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PCT/US2009/004242(74) Agents: **ARORA, Suneel** et al.; Schwegman, Lundberg & Woessner, P.A., P.O. Box 2938, Minneapolis, MN 55402 (US).(22) International Filing Date:
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61/082,732 22 July 2008 (22.07.2008) US(71) Applicant (for all designated States except US): **CARDIAC PACEMAKERS, INC.** [US/US]; 4100 Hamline Avenue North, St. Paul, MN 55112-5798 (US).

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[Continued on next page]

(54) Title: MORPHOLOGY FEATURE EVALUATION IN IMPLANTABLE MEDICAL DEVICES

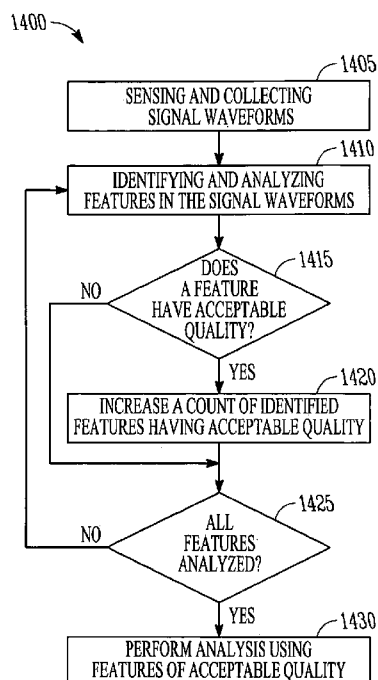


FIG. 14

(57) Abstract: An apparatus comprises an implantable sensor, which provides a plurality of physiologic sensor signals of a subject, and a processor. The signals may be cardiac signals. The processor includes a feature module and a detection module. The feature module is configured to identify a feature in the sensor signals and to determine a measure of quality of the feature in the sensor signals. The detection module is configured to perform a morphology analysis of a subsequent portion of at least one of the sensor signals using the feature when the measure of quality of the feature satisfies a quality measure threshold. The measure of quality includes at least one of: a measure of dispersion of the feature; a measure of regularity of a shape of a sensor signal segment comprising the feature; a number of zero-value crossings in a gradient of the sensor signal segment comprising the feature; or a number of inflection points determined in the feature.



TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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— *with international search report (Art. 21(3))*

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/004242

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/00 A61B5/0452

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.
Y	US 2007/239220 A1 (GREENHUT SAUL E [US] ET AL) 11 October 2007 (2007-10-11) paragraphs [0011] - [0014], [0024], [0039] - [0063]; figures 1,4,5	1-3,7-15
Y	US 5 897 575 A (WICKHAM JOHN [AU]) 27 April 1999 (1999-04-27) the whole document	1-3,7-15
Y	WO 2004/012596 A (CARDIAC PACEMAKERS INC [US]) 12 February 2004 (2004-02-12) page 10, line 15 - page 14, line 9; figures	1-3,7-15
A	WO 2007/124270 A (MEDTRONIC INC [US]; DREW TOUBY A [US]; PANKEN ERIC J [US]; WERDER JONA) 1 November 2007 (2007-11-01) page 40, line 24 - page 45, line 15; figure 18	1

☐ Further documents are listed in the continuation of Box C.

☒ 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

20 October 2009

Date of mailing of the international search report

10/02/2010

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/004242

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. ☒ Claims Nos.: 16-28
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Diagnostic method practised on the human or animal body
(see in particular the step of "performing a morphology analysis", which
covers e.g. heart arrhythmia classification, cf. also p. 11 l. 8-22)
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. ☐ 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 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 report covers 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.:

see annex

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.
- ☐ 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 (first alternative), 2, 3 and 7-15, if dependent thereon

Apparatus for determining a measure of quality, wherein the measure of quality includes a measure of dispersion

2. claims: 1 (second alternative), 4 and 7-15, if dependent thereon

Apparatus for determining a measure of quality, wherein the measure of quality includes a measure of shape regularity

3. claims: 1 (third alternative), 5 and 7-15, if dependent thereon

Apparatus for determining a measure of quality, wherein the measure of quality includes a number of zero crossings in a gradient

4. claims: 1 (fourth alternative), 6 and 7-15, if dependent thereon

Apparatus for determining a measure of quality, wherein the measure of quality includes a number of inflection points

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/004242

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2007239220	A1	11-10-2007	EP 2004285 A2	24-12-2008
			WO 2007117826 A2	18-10-2007
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WO 2004012596	A	12-02-2004	AU 2003257174 A1	23-02-2004
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			JP 2005534427 T	17-11-2005
			US 2004030256 A1	12-02-2004
			US 2007135722 A1	14-06-2007
WO 2007124270	A	01-11-2007	NONE	