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## EUROPEAN PATENT APPLICATION

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### (54) **Ultrasound imaging method combined with the presence of contrast media in the body under examination**

(57) Ultrasound imaging method combined with the presence of contrast agents in the body under examination, comprising the steps of: transmitting at least one beam of acoustic waves into a body under examination carrying contrast agents, and which acoustic waves are transmitted at a first fundamental transmission frequency and are focused on at least one scan line; receiving the acoustic beam reflected from the body under examination and the contrast agents along said at least one scan line; separating, in said received signal, the at least one harmonic or subharmonic components from the fundamental frequency component; generating one image from at least one of the fundamental, harmonic and/or

subharmonic components of the received signal. According to the invention, the components of the received signal are separated according to their being at the first fundamental frequency, at the harmonic frequency and at the subharmonic frequency; whereas the amplitudes of the received signals are stored for each of the fundamental, harmonic or subharmonic frequency components at each reflected point; depending on the amplitudes of the signal components, the reflector nature is determined, said nature being assumed as a contrast agent, when the subharmonic component of the received signal has an amplitude above a predetermined minimum amplitude.

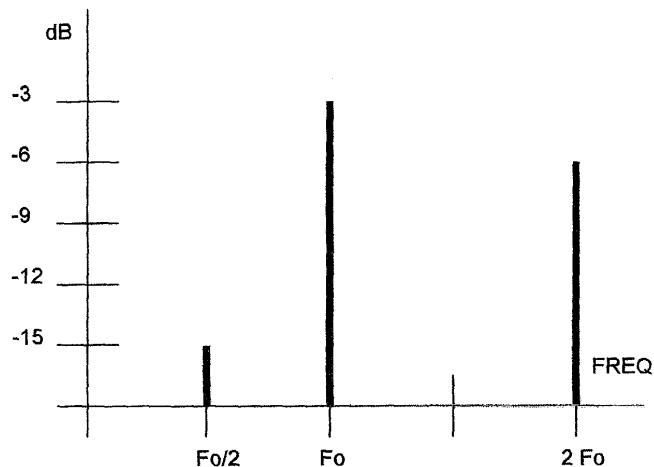


Fig. 1



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	G01S7/52 A61B8/00
X	WO 00 42916 A (FRINKING PETER ; JONG NIC DE (NL); ACUSON (US)) 27 July 2000 (2000-07-27)	1,2,4,9, 10	G01S7/52 A61B8/00
A	* page 3, line 11 - line 23 * * page 9, line 16 - page 11, line 5 * * page 12, line 1 - line 11 * * figures 6-8 *	8	
X	US 6 117 082 A (BRADLEY CHARLES E ET AL) 12 September 2000 (2000-09-12)	1	
Y	* column 9, line 7 - line 18 *	15,16	
A	-----	6,8,13, 14	
A	US 2002/091317 A1 (CHIAO RICHARD YUNG) 11 July 2002 (2002-07-11) * abstract *	6	
Y	US 6 066 098 A (CEROFOLINI MARINO ET AL) 23 May 2000 (2000-05-23) * abstract *	15,16	
A	US 5 980 459 A (CHIAO RICHARD YUNG ET AL) 9 November 1999 (1999-11-09) * abstract *	17,18	G01S A61B
A	US 6 050 947 A (CHIAO RICHARD Y ET AL) 18 April 2000 (2000-04-18) * abstract * * column 2, line 51 - column 3, line 14 *	17	
The present search report has been drawn up for all claims			
7	Place of search	Date of completion of the search	Examiner
EPO FORM 1503 03.82 (P04C01)	THE HAGUE	9 March 2004	Zaccà, F
CATEGORY OF CITED DOCUMENTS		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	
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			

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims 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 the first ten claims.

**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 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: 1-5,9,10,19,20

Ultrasound imaging method using contrast agents

2. Claims: 6,7,11,12

Ultrasound imaging method with transmission and reception of three ultrasonic beams

3. Claim : 8

Combination of transmit-receive frequency pairs successions in a Ultrasound imaging method

4. Claims: 13,14,17,18

Modulation of the transmitted signal in a Ultrasound imaging method

5. Claims: 15,16

Analysis of the received signal in a Ultrasound imaging method

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

EP 03 42 5581

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.

09-03-2004

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专利名称(译)	超声成像方法结合在检查体内存在造影剂		
公开(公告)号	<a href="#">EP1515158A3</a>	公开(公告)日	2006-03-08
申请号	EP2003425581	申请日	2003-09-09
[标]申请(专利权)人(译)	百胜集团		
申请(专利权)人(译)	ESAOTE S.P.A.		
当前申请(专利权)人(译)	ESAOTE S.P.A.		
[标]发明人	CEROFOLINI MARINO		
发明人	CEROFOLINI, MARINO		
IPC分类号	G01S7/52 A61B8/00		
CPC分类号	A61B8/481 G01S7/52038 G01S7/52039		
其他公开文献	EP1515158B1 EP1515158A2		
外部链接	<a href="#">Espacenet</a>		

#### 摘要(译)

超声成像方法结合在检查中的身体中存在造影剂，包括以下步骤：将至少一个声波束传送到携带造影剂的检查的身体中，并且所述声波以第一基本传输频率并且聚焦在至少一条扫描线上；接收从所述被检查身体反射的声束和沿所述至少一条扫描线的造影剂；在所述接收信号中，从所述基频分量中分离所述至少一个谐波或次谐波分量；从接收信号的基波分量，谐波分量和/或分谐波分量中的至少一个生成一个图像。根据本发明，接收信号的分量根据它们处于第一基本频率，谐波频率和次谐波频率而分离；而对于每个反射点处的基频，谐波或次谐波频率分量中的每一个存储接收信号的幅度；取决于信号分量的幅度，当接收信号的分谐波分量具有高于预定最小幅度的幅度时，确定反射器性质，所述性质被假定为造影剂。

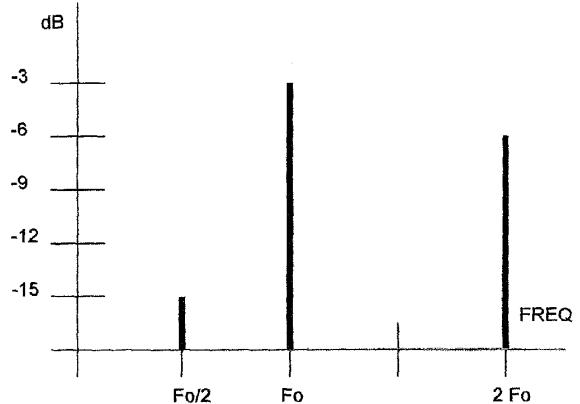


Fig. 1