Title: JOINT MOVEMENT SYSTEM

Abstract: Systems, methods and devices for restoring or enhancing one or more motor functions of a patient are disclosed. The system comprises a biological interface apparatus and a joint movement device such as an exoskeleton device or FES device. The biological interface apparatus includes a sensor that detects the multicellular signals and a processing unit for producing a control signal based on the multicellular signals. Data from the joint movement device is transmitted to the processing unit for determining a value of a configuration parameter of the system. Also disclosed is a joint movement device including a flexible structure for applying force to one or more patient joints, and controlled cables that produce the forces required.
Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
18 October 2007

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

INV. G06N3/06 A61B5/00 G06F3/00 A61F2/68

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)
G06N G06F A61B A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC

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>
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<tbody>
<tr>
<td>X</td>
<td>WO 03/000161 A (MANN ALFRED E FOUND SCIENT RES [US]) 3 January 2003 (2003-01-03) page 18, line 10 - page 20, line 28; figures 6,8</td>
<td>1,115, 196</td>
</tr>
</tbody>
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Further documents are listed in the continuation of Box C.

X See patent family annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier document but published on or after the international filing date
  *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)
  *O* document referring to an oral disclosure, use, exhibition or other means
  *P* document published prior to the international filing date but later than the priority date claimed

* 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

* 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

*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.

* document member of the same patent family

Date of the actual completion of the international search: 12 April 2007

Date of mailing of the international search report: 10/08/2007

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Fax: +31-70 340-3016

Authorized officer
Schenkels, Paul

Form PCT/ISA/210 (second sheet) (April 2005)
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<td>X</td>
<td>WO 03/037231 A (UNIV DUKE [US]; NICOLELIS MIGUEL A L [US]; CHAPIN JOHN K [US]; WESSBER) 8 May 2003 (2003-05-08) the whole document</td>
<td>1,115, 196</td>
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<td>X</td>
<td>WO 01/60445 A2 (NEURODAN AS [DK]; HAUGLAND MORTEN [DK]; SINKJAER THOMAS [DK]) 23 August 2001 (2001-08-23) page 41, line 1 - line 30</td>
<td>1,115, 196</td>
</tr>
</tbody>
</table>
INTERNATIONAL SEARCH REPORT

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. [X] Claims Nos.: 2 – 114, 116 – 195, 197 – 232 because they relate to subject matter not required to be searched by this Authority, namely:

   see FURTHER INFORMATION sheet PCT/ISA/210

2. [X] Claims Nos.: 2 – 114, 116 – 195, 197 – 232 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:

   see FURTHER INFORMATION sheet PCT/ISA/210

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.:

4. [X] 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.:

   1–232

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.
Continuation of Box II.1

The first invention of the present application contains 232 claims of which 3 are independent. There are so many dependent claims (e.g. 51 claims are directly dependent of claim 1), and they are drafted in such a way that the claims as a whole are not in compliance with the provisions of clarity and conciseness (Article 6 PCT), as it is particularly burdensome for a person skilled in the art to establish the subject-matter for which protection is sought when assessing what should be the subject-matter to be searched.
The non-compliance with the substantive provisions is to such an extent, that the search was performed taking into consideration the non-compliance in determining the extent of the search (PCT Guidelines 9.19 and 9.25).
The extent of the search was consequently limited to the Independent claims.

Continuation of Box II.2

The first invention of the present application contains 232 claims of which 3 are independent. There are so many dependent claims (e.g. 51 claims are directly dependent of claim 1), and they are drafted in such a way that the claims as a whole are not in compliance with the provisions of clarity and conciseness (Article 6 PCT), as it is particularly burdensome for a person skilled in the art to establish the subject-matter for which protection is sought when assessing what should be the subject-matter to be searched.
The non-compliance with the substantive provisions is to such an extent, that the search was performed taking into consideration the non-compliance in determining the extent of the search (PCT Guidelines 9.19 and 9.25).
The extent of the search was consequently limited to the Independent claims.
The applicant’s attention is drawn to the fact that claims relating to
inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1 - 232

   A biological interface apparatus comprising a sensor and a processing unit for generating a processed signal to a joint movement device.

2. claims: 233 - 494

   a joint movement device for applying a force to a patient's joint comprising an implantable piston assembly.
<table>
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<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
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<td>WO 9704833 A</td>
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