(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 910 182 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
13.01.2016 Bulletin 2016/02

(43) Date of publication A2:
26.08.2015 Bulletin 2015/35

(21) Application number: **15159340.7**

(22) Date of filing: **14.09.2010**

(51) Int Cl.:
A61B 5/00 *(2006.01)* ***A61B 5/0205*** *(2006.01)*
A61B 5/0402 *(2006.01)* ***A61B 5/11*** *(2006.01)*
A61B 5/08 *(2006.01)* ***A61B 5/113*** *(2006.01)*
A61B 5/053 *(2006.01)* ***A61B 5/024*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **14.09.2009 US 559435**
14.09.2009 US 559419
14.09.2009 US 559422
14.09.2009 US 559426
14.09.2009 US 559429
14.09.2009 US 559430

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
10816259.5 / 2 470 068

(71) Applicant: **Sotera Wireless, Inc.**
San Diego, CA 92121 (US)

(72) Inventors:
- **McCombie, Devin**
  San Diego, CA California 92130 (US)
- **Dhillon, Marshal**
  San Diego, CA California 92127 (US)
- **Banet, Matt**
  San Diego, CA 92101 (US)

(74) Representative: **Schiweck, Weinzierl & Koch**
European Patent Attorneys
Landsberger Straße 98
80339 München (DE)

(54) **Body-worn monitor for measuring respiration rate**

(57) The invention provides a multi-sensor system that uses an algorithm based on adaptive filtering to monitor a patient's respiratory rate. The system features a first sensor selected from the following group: i) an impedance pneumography sensor featuring at least two electrodes and a processing circuit configured to measure an impedance pneumography signal; ii) an ECG sensor featuring at least two electrodes and an ECG processing circuit configured to measure an ECG signal; and iii) a PPG sensor featuring a light source, photodetector, and PPG processing circuit configured to measure a PPG signal. Each of these sensors measures a time-dependent signal which is sensitive to respiratory rate and, during operation, is processed to determine an initial respiratory rate value. An adaptive digital filter is determined from the initial respiratory rate. The system features a second sensor (e.g. a digital 3-axis accelerometer) that attaches to the patient's torso and measures an ACC signal indicating movement of the chest or abdomen that is also sensitive to respiratory rate. This second signal is processed with the adaptive filter to determine a final value for respiratory rate.

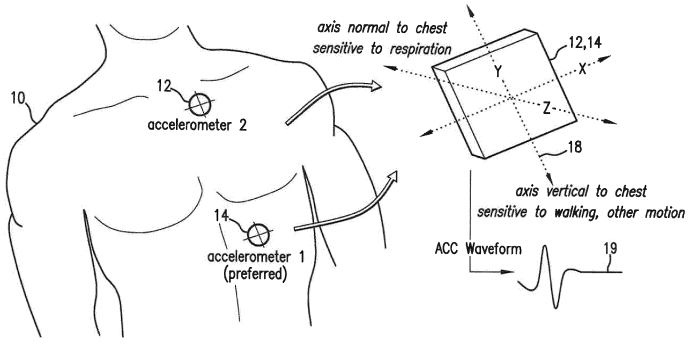

FIG.1A FIG.1B

EP 2 910 182 A3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 15 9340

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	US 2009/118626 A1 (MOON LOELL BOYCE [US] ET AL) 7 May 2009 (2009-05-07) * abstract * * paragraph [0037] - paragraph [0090] * * figures 1-12 *	1,3-8	INV. A61B5/00 A61B5/0205 A61B5/0402 A61B5/11 A61B5/08 A61B5/113 A61B5/053 A61B5/024
A	EP 1 938 862 A2 (CARDIAC PACEMAKERS INC [US]) 2 July 2008 (2008-07-02) * paragraph [0024] * * paragraph [0028] - paragraph [0029] * * paragraph [0312] * * paragraph [0315] *	1,3-8	
X	ANNALISA BONFIGLIO ET AL: "Managing Catastrophic Events by Wearable Mobile Systems", 22 February 2007 (2007-02-22), MOBILE RESPONSE; [LECTURE NOTES IN COMPUTER SCIENCE], SPRINGER BERLIN HEIDELBERG, BERLIN, HEIDELBERG, PAGE(S) 95 - 105, XP019081520, ISBN: 978-3-540-75667-5	2	
A	* section '3 Garment Design' * * section '4 Textile Sensors' * * section '5 Electronic Integration and Transmission' * * figures 1-7 * * table 1 *	9-15	TECHNICAL FIELDS SEARCHED (IPC) A61B
A	US 6 516 218 B1 (CHENG YAO-MING [TW] ET AL) 4 February 2003 (2003-02-04) * abstract * * column 2, line 4 - line 34 * * column 2, line 66 - column 3, line 19 * * figures 1-2 *	2,9-15	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 December 2015	Marteau, Frédéric

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)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 15 9340

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	WO 2008/057883 A2 (BIANCAMED LTD [IE]; DE CHAZAL PHILIP [IE]; HANLEY CONOR [IE]; HENEGHAN) 15 May 2008 (2008-05-15)	9	
A	* paragraph [0013] - paragraph [0026] * * paragraph [0035] - paragraph [0053] * * figure 1 *	10-15	

			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 December 2015	Marteau, Frédéric

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)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 15 15 9340

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).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 15 15 9340

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, 3-8

A system for monitoring respiratory rate from a patient

---

2. claims: 2, 9-15

A system for remote monitoring of a patient

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 15 9340

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.

02-12-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009118626 A1	07-05-2009	NONE	
EP 1938862 A2	02-07-2008	AT 397475 T	15-06-2008
		EP 1656181 A1	17-05-2006
		EP 1938862 A2	02-07-2008
		WO 2005018737 A1	03-03-2005
US 6516218 B1	04-02-2003	TW 436276 B	28-05-2001
		US 6516218 B1	04-02-2003
WO 2008057883 A2	15-05-2008	AU 2007317469 A1	15-05-2008
		CA 2668400 A1	15-05-2008
		CN 101689219 A	31-03-2010
		CN 104352224 A	18-02-2015
		CN 104352225 A	18-02-2015
		EP 2078270 A2	15-07-2009
		EP 2469436 A2	27-06-2012
		JP 5628520 B2	19-11-2014
		JP 2010508128 A	18-03-2010
		JP 2015027550 A	12-02-2015
		JP 2015027551 A	12-02-2015
		US 2010179438 A1	15-07-2010
		US 2014350361 A1	27-11-2014
		WO 2008057883 A2	15-05-2008

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	用于测量呼吸率的体戴式监护仪		
公开(公告)号	EP2910182A3	公开(公告)日	2016-01-13
申请号	EP2015159340	申请日	2010-09-14
[标]申请(专利权)人(译)	索泰拉无线公司		
申请(专利权)人(译)	SOTERA WIRELESS，INC.		
当前申请(专利权)人(译)	SOTERA WIRELESS，INC.		
[标]发明人	MCCOMBIE DEVIN DHILLON MARSHAL BANET MATT		
发明人	MCCOMBIE, DEVIN DHILLON, MARSHAL BANET, MATT		
IPC分类号	A61B5/00 A61B5/0205 A61B5/0402 A61B5/11 A61B5/08 A61B5/113 A61B5/053 A61B5/024		
CPC分类号	A61B5/0002 A61B5/0205 A61B5/02416 A61B5/0402 A61B5/0535 A61B5/0809 A61B5/0816 A61B5/1116 A61B5/1118 A61B5/113 A61B5/681 A61B5/6823 A61B5/6824 A61B5/6826 A61B5/721 A61B5/7239 A61B5/746 A61B2562/0219		
审查员(译)	frÉdÉric锤		
优先权	12/559435 2009-09-14 US 12/559419 2009-09-14 US 12/559422 2009-09-14 US 12/559426 2009-09-14 US 12/559429 2009-09-14 US 12/559430 2009-09-14 US		
其他公开文献	EP2910182A2		
外部链接	Espacenet		

摘要(译)

本发明提供了一种多传感器系统，其使用基于自适应滤波的算法来监测患者的呼吸率。该系统具有选自以下组的第一传感器：i）具有至少两个电极的阻抗呼吸描记传感器和配置成测量阻抗呼吸描记信号的处理电路; ii）具有至少两个电极的ECG传感器和配置为测量ECG信号的ECG处理电路; iii）PPG传感器，其特征在于光源，光电探测器和PPG处理电路，其被配置为测量PPG信号。这些传感器中的每一个测量对呼吸速率敏感的时间相关信号，并且在操作期间，处理该信号以确定初始呼吸速率值。根据初始呼吸速率确定自适应数字滤波器。该系统具有第二传感器（例如，数字3轴加速度计），其连接到患者的躯干并测量ACC信号，该ACC信号指示对呼吸速率也敏感的胸部或腹部的运动。用自适应滤波器处理该第二信号以确定呼吸速率的最终值。

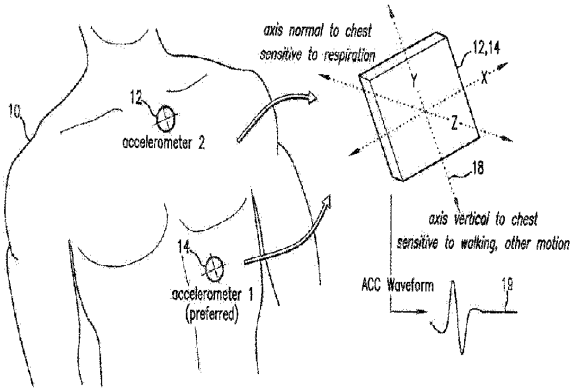

FIG.1A FIG.1B