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English

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English

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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, QA, RO, RS, RU, RW, 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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(54) Title: METHOD AND DEVICE TO MONITOR PATIENTS WITH KIDNEY DISEASE

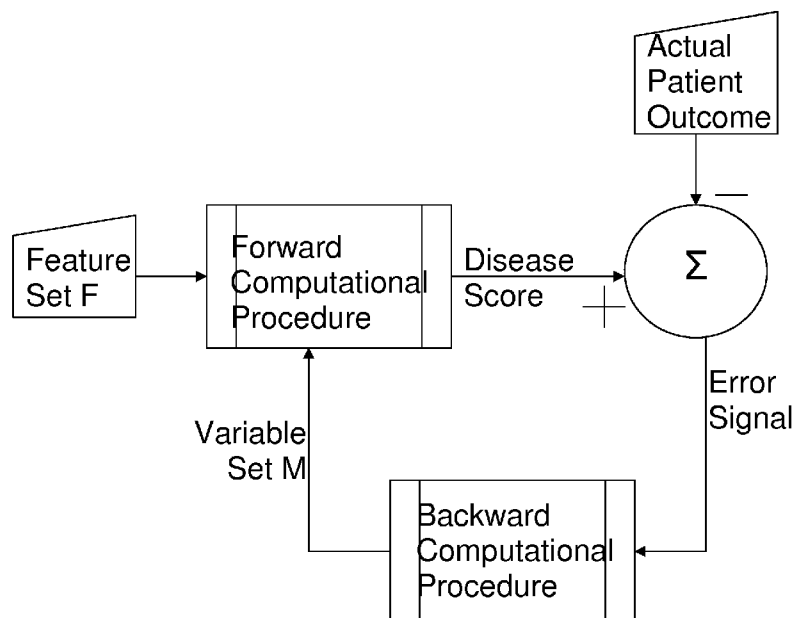


FIG. 8

(57) Abstract: A medical monitoring device for monitoring electrical signals from the body of a subject is described. The medical monitoring device monitors electrical signals originating from a cardiac cycle of the subject and associates each cardiac cycle with a time index. The medical monitoring device applies a forward computational procedure to generate a risk score indicative of hyperkalemia, hypokalemia or arrhythmia of the subject. The medical monitoring device can adjust the forward computational procedure based upon clinical data obtained from the subject.



GM, KE, LR, LS, MW, MZ, NA, RW, 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).

— *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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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/034323

A. CLASSIFICATION OF SUBJECT MATTER INV. A61B5/02 A61M1/00 A61B5/145 A61N1/00 A61N1/37 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) A61B A61M A61N		
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 practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 750 494 A (KING WENDELL L [US]) 14 June 1988 (1988-06-14)	1-3,5, 27,29, 30,36, 37,40
Y	column 14, line 3 - column 18, line 25; claims 1-2,4,9; figures 1-8 column 3, lines 48-60 -----	4,6-14, 17,38, 39,41-47
X,P	US 2011/130666 A1 (DONG YANTING [US] ET AL) 2 June 2011 (2011-06-02) paragraphs [0001] - [0011], [0046] - [0060], [0063] - [0064], [0082] - [0083], [0093] - [0094], [0100] - [0102]; claims 1-7; figures 1-5 ----- -/-	1,2
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. </div>		
<div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search		Date of mailing of the international search report
24 October 2012		07/11/2012
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 Apostol, Simona

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/034323

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 2006/217771 A1 (SOYKAN ORHAN [US] ET AL) 28 September 2006 (2006-09-28) cited in the application	1,2
Y	claims 1-7; figures 1-3	4,9,11, 13,38, 39,41
X	----- US 2008/021337 A1 (LI DAN [US] ET AL) 24 January 2008 (2008-01-24) paragraphs [0021] - [0039], [0048], [0052] - [0053]; claims 1,8; figures 1,6	1,19-26
Y	----- US 2011/066043 A1 (BANET MATT [US] ET AL) 17 March 2011 (2011-03-17) paragraphs [0041], [0045], [0049], [0073]; figures 1-3	42-47
Y	----- EP 2 100 553 A1 (BIOTRONIK CRM PATENT AG [CH]) 16 September 2009 (2009-09-16) paragraphs [0001] - [0005], [0033] - [0036], [0040] - [0042], [0048] - [0054]; claim 5; figures 3,5	6-8,10, 12,14,17
Y	----- COAST D A ET AL: "AN APPROACH TO CARDIAC ARRHYTHMIA ANALYSIS USING HIDDEN MARKOV MODELS", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, IEEE SERVICE CENTER, PISCATAWAY, NJ, USA, vol. 37, no. 9, 1 September 1990 (1990-09-01), pages 826-835, XP000165397, ISSN: 0018-9294, DOI: 10.1109/10.58593 section I Introduction and Section II, subsection D.Application to Arrhythmia Analysis, section IIIA. Model structure; figures 2-3	6,14,17
X	----- US 2004/215090 A1 (ERKKILA JOUNI [FI] ET AL ERKKILAE JOUNI [FI] ET AL) 28 October 2004 (2004-10-28)	1,2,4-6, 14,17, 19-27, 29,30
Y	paragraphs [0008], [0012] - [0013], [0040] - [0058], [0062] - [0063]; figures 1-7	7-13 15,16,18
X	----- US 7 756 572 B1 (FARD MOHSEN [US] ET AL) 13 July 2010 (2010-07-13) abstract; figures 18,24; table I column 24, line 45 - column 27, line 67	1
X	----- US 2009/275849 A1 (STEWART DONALD-BANE [GB]) 5 November 2009 (2009-11-05) abstract; figures 2-3 paragraphs [0063] - [0080]	27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/034323

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.:

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: 1-4

Medical monitor for determining body potassium by monitoring electrical signals wherein a forward computational procedure is adjusted based on error between risk score and clinical information

2. claims: 27-47

Use of a medical monitor for sending an alarm when the risk score (calculated based on a plurality of features of a cardiac cycle) exceed a time threshold,

3. claims: 19-25

Medical monitor using weighted sum algorithm for calculation of a risk score based on plurality of features converted to scalar feature scores on a common scale

4. claims: 5-18, 26

Medical monitor device calculating the risk score based on the comparison of a plurality of features of the cardiac cycle with determinant values

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/034323

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4750494	A	14-06-1988	NONE	
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US 2009275849	A1	05-11-2009	NONE	