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

(11) EP 1 046 929 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
05.09.2001 Bulletin 2001/36

(43) Date of publication A2:
25.10.2000 Bulletin 2000/43

(21) Application number: **00303311.5**

(22) Date of filing: **19.04.2000**

(51) Int Cl.[7]: **G01S 15/89**, A61B 8/00, G06T 1/00

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **23.04.1999 US 299031**

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(54) Method and apparatus for three-dimensional ultrasound imaging using surface-enhanced volume rendering

(57) In performing for three-dimensional ultrasound imaging of an object from any angle relative to the plane of acquisition, a human body is scanned to acquire multiple images forming a data volume (40). The system computer generates a multiplicity of reformatted slices (1,2,3....n) through the data volume and parallel to the imaging plane (36). For each projected pixel, a ray (38) is cast through the reformatted slices onto the imaging plane. For each pixel along the ray, the accumulated intensity is calculated as a function of the pixel and opacity values for the pixel being processed, the accumulated intensity calculated at the preceding pixel the remaining opacity for the subsequent pixels. The final accumulated intensity for each ray is obtained when the remaining opacity reaches a predetermined minimum. The accumulated intensities for all cast rays form the projected image.

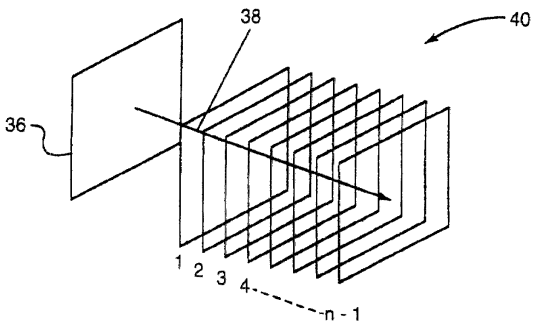

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 3311

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 797 106 A (ADVANCED TECH LAB) 24 September 1997 (1997-09-24) * abstract; figures * * page 3, line 47 - page 4, line 11 * * page 4, line 24 - page 5, line 13 * * page 5, line 34 - line 42 * ---	1-4, 9-15,20	G01S15/89 A61B8/00 G06T1/00
X	EP 0 754 957 A (ALOKA CO LTD) 22 January 1997 (1997-01-22) * abstract; figures 1,2,4-6 * * column 13, line 42 - column 16, line 49 * ---	1,3,4,9, 11,12, 14,15,20	
A	HOKLAND J H ET AL: "Robust semi-transparent volume rendering of abdominal 3D ultrasound data" 1994 IEEE ULTRASONICS SYMPOSIUM. PROCEEDINGS (CAT. NO.94CH3468-6), PROCEEDINGS OF IEEE ULTRASONICS SYMPOSIUM, CANNES, FRANCE, 1-4 NOV. 1994, pages 1567-1571 vol.3, XP002170733 1994, New York, NY, USA, IEEE, USA ISBN: 0-7803-2012-3 * Section "Algorithm: Back-to-Front Blending", page 1568 - page 1569 * -----	1,9,12, 20	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

G01S
A61B
G06T

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 June 2001	Niemeijer, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 3311

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
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28-06-2001

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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)	使用表面增强体绘制的三维超声成像的方法和设备		
公开(公告)号	EP1046929A3	公开(公告)日	2001-09-05
申请号	EP2000303311	申请日	2000-04-19
[标]申请(专利权)人(译)	通用电气公司		
申请(专利权)人(译)	通用电气公司		
当前申请(专利权)人(译)	通用电气公司		
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IPC分类号	A61B8/00 A61B8/14 G01S7/52 G01S15/89 G06T1/00		
CPC分类号	A61B8/483 A61B8/14 G01S7/52034 G01S7/52073 G01S15/8993 Y10S128/916		
优先权	09/299031 1999-04-23 US		
其他公开文献	EP1046929A2 EP1046929B1		
外部链接	Espacenet		

摘要(译)

在从相对于采集平面的任何角度执行对象的三维超声成像时，扫描人体以获取形成数据体积的多个图像（40）。系统计算机通过数据体积生成多个重新格式化的切片（1,2,3 ..... n）并平行于成像平面（36）。对于每个投影像素，光线（38）通过重新格式化的切片投射到成像平面上。对于沿着光线的每个像素，累积强度被计算为被处理像素的像素和不透明度值的函数，在前一像素处计算的累积强度是后续像素的剩余不透明度。当剩余不透明度达到预定最小值时，获得每条射线的最终累积强度。所有投射光线的累积强度形成投影图像。

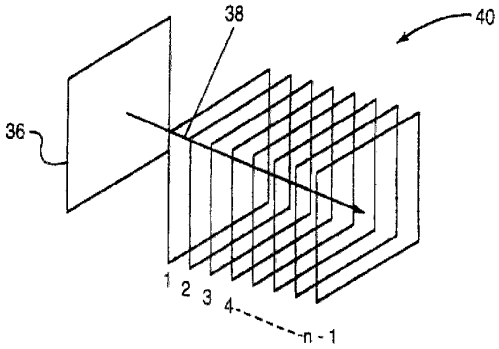

FIG. 3