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- (71) **Applicant (for all designated States except US):**  
**BOSTON SCIENTIFIC NEUROMODULATION CORPORATION** [US/US]; 25155 Rye Canyon Loop, Valencia, CA 91355 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **CHEN, Joey** [US/US]; 24811 Avenida Presidio, Valencia, CA 91355 (US). **OZAWA, Robert** [US/US]; 21819 Lopez Street, Woodland Hills, CA 91364 (US). **HYUN, Joonho** [US/US]; 24409 Mira Vista Street, Valencia, CA 91355 (US). **DRONOV, Vasily** [US/US]; 626 Almaden Walk Loop, San Jose, CA 95125 (US).

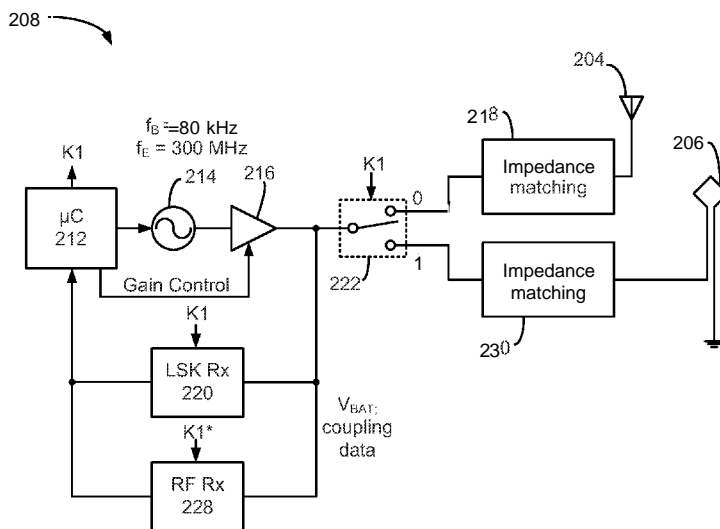
- (74) **Agent:** **LEWIS, Terril, G.;** Wong, Cabello, Lutsch, Rutherford & Brucculeri L.L.P., 20333 Tomball Parkway, Suite 600, Houston, TX 77070 (US).
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, 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.
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**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(H))

[Continued on next page]

(54) **Title:** CHARGING SYSTEM FOR AN IMPLANTABLE MEDICAL DEVICE EMPLOYING MAGNETIC AND ELECTRIC FIELDS



**Figure 7**

(57) **Abstract:** A base station for passively recharging a battery in an implant without patient involvement is disclosed. The base station can be hand held or may comprise equipment configured to be placed at a fixed location, such as under a bed, on or next to a wall, etc. The base station can generate electric and magnetic fields (E-field and B-field) that couple with an antenna and a receiving coil within the implant to generate a charging current for charging the implant's battery. No handling or manipulation on part of the patient is necessary; the implant battery is passively charged whenever the patient is within range of either the magnetic or electric charging fields generated by base station. Charging using the B-field occurs when the IPG is at a relatively short distance from the base station, while charging using the E-field occurs at longer distances. Back telemetry from the implant can inform the base station whether B-field or E-field charging is indicated, and is preferred if possible for its ability to transfer higher amounts of power to the

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implant.



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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Hi))* — *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))*

**Published:**

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

**(88) Date of publication of the international search report:**

23 February 2012

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/US2011/041606

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. A61N1/378 ADD. A61N1/372		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) A61N A61F		
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 , WPI Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
<b>Category*</b>	<b>Citation of document, with indication, where appropriate, of the relevant passages</b>	<b>Relevant to claim No.</b>
X	wo 2007/098367 A2 (UNIV PITTSBURGH [US] ; JACOB DOREEN K [US] ; STEFKO SUSAN TONYA [US] ; HA) 30 August 2007 (2007-08-30)	1,4-7 , 21,22
Y	figure 1 paragraphs [0042] , [0043] , [0049] , [0051] -----	2,3
X	us 6 430 444 B1 (BORZA MICHAEL A [CA] ) 6 August 2002 (2002-08-06)	1,4, 6-11, 20-23 , 25,26
A	abstract; figures 4, 5, 6a col umn 1, lines 15-17 col umn 5, lines 44-45 col umn 6, lines 40-66 col umn 7, lines 12-14, 39- 45 col umn 8, lines 27-33 , 47- 50 ----- - / - -	24
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> 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  26 September 2011		Date of mailing of the international search report  19/12/2011
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer  Pfeiffer, Uwe

**INTERNATIONAL SEARCH REPORT**

International application No PCT/US201 1/041606
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	wo 00/ 13585 AI (WOLFE RESEARCH PTY LTD [AU] ; SORMANN GERARD woLFE [AU] ; WEST SIMON MIC) 16 March 2000 (2000-03 - 16) claim 4 -----	2,3
A	US 2006/ 184209 AI (JOHN CONSTANCE M [US] ET AL) 17 August 2006 (2006-08- 17) abstract ; figure s 8A,8B paragraph [0063] -----	1- 11, 20-26
X	US 5 769 877 A (BARRERAS SR FRANCISCO JOSE [US] ) 23 June 1998 (1998 -06-23 ) abstract ; figure 1 column 10, lines 7- 15 -----	1

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2011/041606

## 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.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
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.:

1-11, 20-26

### 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/US2011/041606
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-11, 20-26

External device for charging an IMD

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2. claims: 12-19

Implantable medical device comprising two antennas for charging.

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3. claims: 27-36

Method of charging an IMD, comprising the step of determining if the IMD can be charged by a magnetic field.

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