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[Continued on next page]

(54) Title: METHOD AND DEVICE FOR TREATING CARDIAC ARRHYTHMIAS

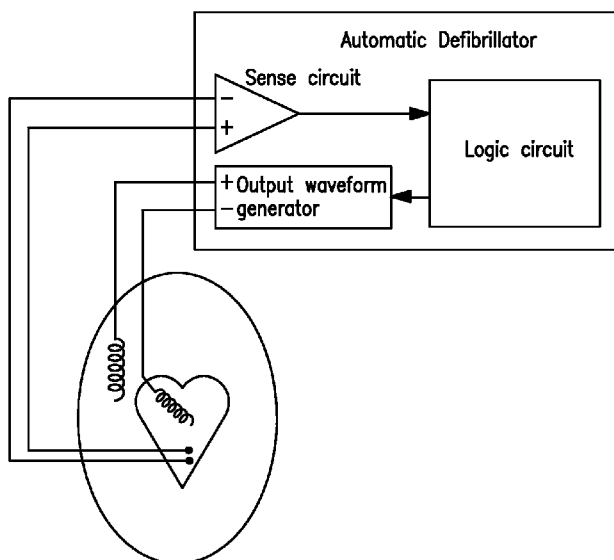


FIG. 1

(57) Abstract: The present invention provides both methods and devices for termination of arrhythmias, such as ventricular or atrial tachyarrhythmias. The device and method involves application of alternating current (AC) for clinically significant durations at selected therapeutic frequencies through the cardiac tissue to a subject experiencing arrhythmia. Methods are also provided to minimize or eliminate pain during defibrillation.

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SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,  
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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))*

**Published:**

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21 July 2011

**A. CLASSIFICATION OF SUBJECT MATTER***A61N 1/39(2006.01)i, A61N 1/05(2006.01)i*

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 1/39; A61N 1/36; A61B 17/36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; Keywords: cardiac, arrhythmia, alternating current, low frequency, electrode, waveform generator, implant

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6408205 B1 (ALEXIS RENIRIE et al.) 18 June 2002 See claim 1, column 3, lines 34-50, figures 1A and 5	45-60
A	ROMAN W. DESANCTIS, "Electrical Conversion of Ventricular Tachycardia", Journal of American Medical Association(JAMA), February 22, 1965, Vol. 191, No. 8, pages 96-100 See the whole document	45-60
A	US 6317631 B1 (SHLOMO BEN-HAIM et al.) 13 November 2001 See claim 32, column 6, lines 10-19, figure 2	45-60
A	US 6120499A A (DUANE DICKENS et al.) 19 September 2000 See claim 1, abstract, figure 1	45-60

 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 application or patent 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

24 MAY 2011 (24.05.2011)

Date of mailing of the international search report

**24 MAY 2011 (24.05.2011)**

Name and mailing address of the ISA/KR

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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.  Claims Nos.: 1-44,61-64  
because they relate to subject matter not required to be searched by this Authority, namely:  
Claims 1-44 and 61-64 pertain to methods for treatment of human body by therapy and thus relate to a subject matter which this International Searching Authority is not required to search under Article 17(2)(a)(i) and Rule 39.1(iv) PCT.
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:

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 fee, this Authority did not invite payment of any additional fee.
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

Information on patent family members

International application No.

**PCT/US2010/047859**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6408205 B1	18.06.2002	DE 69728245 D1	29.04.2004
		DE 69728245 T2	10.03.2005
		EP 0850664 A1	01.07.1998
		EP 0850664 B1	24.03.2004
		US 06110098 A	29.08.2000
		US 6330475 B1	11.12.2001
US 6317631 B1	13.11.2001	AU 1170297 A	01.08.1997
		AU 1958997 A	02.09.1997
		AU 1997-11701 B2	10.02.2000
		AU 1997-11702 B2	16.09.1999
		AU 1997-12066 B2	11.11.1999
		AU 1997-12067 B2	21.09.2000
		AU 1997-16169 B2	22.06.2000
		AU 1997-17314 B2	08.06.2000
		AU 1997-17315 B2	21.10.1999
		AU 1997-19589 B2	19.08.1999
		AU 1997-21314 B2	01.06.2000
		AU 1997-22755 B2	22.06.2000
		AU 1997-27115 B2	18.01.2001
		AU 1997-36328 B2	25.01.2001
		AU 1997-42183 B2	16.12.1999
		AU 1998-53387 B2	05.07.2001
		AU 1998-53388 B2	06.12.2001
		AU 1999-17432 A1	28.10.1999
		AU 1999-17432 B2	19.07.2001
		AU 1999-47964 A1	14.02.2000
		AU 2000-78117 A1	10.05.2001
		CA 2197986 A1	29.02.1996
		CA 2197986 C	18.03.2008
		CA 2237992 A1	26.03.1998
		CA 2237992 C	06.11.2007
		CA 2242353 A1	17.07.1997
		CA 2242353 C	17.03.2009
		CA 2242356 A1	17.07.1997
		CA 2242356 C	23.08.2005
		CA 2242360 C	10.03.2009
		CA 2246284 C	29.01.2008
		CA 2246287 A1	21.08.1997
		CA 2246287 C	24.10.2006
CA 2246288 C	20.09.2005		
CA 2246332 A1	21.08.1997		
CA 2246332 C	14.04.2009		
CA 2246340 A1	21.08.1997		
CA 2246340 C	16.08.2005		
CA 2246341 A1	21.08.1997		
CA 2246341 C	01.05.2007		
CA 2247942 A1	09.07.1998		
CA 2247942 C	02.10.2007		

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/047859**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CA 2247992 A1	09.07.1998
		CA 2247992 C	22.05.2007
		CA 2248223 C	16.01.2007
		CA 2255807 A1	27.11.1997
		CA 2255807 C	27.01.2009
		CA 2262352 C	14.04.2009
		CA 2338201 A1	03.02.2000
		CA 2607769 A1	29.02.1996
		CN 1168511 C0	29.09.2004
		CN 1168625 A0	24.12.1997
		CN 1206006 C0	15.06.2005
		CN 1211930 A0	24.03.1999
		CN 1226960 C0	16.11.2005
		CN 1310636 A0	29.08.2001
		EP 0679068 A1	25.08.2004
		EP 0679068 B1	16.03.2005
		EP 0776176 A1	07.01.1999
		EP 0776176 B1	29.12.1999
		EP 0883375 A2	11.05.2005
		EP 0883375 B1	11.05.2005
		EP 0888082 A1	03.11.2004
		EP 0888082 B1	05.03.2008
		EP 0888086 A1	16.03.2005
		EP 0888086 B1	27.07.2005
		EP 0888150 A1	03.09.2003
		EP 0888150 B1	24.03.2004
		EP 0893965 A1	03.11.2004
		EP 0893965 A1	03.02.1999
		EP 0893965 A4	07.04.1999
		EP 0893965 B1	09.03.2005
		EP 0893967 A1	08.01.2003
		EP 0893967 B1	17.03.2004
		EP 0894473 A2	03.02.1999
		EP 0894473 A3	07.07.1999
		EP 0894473 B1	12.11.2003
		EP 0901341 A1	10.11.2004
		EP 0901341 B1	16.02.2005
		EP 0904127 A1	29.09.2004
		EP 0904127 B1	23.02.2005
		EP 0910278 A1	27.07.2005
		EP 0910278 B1	23.11.2005
		EP 0910299 A1	29.05.2002
		EP 0910299 B1	12.02.2003
		EP 0910300 A1	19.02.2003
		EP 0910300 B1	03.12.2003
		EP 0910429 A1	19.01.2005
		EP 0910429 B1	16.03.2005
		EP 0926997 A1	18.08.2004
		EP 0926997 B1	17.11.2004
		EP 0930917 A1	21.05.2003

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/047859**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		EP 0930917 B1	15.10.2003
		EP 0932362 A2	03.11.2004
		EP 0932362 B1	26.01.2005
		EP 0944350 A1	22.01.2003
		EP 0944350 A1	29.09.1999
		EP 0944350 B1	03.12.2003
		EP 0973581 A1	26.01.2000
		EP 0973581 A4	05.04.2000
		EP 1011793 A1	28.06.2000
		EP 1011794 A1	28.06.2000
		EP 1011795 A1	28.06.2000
		EP 1011795 B1	10.03.2010
		EP 1011796 A1	28.06.2000
		EP 1011796 B1	07.04.2010
		EP 1098674 A2	16.05.2001
		EP 1098674 A4	02.05.2007
		EP 1382293 A2	21.01.2004
		EP 1382293 A3	28.01.2004
		EP 1382293 B1	02.07.2008
		EP 1428472 A2	16.06.2004
		EP 1428472 A3	28.05.2008
		EP 1491139 A2	29.12.2004
		EP 1491139 A3	01.06.2005
		EP 1491139 B1	29.08.2007
		EP 1514577 A1	16.03.2005
		JP 08-504653 A	21.05.1996
		JP 10-507104 A	14.07.1998
		JP 11-313894 A	16.11.1999
		JP 2000-501018 A	02.02.2000
		JP 2000-502931 A	14.03.2000
		JP 2000-505325 A	09.05.2000
		JP 2000-506027 A	23.05.2000
		JP 2000-506409 A	30.05.2000
		JP 2000-507118 A	13.06.2000
		JP 2000-508223 A	04.07.2000
		JP 2000-508224 A	04.07.2000
		JP 2000-514320 A	31.10.2000
		JP 2001-500749 A	23.01.2001
		JP 2001-501490 A	06.02.2001
		JP 2001-501503 A	06.02.2001
		JP 2001-502189 A	20.02.2001
		JP 2001-502556 A	27.02.2001
		JP 2001-505472 A	24.04.2001
		JP 2001-506870 A	29.05.2001
		JP 2001-507951 A	19.06.2001
		JP 2001-509036 A	10.07.2001
		JP 2002-500521 A	08.01.2002
		JP 2002-511774 A	16.04.2002
		JP 2002-514947 A	21.05.2002
		JP 2002-521099 A	16.07.2002

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/047859**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		JP 2004-275776 A	07. 10. 2004
		JP 2004-283601 A	14. 10. 2004
		JP 2007-044537 A	22. 02. 2007
		JP 2007-175505 A	12. 07. 2007
		JP 2007-301403 A	22. 11. 2007
		JP 2008-018252 A	31. 01. 2008
		JP 2008-100092 A	01. 05. 2008
		JP 2008-149161 A	03. 07. 2008
		JP 2009-045454 A	05. 03. 2009
		JP 2009-066429 A	02. 04. 2009
		JP 2009-207926 A	17. 09. 2009
		JP 3708121 B2	19. 10. 2005
		JP 3881029 B2	17. 11. 2006
		JP 3930052 B2	13. 06. 2007
		JP 3934159 B2	20. 06. 2007
		JP 3935943 B2	27. 06. 2007
		JP 3949729 B2	25. 07. 2007
		JP 3949730 B2	25. 07. 2007
		JP 3964462 B2	01. 06. 2007
		JP 4018147 B2	05. 12. 2007
		JP 4025309 B2	19. 12. 2007
		JP 4027976 B2	26. 12. 2007
		JP 4040672 B2	30. 01. 2008
		JP 4044590 B2	06. 02. 2008
		JP 4065027 B2	19. 03. 2008
		JP 4102439 B2	18. 06. 2008
		JP 4130226 B2	06. 08. 2008
		JP 4166277 B2	15. 10. 2008
		JP 4175662 B2	05. 11. 2008
		JP 4208054 B2	14. 01. 2009
		JP 4236014 B2	11. 03. 2009
		JP 4394733 B2	23. 10. 2009
		JP 4448194 B2	29. 01. 2010
		JP 4518339 B2	28. 05. 2010
		JP 4589365 B2	17. 09. 2010
		KR 10-1999-0077062 A	25. 10. 1999
		KR 10-2001-0071971 A	31. 07. 2001
		US 05391199 A	21. 02. 1995
		US 05443489 A	22. 08. 1995
		US 05480422 A	02. 01. 1996
		US 05546951 A	20. 08. 1996
		US 05568809 A	29. 10. 1996
		US 05694945 A	09. 12. 1997
		US 05713946 A	03. 02. 1998
		US 05738096 A	14. 04. 1998
		US 05840025 A	24. 11. 1998
		US 05928248 A	27. 07. 1999
		US 06063022 A	16. 05. 2000
		US 06066094 A	23. 05. 2000
		US 06083170 A	04. 07. 2000



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/047859**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2001-003790 A1	14.06.2001
		US 2002-032380 A1	14.03.2002
		US 2002-032467 A1	14.03.2002
		US 2002-045809 A1	18.04.2002
		US 2002-045810 A1	18.04.2002
		US 2002-045812 A1	18.04.2002
		US 2002-052632 A1	02.05.2002
		US 2002-055674 A1	09.05.2002
		US 2002-065455 A1	30.05.2002
		US 2002-087089 A1	04.07.2002
		US 2002-165448 A1	07.11.2002
		US 2002-169481 A1	14.11.2002
		US 2002-183809 A1	05.12.2002
		US 2003-040777 A1	27.02.2003
		US 2003-139668 A1	24.07.2003
		US 2003-191383 A1	09.10.2003
		US 2004-138710 A1	15.07.2004
		US 2004-243190 A1	02.12.2004
		US 2005-004450 A1	06.01.2005
		US 2005-215887 A1	29.09.2005
		US 2007-027490 A1	01.02.2007
		US 2007-088393 A1	19.04.2007
		US 2007-162079 A1	12.07.2007
		US 2007-239216 A9	11.10.2007
		US 2008-058879 A1	06.03.2008
		US 2008-065159 A1	13.03.2008
		US 2008-065163 A1	13.03.2008
		US 2008-065164 A1	13.03.2008
		US 2008-140142 A1	12.06.2008
		US 6171303 B1	09.01.2001
		US 6200310 B1	13.03.2001
		US 6203493 B1	20.03.2001
		US 6233484 B1	15.05.2001
		US 6236887 B1	22.05.2001
		US 6298268 B1	02.10.2001
		US 6415178 B1	02.07.2002
		US 6436095 B1	20.08.2002
		US 6463324 B1	08.10.2002
		US 6751492 B2	15.06.2004
		US 6915149 B2	05.07.2005
		US 6983179 B2	03.01.2006
		US 6996431 B2	07.02.2006
		US 7062318 B2	13.06.2006
		US 7167748 B2	23.01.2007
		US 7187970 B2	06.03.2007
		US 7218963 B2	15.05.2007
		US 7460907 B1	02.12.2008
US 6120499A A	19.09.2000	WO 95-24160 A1	14.09.1995