Title: DEVICES AND METHODS FOR ASSESSING SPINAL AND IMPLANT MOTION AND FOR OPTIMIZING ALIGNMENT AND MOVEMENT

Abstract: Devices and associated methods help surgeons assess spinal and artificial disc replacement (ADR) position, orientation and motion. The device moves the spine through flexion, extension, lateral bending, and/or axial rotation while measuring the amount of movement in these directions. The device may also measure the force required to move the spine in one or more of the above-named directions. The various disclosed embodiments maximize motion through careful alignment, size, location in the disc space, configuration of the articulating surfaces of the ADR, and adequate soft tissue release. The invention may utilize pre-operative images to determine the preferred alignment of the ADR; intra-operative images to align the instruments, trial ADRs and the ADR; devices that assess the ROM of the vertebrae after soft tissue release; devices that determine the proper size of the ADR; devices that test the motion after machining the vertebrae; or ADR embodiments with different degrees of axial rotation. Although the various procedures are described for ADRs that are inserted from an anterior approach to the spine, the invention could also be used for ADRs that are inserted from a lateral or posterior-lateral approach to the spine.
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Previous Correction:
see PCT Gazette No. 16/2005 of 21 April 2005, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
  IPC(7) : A61F 2/08
  US CL : 606/102,105,86,61; 623/17,14
  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)
  U.S. : 606/102,105,86; 623/17,14

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6,224,604 B1 (SUDSABY) 01 May 2001 (01.05.2001), see Fig. 1</td>
<td>1-5 and 7</td>
</tr>
<tr>
<td>X</td>
<td>US 5,329,933 A (GRAF) 19 July 1994 (19.07.1994), see Fig. 6</td>
<td>1,9,10 and 12-14</td>
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<td>X</td>
<td>US 2002/0161446 A1 (BRYAN et al) 31 October 2002 (31.10.2002), see Figs. 1A-1B</td>
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<td>X, P</td>
<td>US 6,648,891 B2 (KIM) 18 November 2003 (18.11.2003), see Fig. 4</td>
<td>1,11,13 and 14</td>
</tr>
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<td>X</td>
<td>US 6,113,637 A (GILL et al) 05 September 2000 (05.09.2000), see Fig. 16</td>
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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 05 January 2005 (05.01.2005)

Date of mailing of the international search report

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