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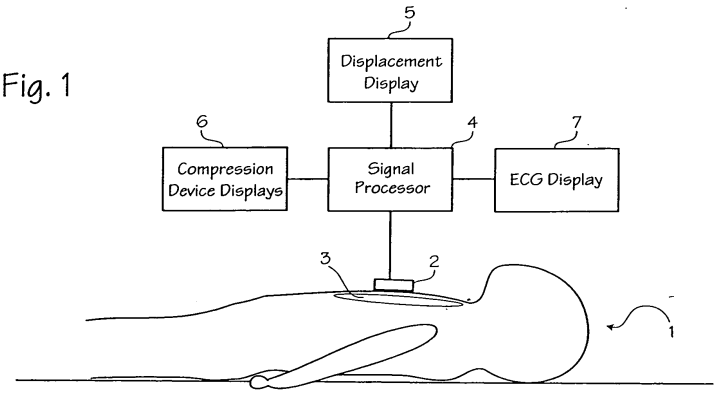
(54) Method of determining depth of compressions during cardio-pulmonars resuscitation

(57) A method of processing a raw acceleration signal, measured by an accelerometer-based compression monitor, to produce an accurate and precise estimated actual depth of chest compressions. The raw acceleration signal is filtered during integration and then a moving average of past starting points estimates the actual current starting point. An estimated actual peak of the compression is then determined in a similar fashion. The estimated actual starting point is subtracted from the estimated actual peak to calculate the estimated actual depth of chest compressions. In addition, one or more reference sensors (such as an ECG noise sensor) may be used to help establish the starting points of compressions. The reference sensors may be used, either alone or in combination with other signal processing techniques, to enhance the accuracy and precision of the estimated actual depth of compressions.

Fig. 1



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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 12 00 3128

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	EP 1 079 310 A2 (LAERDAL MEDICAL AS [NO]) 28 February 2001 (2001-02-28) * paragraphs [0009] - [0018]; figures * -----	1-14	INV. A61H31/00 A61B5/04 A61B5/00 G06K9/00 A61N1/39 A61B5/053 A61M16/00
X	SVEN OLE AASE* ET AL: "CPR Artifact Removal from Human ECG Using Optimal Multichannel Filtering", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, IEEE SERVICE CENTER, PISCATAWAY, NJ, USA, vol. 47, no. 11, November 2000 (2000-11), XP011006983, ISSN: 0018-9294 * Sections I. to IV. * -----	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

A61H
A61B
G06K
A61N

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

1

Place of search	Date of completion of the search	Examiner
Munich	29 August 2013	Fischer, Elmar

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 (P04E07)

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 12 00 3128

Claim(s) completely searchable:
-

Claim(s) searched incompletely:
1-14

Claim(s) not searched:
15

Reason for the limitation of the search:

Multiple independent claims in the same category not complying with Rule 43(2) EPC.
In reply to the invitation pursuant to Rule 62a(1) EPC the applicant has not indicated the claims complying with Rule 43(2) EPC on the basis of which the search is to be carried out.
Thus, the search report has been drawn up on the basis of the first independent claim of each category (Rule 62a(1) EPC), namely independent claim 1.

Article 76(1) EPC - Extension of subject-matter.
Taking into account the applicant's reply to the invitation pursuant to Rule 63(1) EPC, the search has been restricted (Rule 63(2) EPC) to the subject-matter complying with Article 76(1) EPC and being closest to that of present claims 1-14.
Independent claim 1: Instead of that claim, original claim 45 of the parent application as filed has been searched with the additional restrictions as disclosed in the original description of the parent application, page 54, line 16 - page 55, line 19, namely an automated CPR device equipped with an automated external defibrillator, performing defibrillation shocks to a patient without stopping compressions, determination when defibrillation is appropriate based on the estimated actual ECG, application of appropriate defibrillation voltage based on estimated actual transthoracic impedance.
Dependent claims 2-14: Instead of these claims, original claims 46-52 of the parent application as filed have been searched.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 00 3128

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.

29-08-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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

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

专利名称(译)	在心肺复苏期间确定按压深度的方法		
公开(公告)号	EP2532339A3	公开(公告)日	2013-10-09
申请号	EP2012003128	申请日	2003-10-23
[标]申请(专利权)人(译)	REVIVANT		
申请(专利权)人(译)	REVIVANT CORPORATION		
当前申请(专利权)人(译)	REVIVANT CORPORATION		
[标]发明人	PALAZZOLO JAMES A BERGER RONALD D HALPERIN HENRY R SHERMAN DARREN R		
发明人	PALAZZOLO, JAMES A. BERGER, RONALD D. HALPERIN, HENRY R. SHERMAN, DARREN R.		
IPC分类号	A61H31/00 A61B5/04 A61B5/00 G06K9/00 A61N1/39 A61B5/053 A61M16/00		
CPC分类号	A61B5/04012 A61B5/0535 A61B5/721 A61B5/7242 A61B5/725 A61H31/005 A61H31/006 A61H31/007 A61H31/008 A61H2201/5007 A61H2201/501 A61H2201/5012 A61H2201/5043 A61H2201/5048 A61H2201/5058 A61H2201/5084 A61H2201/5097 A61H2230/04 A61H2230/08 A61H2230/40 A61M16/00 A61N1/39044 G06K9/0051 Y10S128/901 Y10S601/08 Y10S601/09 Y10S601/10 A61B5/044 A61B5/053 A61M16/0078		
审查员(译)	FISCHER，ELMAR		
优先权	10/280220 2002-10-25 US		
其他公开文献	EP2532339A2		
外部链接	Espacenet		

摘要(译)

一种处理原始加速度信号的方法，该原始加速度信号由基于加速度计的压缩监测器测量，以产生准确且精确的胸部按压的估计实际深度。在积分期间过滤原始加速度信号，然后过去起始点的移动平均值估计实际当前起始点。然后以类似的方式确定估计的压缩实际峰值。从估计的实际峰值中减去估计的实际起始点，以计算估计的胸部按压的实际深度。另外，可以使用一个或多个参考传感器（例如ECG噪声传感器）来帮助建立压缩的起始点。可以单独使用参考传感器或者与其他信号处理技术组合使用参考传感器，以增强估计的实际压缩深度的准确度和精度。