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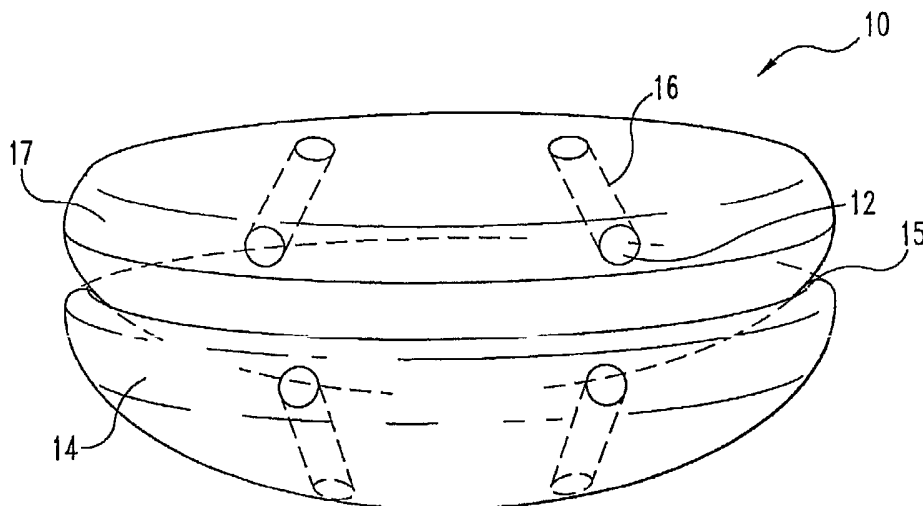
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[Continued on next page]

(54) Title: IMPLANTS BASED ON ENGINEERED METAL MATRIX COMPOSITE MATERIALS HAVING ENHANCED
IMAGING AND WEAR RESISTANCE



(57) Abstract: This invention relates to an implantable medical device to treat a patient. The implantable device can be an orthopedic device such as a spinal implant including, but not restricted to, a disc or nucleus pulposus prosthesis, a spinal rod assembly, or a bone fixation plate. The orthopedic device can be formed to include a metal matrix composite that provides enhanced wear and diagnostic imaging techniques. In other forms, the present invention provides an implantable medical device that includes a porous metal matrix composite that can deliver a therapeutic composition to a patient. In still other forms, the present invention provides an implantable electrical device or lead formed to include a metal matrix composite that provides lower polarization and interfacial impedance and allows enhanced sensing of the physiological signals.

**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

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INTERNATIONAL SEARCH REPORT

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| | | |
|---|---|---|
| A. CLASSIFICATION OF SUBJECT MATTER IPC 7 A61F2/44 A61F2/06 A61L27/40 A61L27/42 A61L27/56 A61L31/12 A61L31/14 A61N1/05 | | |
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| B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 A61L A61F A61M A61B A61N | | |
| 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. |
| Y | DE 196 41 023 A (UNIV SINGAPORE) 10 April 1997 (1997-04-10) the whole document | 1-4, 6-18, 21-28, 33-43, 53-58, 62-64 |
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| <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex. </div> | | |
| <div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents:</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*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)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>*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</p> <p>*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</p> <p>*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.</p> <p>*&* document member of the same patent family</p> </div> </div> | | |
| Date of the actual completion of the international search <div style="text-align: center;">26 November 2004</div> | | Date of mailing of the international search report <div style="text-align: center;">08.12.2004</div> |
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/016772

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

International application No.
PCT/US2004/016772

Box 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.: 93-96
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
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 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 fee, this Authority did not invite payment of any additional fee.
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.:
1-33, 34-43, 53-64, 65-73, 74-84, 85-92
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.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-33,34-43,53-64

A spinal implant comprising a metal matrix composite including a metallic matrix and a reinforcing component dispersed within the metallic matrix.

2. claims: 44-52

A medical device comprising a metal matrix composite including a metallic matrix and a reinforcing component dispersed within the metallic matrix.

3. claims: 65-73

A catheter comprising a metal matrix composite including a metallic matrix and a reinforcing component dispersed within the metallic matrix.

4. claims: 74-84

A pacemaker lead comprising a metal matrix composite including a metallic matrix and a reinforcing component dispersed within the metallic matrix.

5. claims: 85-92

A bone plate comprising a metal matrix composite including a metallic matrix and a reinforcing component dispersed within the metallic matrix.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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