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(54) **System for processing data from ambulatory physiological monitoring**

(57) This invention provides a system for processing physiological sensor signal data comprising: a wearable construction comprising one or more sensors sensitive to physiological systems or processes comprising electrocardiographic (ECG) activity and respiratory activity; and computer memory comprising computer instructions to retrieve sensor signals from said wearable construction when worn by a monitored subject during periods comprising unconstrained activities, said retrieved sensor

signals comprising ECG signals and respiratory signals; generate an RR interval signal from said ECG signal comprising data describing successive intervals between successive R-waves; and estimate respiratory components in said ECG signal by adaptively processing said ECG signals jointly with said respiratory signals in order to reduce an error signal, wherein a high frequency heart rate variability (HF HRV) signal comprises said estimated respiratory components, a low frequency heart rate variability (LF HRV) signal comprises said error signal.

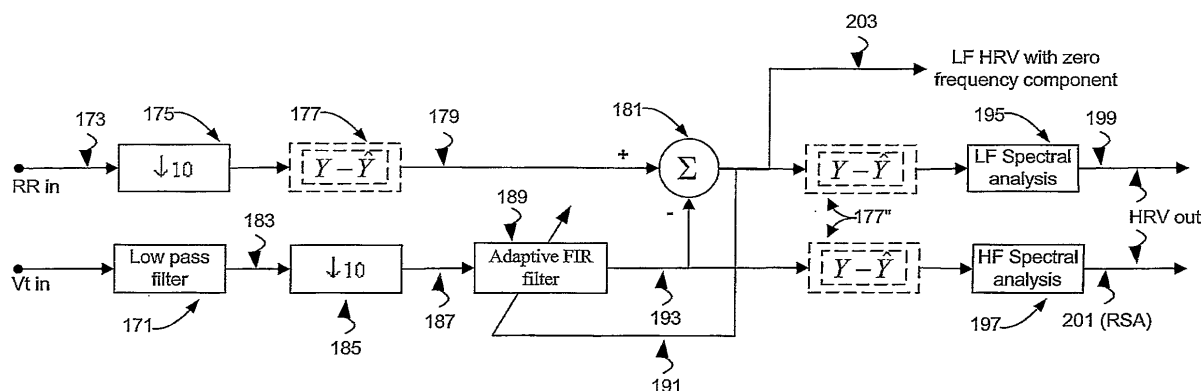


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7663

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	BALOCCHI R ET AL: "A methodology for evaluating the influence of the respiratory component in measuring the complexity of heart rate variability", COMPUTERS IN CARDIOLOGY 1992, PROCEEDINGS OF DURHAM, NC, USA 11-14 OCT. 1992, LOS ALAMITOS, CA, USA, IEEE COMPUT. SOC, US, 11 October 1992 (1992-10-11), pages 407-410, XP010032203, DOI: 10.1109/CIC.1992.269500 ISBN: 978-0-8186-3552-6	1,4,6-8	INV. A61B5/0205 A61B5/0402 A61B5/08 ADD. A61B5/107
Y	* Abstract 2. Materials and Methods *	5,9-15	
X	TOSIAKI YAMANOUCI ET AL: "Detection of Respiratory Sinus Arrhythmia by Using Adaptive Filter", JAPANESE JOURNAL OF MEDICAL ELECTRONICS AND BIOLOGICAL ENGINEERING, vol. 31, no. 1, 1 March 2003 (2003-03-01), pages 18-24, XP55069667, DOI: http://dx.doi.org/10.11239/jsmbe1963.31.18	1-4	
Y	* abstract; figures 1,2 *	5,9-15	
X	VARANINI M ET AL: "Effectiveness of adaptive filtering in cancelling the respiratory component from cardiovascular series", COMPUTERS IN CARDIOLOGY, 1996 INDIANAPOLIS, IN, USA 8-11 SEPT. 1996, NEW YORK, NY, USA, IEEE, US, 8 September 1996 (1996-09-08), pages 517-520, XP010205950, DOI: 10.1109/CIC.1996.542587 ISBN: 978-0-7803-3710-7	1	
Y	* the whole document *	9-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 November 2013	Examiner Lahorte, Philippe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7663

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	US 6 551 252 B2 (SACKNER MARVIN A [US] ET AL) 22 April 2003 (2003-04-22) * figure 2 *	5	
A	----- EP 1 079 310 A2 (LAERDAL MEDICAL AS [NO]) 28 February 2001 (2001-02-28) * paragraphs [0009] - [0021]; figure 3 *	1	
A	----- JP 2003 225211 A (LEADTEK RESEARCH INC; KAKU HAKUSHO) 12 August 2003 (2003-08-12) * paragraph [0008] *	1	
A	----- TAZEBAY M V ET AL: "Adaptive time-frequency analysis of autonomic nervous system", ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY, 1995., IEEE 17TH ANNUAL CONFERENCE MONTREAL, QUE., CANADA 20-23 SEPT. 1995, NEW YORK, NY, USA, IEEE, US, vol. 2, 20 September 1995 (1995-09-20), pages 1073-1074, XP010215100, DOI: 10.1109/IEMBS.1995.579494 ISBN: 978-0-7803-2475-6 * the whole document *	1	
A	----- VARANINI M ET AL: "Adaptive Filtering of ECG Signal for Deriving Respiratory Activity", COMPUTERS IN CARDIOLOGY, IEEE COMPUTER SOCIETY, US, FR, 1 September 1990 (1990-09-01), pages 621-624, XP002524559, ISSN: 0276-6574, DOI: 10.1109/CIC.1990.144296 [retrieved on 2002-08-06] * "Summary" and "Methods"; figure 3 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search Munich		Date of completion of the search 22 November 2013	Examiner Lahorte, Philippe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.02 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7663

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	SAGIE ET AL.: "An improved method for adjusting the QT interval for heart rate (the Framingham heartStudy", AM J CARDIOL, vol. 70, 1992, pages 797-801, XP026356432, * abstract; figures 1-2 *	9-15	
Y	TODT H ET AL: "Mode of QT correction for heart rate: Implications for the detection of inhomogeneous repolarization after myocardial infarction", AMERICAN HEART JOURNAL, MOSBY- YEAR BOOK INC, US, vol. 124, no. 3, 1 September 1992 (1992-09-01), pages 602-609, XP022926720, ISSN: 0002-8703, DOI: 10.1016/0002-8703(92)90266-X [retrieved on 1992-09-01] * abstract; figures 2, 4; table II * * page 602, column 2 - page 605, column 1 *	9-15	
Y	US 6 238 350 B1 (NEILSON JAMES MCEWAN MCINTYRE [GB]) 29 May 2001 (2001-05-29) * abstract; figures 1-2 * * column 1, line 56 - column 3, line 61 *	9-15	
Y	PATRICK DAVEY: "How to correct the QT interval for the effects of heart rate in clinical studies", JOURNAL OF PHARMACOLOGICAL AND TOXICOLOGICAL METHODS, vol. 48, no. 1, 1 July 2002 (2002-07-01), pages 3-9, XP055089624, ISSN: 1056-8719, DOI: 10.1016/S1056-8719(03)00008-X * abstract; figures 2-3 * * paragraphs [0002], [03.2], [04.3] *	9-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search Munich		Date of completion of the search 22 November 2013	Examiner Lahorte, Philippe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.92 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 11 18 7663

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8

System for processing physiological sensor signal data,
estimating respiratory components in an ECG signal.

2. claims: 9-15

System for processing physiological sensor signal data,
estimating corrected QT intervals.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6551252	B2	22-04-2003	
		AU 5359901 A	30-10-2001
		CA 2405848 A1	25-10-2001
		EP 1296591 A2	02-04-2003
		EP 2324760 A2	25-05-2011
		EP 2324761 A2	25-05-2011
		IL 152300 A	19-08-2007
		JP 5084923 B2	28-11-2012
		JP 2003530184 A	14-10-2003
		JP 2010279715 A	16-12-2010
		JP 2011136182 A	14-07-2011
		US 2002032386 A1	14-03-2002
		US 2003135127 A1	17-07-2003
		US 2011087115 A1	14-04-2011
		WO 0178577 A2	25-10-2001

EP 1079310	A2	28-02-2001	
		AU 772132 B2	08-04-2004
		AU 5335100 A	01-03-2001
		EP 1079310 A2	28-02-2001
		JP 2001104259 A	17-04-2001
		NO 994153 A	28-02-2001
		US 6807442 B1	19-10-2004

JP 2003225211	A	12-08-2003	NONE

US 6238350	B1	29-05-2001	
		DE 69824163 D1	01-07-2004
		DE 69824163 T2	23-06-2005
		EP 0971627 A1	19-01-2000
		JP 2001524849 A	04-12-2001
		US 6238350 B1	29-05-2001
		WO 9840011 A1	17-09-1998

专利名称(译)	用于处理来自动态生理监测的数据的系统		
公开(公告)号	EP2508124A3	公开(公告)日	2014-01-01
申请号	EP2011187663	申请日	2004-11-18
[标]申请(专利权)人(译)	阿迪达斯股份公司		
申请(专利权)人(译)	阿迪达斯		
当前申请(专利权)人(译)	阿迪达斯		
[标]发明人	KEENAN DESMOND B COYLE MICHAEL		
发明人	KEENAN, DESMOND B. COYLE, MICHAEL		
IPC分类号	A61B5/0205 A61B5/0402 A61B5/08 A61B5/107 A61B A61B5/00 A61B5/04 A61B5/103		
CPC分类号	A61B5/721 A61B5/0002 A61B5/01 A61B5/0205 A61B5/02055 A61B5/029 A61B5/0402 A61B5/0456 A61B5/0468 A61B5/0476 A61B5/0488 A61B5/0806 A61B5/085 A61B5/1073 A61B5/4803 A61B5/6804 A61B5/725 A61B2560/0242 A61B2562/0219		
优先权	60/586347 2004-07-08 US 60/523495 2003-11-18 US		
其他公开文献	EP2508124A2		
外部链接	Espacenet		

摘要(译)

本发明提供了一种用于处理生理传感器信号数据的系统，包括：可穿戴结构，包括对生理系统或过程敏感的一个或多个传感器，包括心电图（ECG）活动和呼吸活动；计算机存储器包括计算机指令，用于在包括无约束活动的时段期间由被监测对象佩戴时从所述可佩戴结构检索传感器信号，所述检索到的传感器信号包括ECG信号和呼吸信号；从所述ECG信号产生RR间期信号，该信号包括描述连续R波之间的连续间隔的数据；通过与所述呼吸信号联合自适应地处理所述ECG信号以估计所述ECG信号中的呼吸分量，以便减少误差信号，其中高频心率变异性（HF HRV）信号包括所述估计的呼吸分量，低频心率变异性（LF HRV）信号包括所述误差信号。

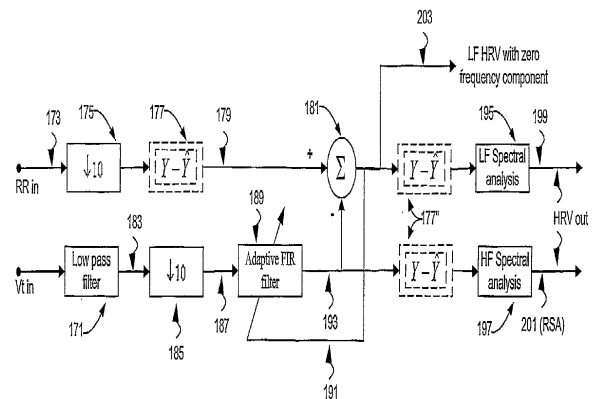


FIG. 7