

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
6 March 2008 (06.03.2008)

PCT

(10) International Publication Number
WO 2008/027339 A3(51) International Patent Classification:
A61N 1/36 (2006.01) A61B 5/08 (2006.01)

55014 (US). **JAMES, Kristofer, J.** [US/US]; 1073 Ticonderoga Trail, Eagan, Minnesota 55123 (US). **LEE, Kent** [US/US]; Dover Park View, Tower A # 01-02, Singapore, 138684 (US). **LIBBUS, Imad** [US/US]; 1726 Stanford Avenue, St. Paul, Minnesota 55105 (US). **CAPARSO, Anthony, V.** [US/US]; 80 Descanso Drive, Apt. 1325, San Jose, California 95134 (US). **KWOK, Jonathan** [CA/US]; 817 Buckland Ct., Denville, New Jersey 07834 (US). **PU, Yachuan** [CN/US]; 1811 Ulysses Street NE, Apt. 7, Minneapolis, Minnesota 55418 (US).

(21) International Application Number:
PCT/US2007/0 18846

(22) International Filing Date: 24 August 2007 (24.08.2007)

(25) Filing Language: English

(26) Publication Language: English

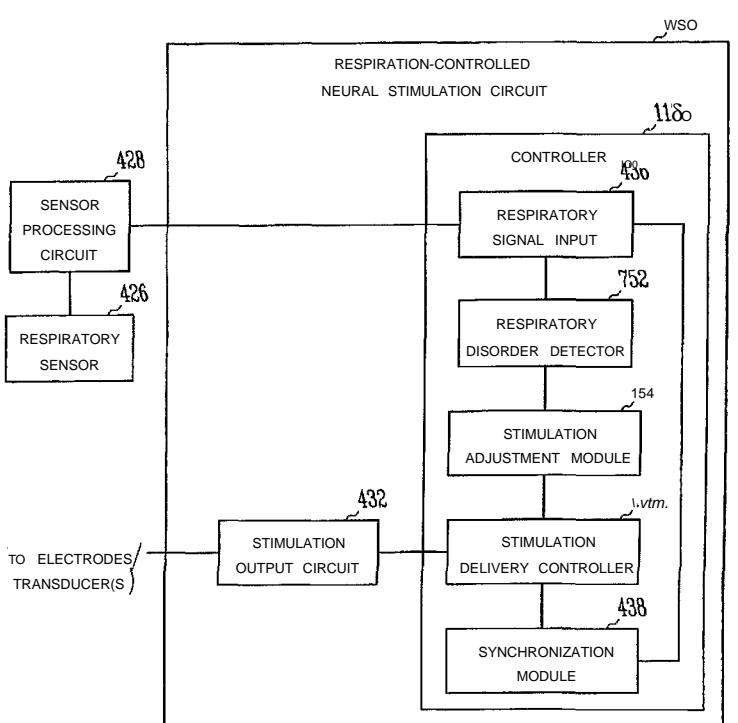
(30) Priority Data:
11/468,595 30 August 2006 (30.08.2006) US(74) Agents: **CLISE, Timothy, B.** et al; Schwegman, Lundberg, Woessner & Kluth, P.A., P.O. Box 2938, Minneapolis, Minnesota 55402 (US).(71) Applicant (for all designated States except US): **CARDIAC PACEMAKERS, INC.** [US/US]; 4100 Hamline Avenue North, St. Paul, Minnesota 55112-5798 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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,

(72) Inventors; and
(75) Inventors/Applicants (for US only): **HAEFNER, Paul, A.** [US/US]; 252 Cobbler Court, Circle Pines, Minnesota

[Continued on next page]

(54) Title: SYSTEM FOR NEURAL STIMULATION WITH RESPIRATORY FEEDBACK



(57) **Abstract:** A neural stimulation system controls the delivery of neural stimulation using a respiratory signal as a therapy feedback input. The respiratory signal is used to increase the effectiveness of the neural stimulation, such as vagal nerve stimulation, while decreasing potentially adverse side effects in respiratory functions. In one embodiment, the neural stimulation system synchronizes the delivery of the neural stimulation pulses to the respiratory cycles using a respiratory fiducial point in the respiratory signal and a delay interval. In another embodiment, the neural stimulation system detects a respiratory disorder and, in response, adjusts the delivery of the neural stimulation pulses and/or delivers a respiratory therapy treating the detected respiratory disorder.

WO 2008/027339 A3



MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, 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, MT, 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:**

24 July 2008

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/018846

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61N1/36
ADD. A61B5/08

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^a	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	US 6 021 352 A (CHRISTOPHERSON MARK A [US] ET AL) 1 February 2000 (2000-02-01)	1-4,7,8, 12-14, 27-30 5,6,31, 32 9-11
Y		
A	column 6, line 32 - column 7, line 67 column 12, line 43 - column 15, line 47 column 18, line 1 - column 19, line 50 column 21 , lines 1-38 column 24, line 39 - column 25, line 30 column 29, line 64 - column 30, line 60 figures 5,6,14,15,16c,17a ----- -/-	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- ¹A¹ document defining the general state of the art which is not considered to be of particular relevance
- ¹E¹ earlier document but published on or after the International filing date
- ¹L¹ 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)
- ¹O¹ document referring to an oral disclosure, use, exhibition or other means
- ¹P¹ document published prior to the international filing date but later than the priority date claimed

¹T¹ 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

¹X¹ 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

¹Y¹ 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.

¹S¹ document member of the same patent family

Date of the actual completion of the international search

9 May 2008

Date of mailing of the international search report

27/05/2008

Name and mailing address of the ISA/

European Patent Office, P.B 5818 Palentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Fischer, Olivier

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/018846

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 2004/210261 A1 (KING GARY W [US] ET AL) 21 October 2004 (2004-10-21)	1-4,9
Y	paragraphs [0005] - [0009], [0012], [0032] - [0038], [0043] - [0047], [0072] - [0074];- figures 1,2,6 -----	31,32
X	US 2003/153953 A1 (PARK EULJOON [US] ET AL) 14 August 2003 (2003-03-14) paragraphs [0143] - [0153]; figures 8-10 -----	1,2,12, 13,27,30
X	US 2005/149127 A1 (LIBBUS IMAD [US]) 7 July 2005 (2005-07-07) paragraphs [0097] - [0100]; figures 17,19A-20B -----	1,9
Y	US 2005/039745 A1 (STAHHMANN JEFFREY E [US] ET AL) 24 February 2005 (2005-02-24) paragraphs [0100] - [0105]; figures 5-8B -----	5,6
A	US 2005/085866 A1 (TEHRANI AMIR J [US]) 21 April 2005 (2005-04-21) abstract; figures 1-8 -----	1-14, 27-32
P,L, X	US 2006/271108 A1 (LIBBUS IMAD [US] ET AL) 30 November 2006 (2006-11-30) paragraphs [0037] - [0044], [0065] - [0069]; figures 2,4,6,13 -----	1-4,8-11

INTERNATIONAL SEARCH REPORT

international application NO
PCT/US2007/018846

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 15-26, 33-38

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, these claims pertain to the application of therapeutic neural stimulation to the human body

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 D 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

1 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 report covers only those claims for which fees were paid, specifically claims Nos

4 D 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

Information on patent family members

International application No

PCT/US2007/018846

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 6021352	A	01-02-2000	AT 301490	T	15-08-2005	
			AU 727327	B2	07-12-2000	
			AU 3649797	A	14-01-1998	
			CA 2259155	A 1	31-12-1997	
			DE 69733954	D 1	15-09-2005	
			DE 69733954	T 2	18-05-2006	
			DK 0917486	T 3	12-12-2005	
			EP 0917486	A 1	26-05-1999	
			ES 2246516	T 3	16-02-2006	
			JP 11514557	T	14-12-1999	
			JP 2004167211	A	17-06-2004	
			UO 9749455	A 1	31-12-1997	
US 2004210261	A 1	21-10-2004	WO 2004093982	A 1	04-11-2004	
us 2003153953	A 1	14-08-2003	US 2003153956	A 1	14-08-2003	
us 2005149127	A 1	07-07-2005	NONE			
us 2005039745	A 1	24-02-2005	NONE			
US 2005085866	A 1	21-04-2005	DE 112004001953	T 5	26-10-2006	
			DE 112004001954	T 5	26-10-2006	
			DE 112004001957	T 5	31-08-2006	
			US 2006030894	A 1	09-02-2006	
			US 2006036294	A 1	16-02-2006	
			us 2007021795	A 1	25-01-2007	
			us 2005085865	A 1	21-04-2005	
			us 2005085867	A 1	21-04-2005	
			us 2005085868	A 1	21-04-2005	
			us 2005085869	A 1	21-04-2005	
			us 2005085734	A 1	21-04-2005	
			WO 2005037172	A 2	28-04-2005	
			IAIO 2005037366	A 1	28-04-2005	
			WO 2005037220	A 2	28-04-2005	
			WO 2005037077	A 2	28-04-2005	
			WO 2005037173	A 2	28-04-2005	
			WO 2005037174	A 2	28-04-2005	
US 2006271108	A 1	30-11-2006	WO 2006127366	A 1	30-11-2006	