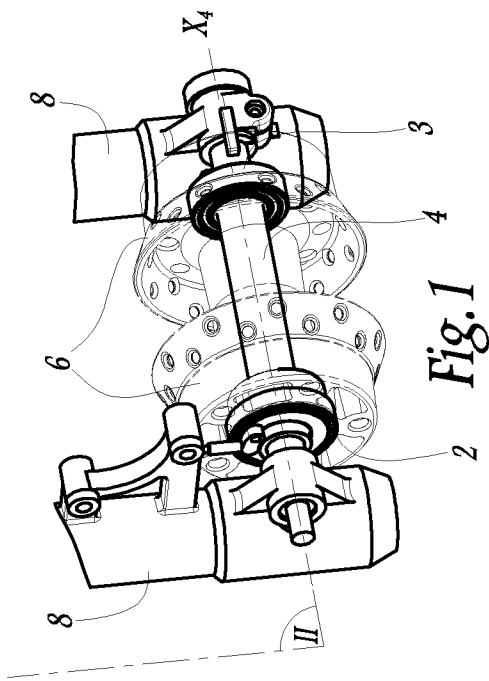
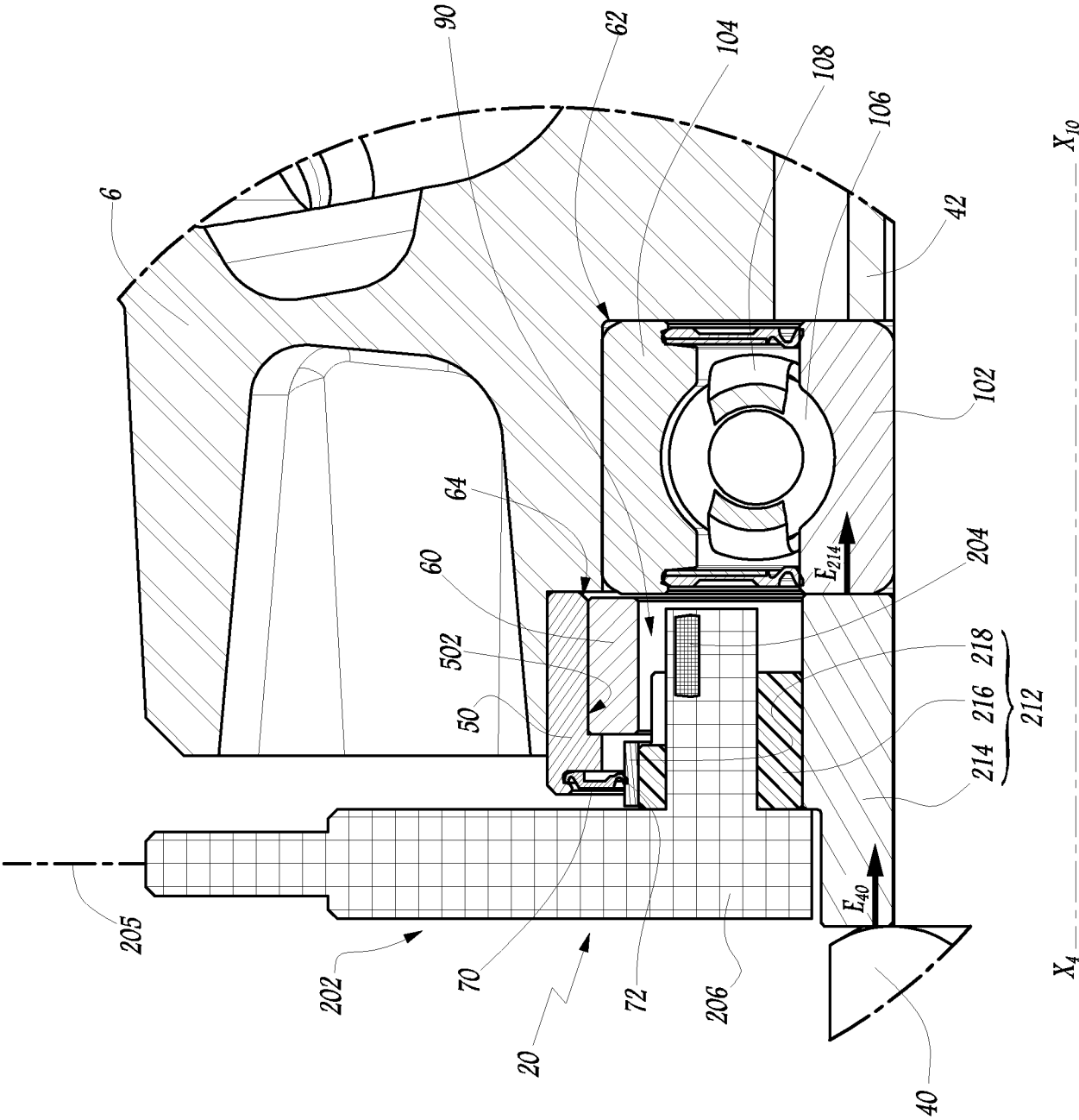


Fig.3



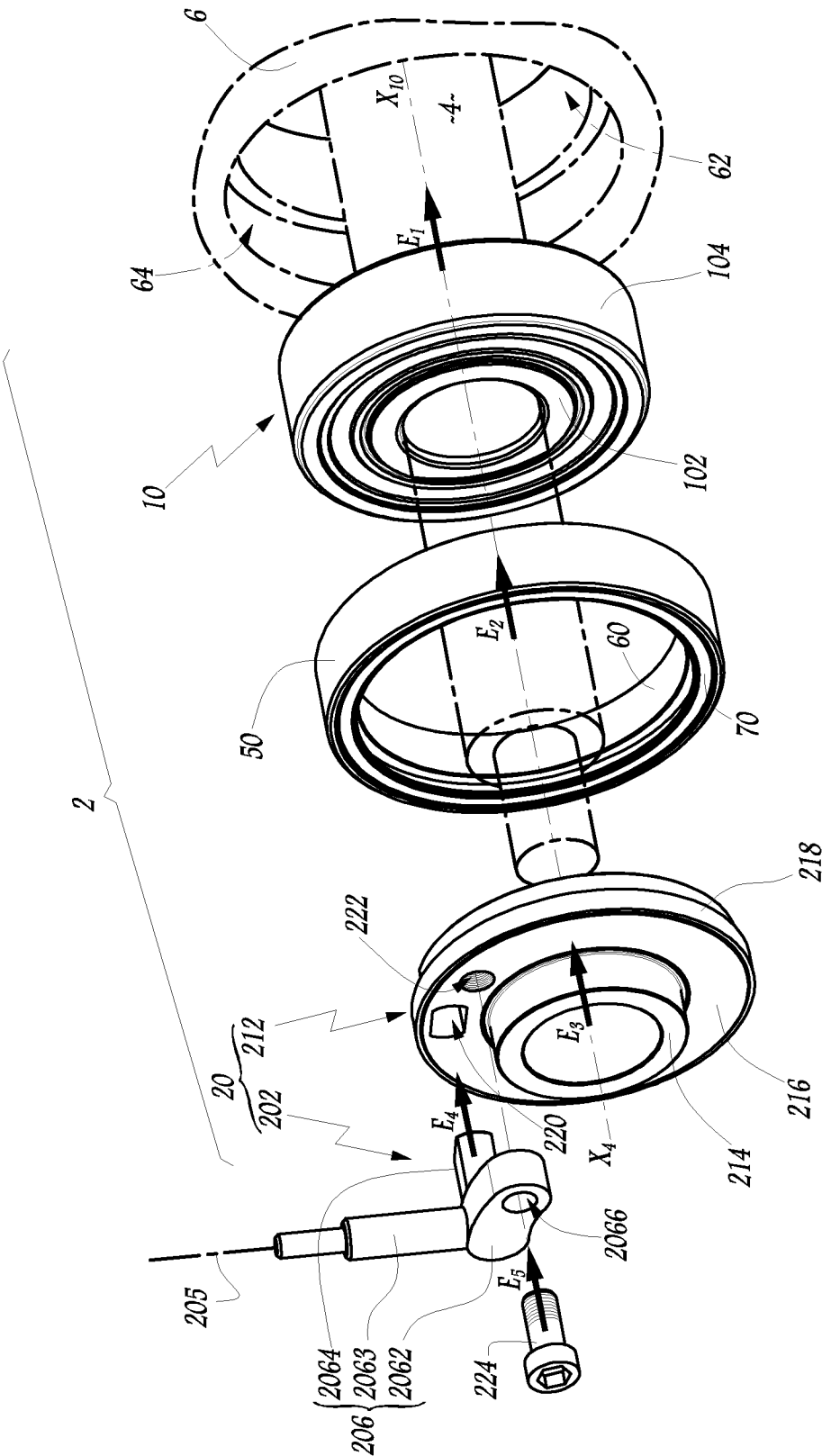
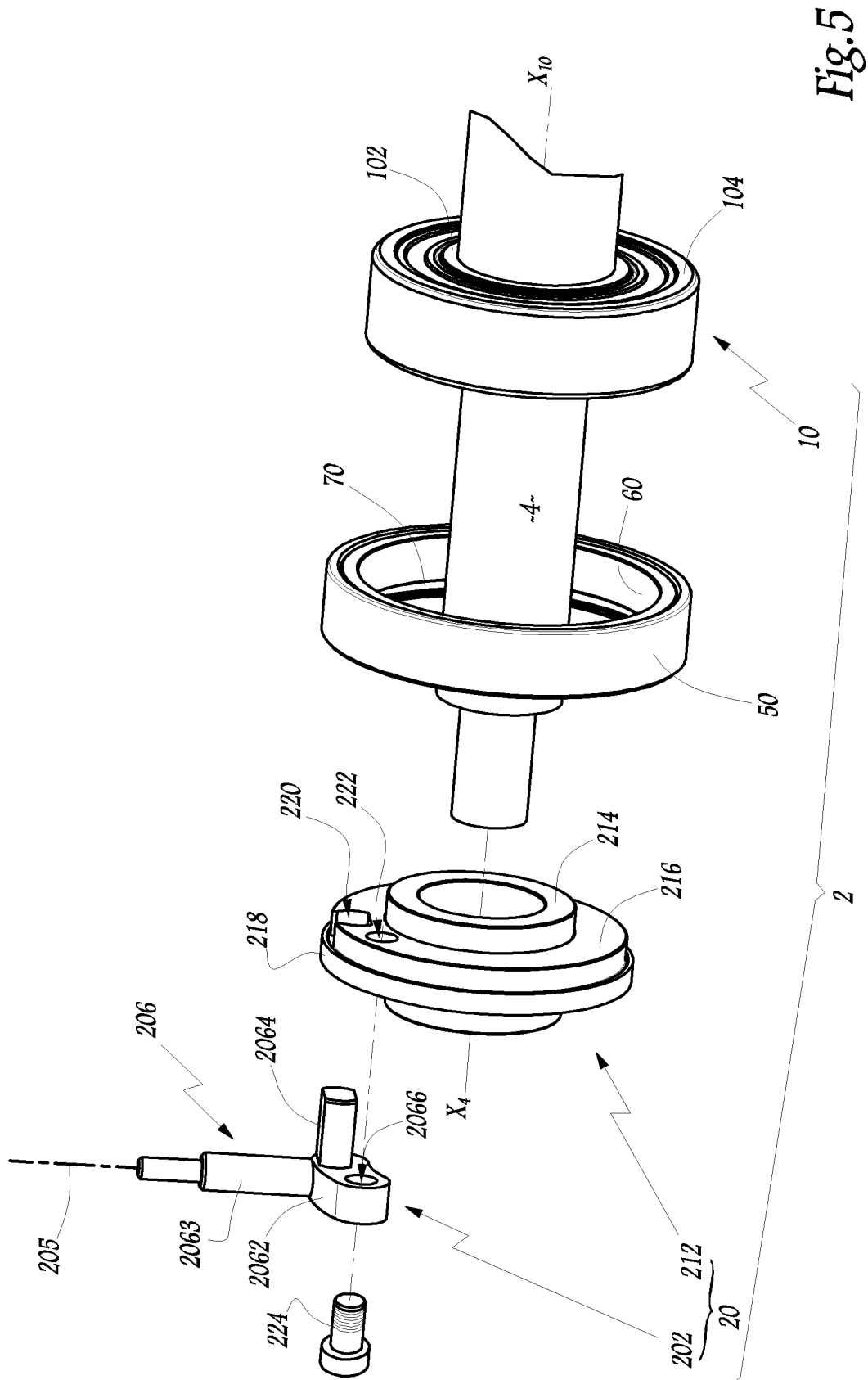


Fig. 4

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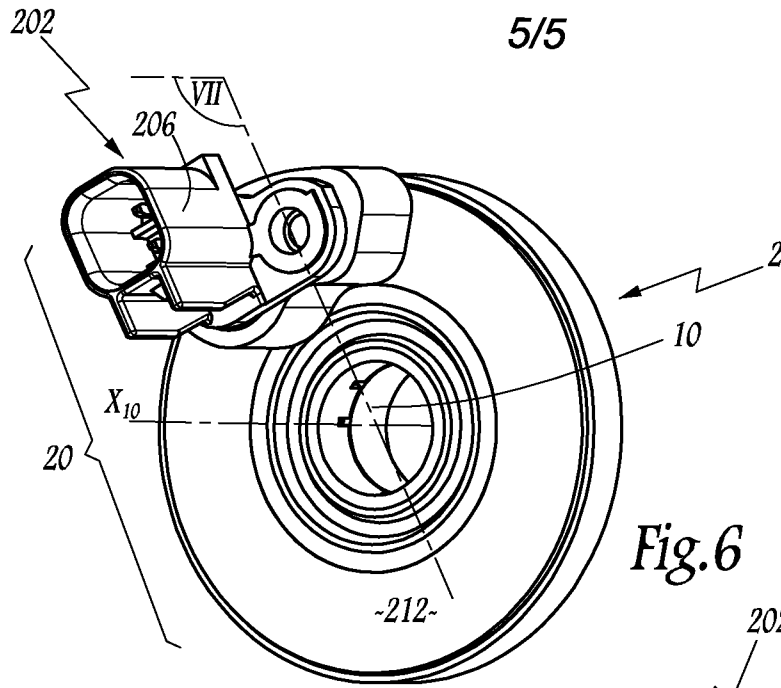


Fig. 6

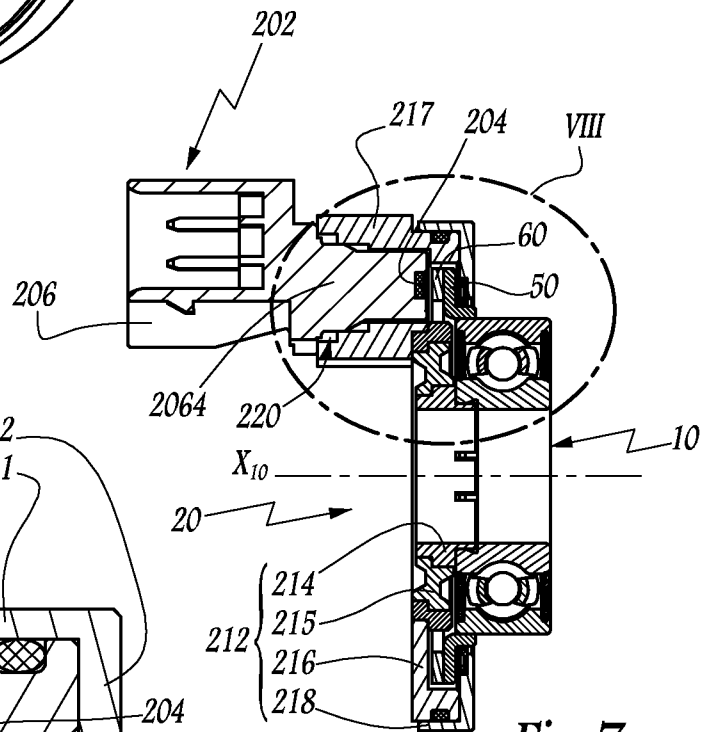


Fig. 7

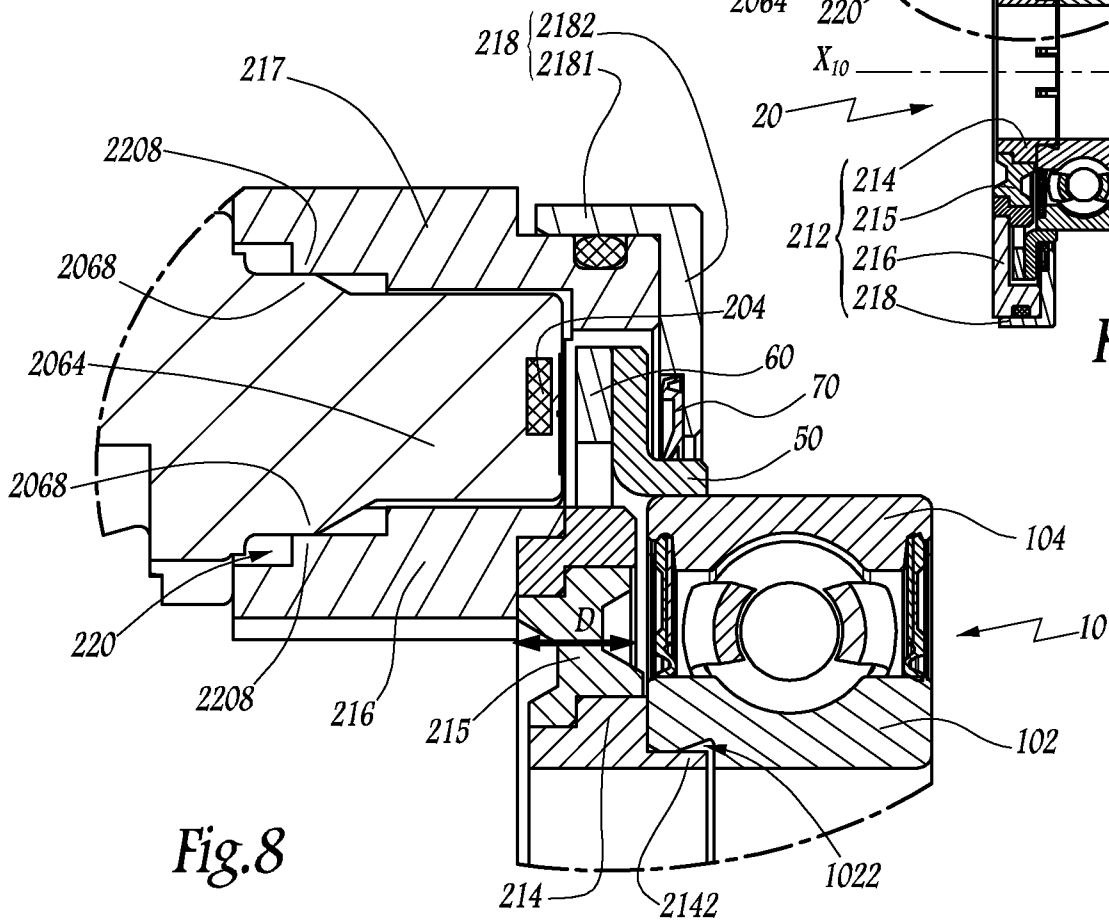


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2010/001275

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16C35/06 F16C41/00 F16J15/32 G01P3/44
 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)

F16J 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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 671 628 A1 (ROULEMENTS SOC NOUVELLE [FR]) 13 September 1995 (1995-09-13) column 2, line 6 - column 4, line 6 figures 2-5,7	1,5-7,9, 11-13,15
X	FR 2 894 677 A1 (BOSCH GMBH ROBERT [DE]) 15 June 2007 (2007-06-15) page 5, line 36 - page 8, line 24 figures	1,5,7,9, 11,12, 14,15
X	EP 0 619 438 A1 (ROULEMENTS SOC NOUVELLE [FR]) 12 October 1994 (1994-10-12) column 2, line 2 - column 4, line 11 figures ----- -/--	1,5,7, 9-13,15



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

13 January 2011

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Name and mailing address of the ISA/

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Prieto Sanz, M

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2010/001275

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 159 578 A1 (JTEKT CORP [JP]) 3 March 2010 (2010-03-03) figures 1-5, -----	1-5, 7, 10-15
X	EP 1 388 736 A1 (ROULEMENTS SOC NOUVELLE [FR]) 11 February 2004 (2004-02-11) paragraph [0016] - paragraph [0052] figures 1-7, 10-15 -----	1, 5, 7-9, 11, 12, 14, 15
X	US 2007/159352 A1 (SAHASHI KOJI [JP] ET AL) 12 July 2007 (2007-07-12) figures 3-7B paragraph [0051] - paragraph [0056] -----	1, 5, 7, 9-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2010/001275

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0671628	A1	13-09-1995	BR 9500841 A CN 1122003 A DE 69506755 D1 DE 69506755 T2 ES 2126222 T3 FR 2717266 A1	24-10-1995 08-05-1996 04-02-1999 01-07-1999 16-03-1999 15-09-1995
FR 2894677	A1	15-06-2007	DE 102005059183 A1 JP 2007163487 A	21-06-2007 28-06-2007
EP 0619438	A1	12-10-1994	BR 9401349 A CN 1095142 A DE 69406834 D1 DE 69406834 T2 ES 2109622 T3 FR 2703740 A1 JP 3312076 B2 JP 6308145 A US 5451869 A	18-10-1994 16-11-1994 02-01-1998 30-04-1998 16-01-1998 14-10-1994 05-08-2002 04-11-1994 19-09-1995
EP 2159578	A1	03-03-2010	CN 101680909 A WO 2008152987 A1	24-03-2010 18-12-2008
EP 1388736	A1	11-02-2004	FR 2843430 A1 US 2004109623 A1	13-02-2004 10-06-2004
US 2007159352	A1	12-07-2007	CN 1856661 A DE 112004001823 T5 JP 2005098941 A WO 2005031181 A1	01-11-2006 03-08-2006 14-04-2005 07-04-2005