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(54) Title: METHOD AND APPARATUS FOR CONTROLLING CATHETER POSITIONING AND ORIENTATION

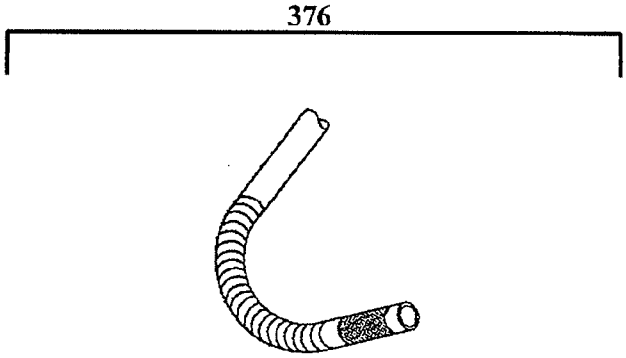

FIG. 4

(57) Abstract: A method and apparatus for detecting position and orientation of catheter distal magnetic element end while moving in a patient's heart is described. The apparatus includes magnetic sensors for to detect the magnetic field of a generated by the catheter tip. Each sensor transmits the field magnitude and direction to a detection unit, which filters the signals and removes other field sources, such as generated by CGCI coils and external medical hardware. The method allows the measurements of magnitude corresponding to the catheter tip distance from the sensor and the orientation of the field showing the magnetic tip orientation. Since the tip's magnetic field is not necessarily symmetric, the position and orientation computation technique are not independent of each other. Hence, an iterative calculation is used to converge to a solution. The method of determining tip position is calculated by triangulation from each sensor. In one embodiment, the tip orientation is calculated by an intersecting-planes algorithm. The orientation is used to adjust the distances from each sensor, and the process is repeated until convergence for both position and orientation is achieved. The resultant value provides the actual catheter tip position and orientation (AP). The actual position is further filtered by synchronizing the AP measurements with the QRS signal of the heart, allowing the operator and CGCI controller to view the organ as a static object.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/056277

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/06

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)
A61B

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	US 2006/116634 A1 (SHACHAR YEHOSHUA [US]) 1 June 2006 (2006-06-01) paragraphs [0021], [0023], [0024], [0074], [0151] figures 13A,13B,14,16,19,20,19A,20A	1-6,8, 12,13, 15-25
X,P	WO 2007/100559 A (MAGNETECS INC [US]) 7 September 2007 (2007-09-07) paragraphs [0019], [0025], [0032] - [0034], [0057] claim 17 figures 1,6A,6B	1,7, 12-19, 21-25

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[X] 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

"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

"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

"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	Date of mailing of the international search report
7 November 2008	18/11/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Worms, Georg

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/056277

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/004449 A1 (MITSCHKE MATTHIAS [DE] ET AL) 6 January 2005 (2005-01-06) paragraphs [0023], [0025], [0029]; figures 1-3	9,10
X	DE 10 2005 045073 A1 (SIEMENS AG [DE]) 22 March 2007 (2007-03-22) paragraphs [0011], [0012], [0023], [0024]; figure 1	9,10
A	US 2005/096589 A1 (SHACHAR YEHOSHUA [US]) 5 May 2005 (2005-05-05) the whole document	1-8, 12-25

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 11

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery; In order to carry out the method of claim 11 a surgical step would be necessary to introduce the invasive medical device into a patient. Hence, the method of claim 11 entails an implicit surgical step and is therefore not allowable.

INTERNATIONAL SEARCH REPORT

International application No.
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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. [X] Claims Nos.: 11
because they relate to subject matter not required to be searched by this Authority, namely:

see FURTHER INFORMATION sheet PCT/ISA/210

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. [X] As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable 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 reportcovers 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.:

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.

[X] 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: 1-8, 12-25

   directed to a method and apparatus for determining the position and orientation of an invasive medical device

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2. claims: 9,10

   directed to a method for correlating a fiducial alignment with a medical device position detection system

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/056277

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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