

(51) International Patent Classification:
A61N 1/36 (2006.01) *A61B 5/04* (2006.01)(21) International Application Number:
PCT/US2011/039764(22) International Filing Date:
9 June 2011 (09.06.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/356,251 18 June 2010 (18.06.2010) US(71) Applicant (for all designated States except US): **CARDIAC PACEMAKERS, INC.** [US/US]; 4100 Hamline Avenue North, St. Paul, Minnesota 55112-5798 (US).

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, 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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

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

[Continued on next page]

(54) Title: NEUROSTIMULATION SYSTEM WITH CONTROL USING EVOKED RESPONSES

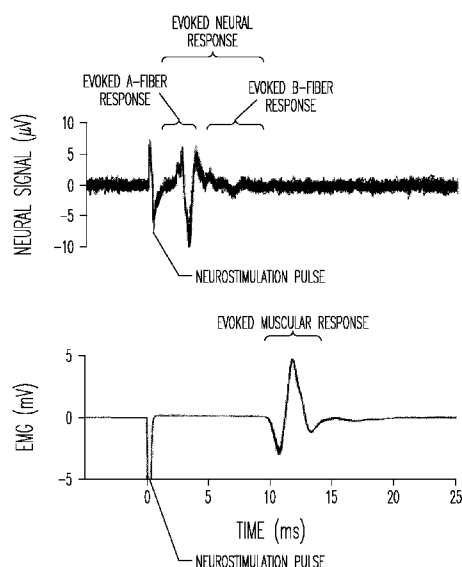


Fig. 6

(57) Abstract: A neurostimulation system provides for capture verification and stimulation intensity adjustment to ensure effectiveness of vagus nerve stimulation in modulating one or more target functions in a patient. In various embodiments, stimulation is applied to the vagus nerve, and evoked responses are detected to verify that the stimulation captures the vagus nerve and to adjust one or more stimulation parameters that control the stimulation intensity.



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- *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))*
- (88) Date of publication of the international search report:**
15 March 2012

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/039764

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61N1/36 A61B5/04
ADD.

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)
A61N 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)

EP0-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 2006/167497 A1 (ARMSTRONG RANDOLPH K [US] ET AL) 27 July 2006 (2006-07-27)	1-4,6, 21-23, 28,29 5,7-10
Y	paragraphs [0032], [0033], [0041], [0042], [0045], [0046], [0055], [0058], [0059], [0062], [0063]; figures 1-3, 6, 8	
Y	----- US 2008/300655 A1 (CHOLETTE MARTIN [US]) 4 December 2008 (2008-12-04) paragraphs [0034] - [0036], [0043], [0044], [0051] - [0060], [0069] - [0071], [0078], [0105]; figures 2-10; tables 1, 2	5,7,9,10
Y	----- US 2006/241725 A1 (LIBBUS IMAD [US] ET AL) 26 October 2006 (2006-10-26) abstract; figures 1, 4, 5, 6A-10 ----- -/--	7

☒ 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

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"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

9 January 2012

Date of mailing of the international search report

31/01/2012

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/039764

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.: 11-20, 31-40, 44-50, 55-60
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 therapy. Claims 11-20, 31-40, 44-50, 55-60 pertain to the delivery of therapeutical stimulation pulses to the human body nerves.
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.:

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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/039764

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/021504 A1 (MCCABE AARON [US] ET AL) 24 January 2008 (2008-01-24) paragraphs [0083] - [0086], [0090]; figures 13, 15 -----	8
A	US 2004/054297 A1 (WINGEIER BRETT M [US] ET AL) 18 March 2004 (2004-03-18) abstract; figures 5-10 -----	1-10
X	US 2006/106428 A1 (LIBBUS IMAD [US] ET AL) 18 May 2006 (2006-05-18) paragraphs [0074] - [0081]; figures 8, 15-17 -----	21-30
X	US 2007/179557 A1 (MASCHINO STEVEN E [US] ET AL) 2 August 2007 (2007-08-02) paragraphs [0058], [0061], [0083], [0105] - [0115]; figures 2, 8-11 -----	21-30
X	US 2008/058874 A1 (WESTLUND RANDY [US] ET AL) 6 March 2008 (2008-03-06) paragraphs [0035] - [0040], [0049] - [0051]; figures 2-4, 9 -----	41-43, 51-54
X	US 2006/135998 A1 (LIBBUS IMAD [US] ET AL) 22 June 2006 (2006-06-22) paragraphs [0062] - [0064], [0078] - [0080], [0088] - [0090]; figures 10,14,17 -----	41-43, 51,53,54

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2011/039764

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006167497 A1	27-07-2006	US 2006167497 A1 WO 2006081125 A2	27-07-2006 03-08-2006
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US 2006135998 A1	22-06-2006	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-10

System for delivering neurostimulation pulses to A-nerve fibers and B-nerve fibers with an evoked neural response detection circuit including a DETECTION TIMER to time a DELAY INTERVAL, a FIRST DETECTION WINDOW and a SECOND DETECTION WINDOW, and a COMPARATOR detecting evoked A-fiber response and evoked B-fiber response by USING THE DETECTION WINDOWS and DETECTION THRESHOLDS ASSOCIATED TO THE DETECTION WINDOWS.

2. claims: 21-30

System for delivering neurostimulation pulses to a vagus nerve and to the laryngeal muscle, comprising an evoked neural response detection circuit detecting evoked responses using one or more detection thresholds, and a SENSING PARAMETER ADJUSTOR to adjust the one or more detection thresholds.

3. claims: 41-43, 51-54

System for delivering neurostimulation pulses to a vagus nerve and to the laryngeal muscle, comprising an evoked neural response detection circuit, and a STIMULATION PARAMETER ADJUSTOR to adjust the stimulation intensity.
