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(54) **DEVICE AND METHOD FOR HYBRID OPTOACOUSTIC TOMOGRAPHY AND ULTRASONOGRAPHY**

(57) The invention relates to a device and an according method for hybrid optoacoustic and ultrasonographic imaging of an object (1). The device comprising an irradiation unit (2, 3) for irradiating the object (1) with electromagnetic radiation, in particular light, and a transducer unit (4) comprising a plurality of transducer elements (5), the transducer elements (5) being configured to emit ultrasound waves impinging on the object (1) and to detect ultrasound waves which are reflected and/or transmitted by the object (1) upon impinging on the object (1), and to detect ultrasound waves which are generated in the object (1) upon irradiation with electromagnetic radiation, wherein the transducer elements (1) are arranged along a curved line, in particular a concave line, or a curved surface, in particular a concave surface. A multiplexer unit (15) is configured to control the transducer unit (4) to operate in different operation modes and to switch the transducer unit (4) between the different operation modes, in particular between a first mode (receive-only mode) and/or a second mode (transmit-and-receive mode) and/or a third mode (mixed mode). The multiplexer unit (15) comprises a first electronic circuit designed

for acquisition of ultrasound data and a second electronic circuit designed for acquisition of optoacoustic data, the first electronic circuit having a first input impedance and the second electronic circuit having a second input impedance, which is different from the first input impedance.

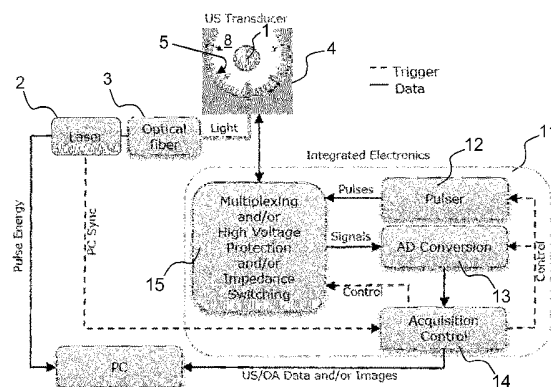


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 19 16 1869

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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	EP 2 679 161 A1 (FUJIFILM CORP [JP]) 1 January 2014 (2014-01-01) * paragraphs [0058] - [0060], [0070] * * figure 10 *	1-3,15	INV. A61B8/00 A61B8/14 A61B8/15 A61B8/08 A61B5/00 G01N21/17
Y	A. BUEHLER ET AL: "Three-dimensional optoacoustic tomography at video rate", OPTICS EXPRESS, vol. 20, no. 20, 24 September 2012 (2012-09-24), page 22712, XP055212571, DOI: 10.1364/OE.20.022712 * chapter "1. Introduction", last par. * * chapter "2. Materials and methods", section "2.1 Imaging system", 1st par. * * figure 1 *	1-3,15	
Y	WO 2009/154298 A1 (CANON KK [JP]; SOMEDA YASUHIRO [JP] ET AL.) 23 December 2009 (2009-12-23) * page 1, lines 7-12 * * page 5, lines 16-22 * * page 9, line 2 - page 11, line 20 * * page 14, line 22 - page 16, line 4 * * figure 2 *	1-3,15	TECHNICAL FIELDS SEARCHED (IPC) A61B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 July 2019	Examiner Willig, Hendrik
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)



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:

1-3, 15

☐ 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 19 16 1869

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, 15

Device and corresponding method for hybrid optoacoustic and ultrasonographic imaging of an object with multiplexer unit to control the transducer unit in different operation modes.

2. claims: 4-7, 14

Device for hybrid optoacoustic and ultrasonographic imaging of an object with control unit to control transducer elements to sequentially emit ultrasound pulses and to control transducer elements to simultaneously detect the reflected or transmitted ultrasound waves.

3. claims: 8, 9

Device for hybrid optoacoustic and ultrasonographic imaging of an object with processing unit to perform spatial compounding processing.

4. claim: 10

Device for hybrid optoacoustic and ultrasonographic imaging of an object configured for combining images to a preliminary image.

5. claims: 11, 12

Device for hybrid optoacoustic and ultrasonographic imaging of an object with ultrasound or optoacoustic image reconstruction after a number of data acquisitions.

6. claim: 13

Device for hybrid optoacoustic and ultrasonographic imaging of an object with implementation of a compressed sensing scheme for synthetic aperture.

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

EP 19 16 1869

5 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.

18-07-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP 2012187389 A	04-10-2012
		US 2013338478 A1	19-12-2013
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ORM P0459

专利名称(译)	混合光声层析成像和超声超声照相术的装置和装置		
公开(公告)号	EP3530192A3	公开(公告)日	2019-12-04
申请号	EP2019161869	申请日	2015-06-10
[标]申请(专利权)人(译)	ITHERA医疗		
申请(专利权)人(译)	ITHERA医疗GMBH		
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[标]发明人	WIEST CHRISTIAN RAZANSKY DANIEL LI PAI CHI JENG GENG SHI		
发明人	WIEST, CHRISTIAN RAZANSKY, DANIEL MERCEP, ELENA LI, PAI-CHI JENG, GENG-SHI		
IPC分类号	A61B8/00 A61B8/14 A61B8/15 A61B8/08 A61B5/00 G01N21/17		
CPC分类号	A61B5/0035 A61B5/0095 A61B5/42 A61B5/7203 A61B5/725 A61B5/7253 A61B8/14 A61B8/15 A61B8/4444 A61B8/4494 A61B8/5246 A61B8/5253 A61B8/5261 A61B2562/063 G01N2021/1706 G01S15/8927 G01S15/8929 G01S15/8952 G01S15/8993 G01S15/8995 G01S15/8997 A61B8/145 A61B8/4455 A61B8/5207 A61B8/5269		
优先权	2014001989 2014-06-10 EP 2014002003 2014-06-11 EP PCT/EP2015/062934 2015-06-10 WO		
其他公开文献	EP3530192A2		
外部链接	Espacenet		

摘要(译)

本发明涉及一种用于对物体（1）进行光声和超声混合成像的装置和方法。该设备包括：辐射单元（2、3），用于用电磁辐射，特别是光，辐射物体（1），以及包括多个换能器元件（5）的换能器单元（4），换能器元件（5）是构造成发射撞击在对象（1）上的超声波，并检测撞击在对象（1）上时由对象（1）反射和/或透射的超声波，并检测在对象中产生的超声波（1）在电磁辐射的照射下，其中换能器元件（1）沿着曲线，特别是凹线，或弯曲表面，特别是凹面布置。多路复用器单元（15）被配置为控制换能器单元（4）以不同的操作模式操作并且在不同的操作模式之间，特别是在第一模式（仅接收模式）和第一操作模式之间切换换能器单元（4）。/或第二模式（发射和接收模式）和/或第三模式（混合模式）。多路复用器单元（15）包括设计用于采集超声数据的第一电子电路和设计用于采集光声数据的第二电子电路，该第一电子电路具有第一输入阻抗，而第二电子电路具有第二输入阻抗，其中与第一输入阻抗不同。

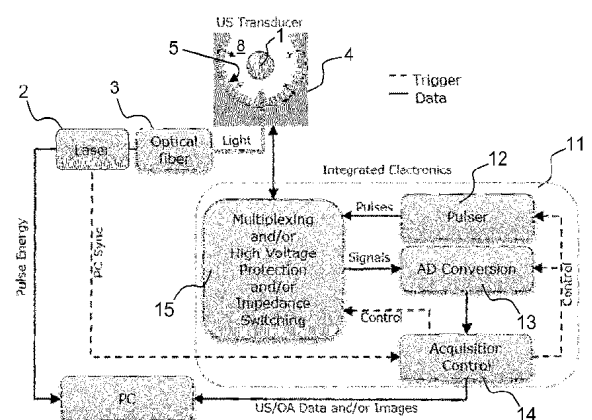


Fig. 2