



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
**22.09.2004 Bulletin 2004/39**

(51) Int Cl.<sup>7</sup>: **G01S 7/52**

(43) Date of publication A2:  
**22.08.2001 Bulletin 2001/34**

(21) Application number: **01103458.4**

(22) Date of filing: **14.02.2001**

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

- Kumasaki, Kenji, c/o Aloka Co.,Ltd.  
Mitaka-shi, Tokyo, 181-8622 (JP)
- Itoh, Takashi, c/o Aloka Co.,Ltd.  
Mitaka-shi, Tokyo, 181-8622 (JP)
- Wakamatsu, Tatsuya, c/o Aloka Co.,Ltd.  
Mitaka-shi, Tokyo, 181-8622 (JP)

(30) Priority: **17.02.2000 JP 2000039174**  
**07.09.2000 JP 2000271224**

(71) Applicant: **Aloka Co. Ltd.**  
**Mitaka-shi Tokyo, 181-8622 (JP)**

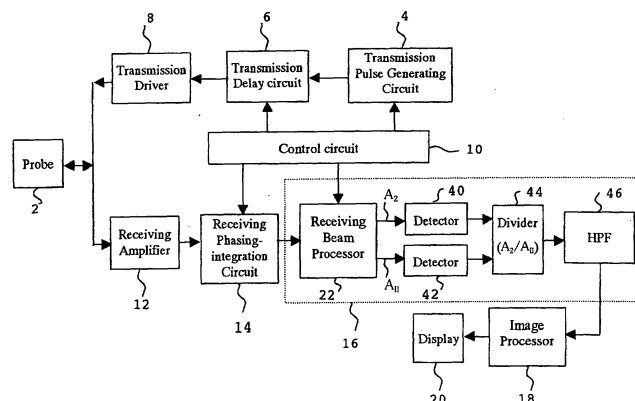
(72) Inventors:  
• Tsao, Jing-Wen, c/o Aloka Co.,Ltd.  
Mitaka-shi, Tokyo, 181-8622 (JP)

(74) Representative: **Heim, Hans-Karl, Dipl.-Ing. et al**  
**Weber & Heim**  
**Patentanwälte**  
**Irmgardstrasse 3**  
**81479 München (DE)**

(54) **Ultrasonic diagnosis apparatus**

(57) In an ultrasonic diagnosis apparatus, a first transmission signal including both of two fundamentals of frequencies  $f_0$  and  $2f_0$  is transmitted, and then a second transmission signal having a polarity reverse that of the first transmission signal is transmitted. A receiving beam processor 22 generates a signal in which the echoes of the two transmission signals are added, and a signal in which the echoes are subtracted. The fundamental components are canceled out by addition and a

secondary harmonic component  $A_2$  generated by the non-linear interaction remains in the sum signal. In the subtraction signal, the fundamental component remains while the secondary harmonic component is canceled out by subtraction. The fundamental component  $A_{11}$  of the frequency  $2f_0$  is extracted from the subtraction signal, and a ratio  $(A_2/A_{11})$  is calculated by a divider 44. A differentiating process is then executed by an HPF 46 to obtain the evaluation value reflecting the non-linear parameter at each depth of the body.



**Fig. 2**



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 01 10 3458

| 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)    |
| Y                                                                                                                                                                                                                                                      | SIMPSON D H ET AL: "PULSE INVERSION DOPPLER: A NEW METHOD FOR DETECTING NONLINEAR ECHOES FROM MICROBUBBLE CONTRAST AGENTS"<br>IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL, IEEE INC. NEW.YORK, US,<br>vol. 46, no. 2, March 1999 (1999-03),<br>pages 372-382, XP000834210<br>ISSN: 0885-3010                                                                                | 1-3,9,17                                                                                                                                                                                                                                                                              | G01S7/52<br>G01S7/52<br>G01S15/89               |
| A                                                                                                                                                                                                                                                      | * abstract; figure 2 *<br>* page 372, left-hand column - page 374, right-hand column *<br>-----                                                                                                                                                                                                                                                                                                        | 4-8,<br>10-16,18                                                                                                                                                                                                                                                                      |                                                 |
| Y                                                                                                                                                                                                                                                      | KRISHNAN S ET AL: "Suppression of propagating second harmonic in non-linear imaging"<br>ULTRASONICS SYMPOSIUM, 1997. PROCEEDINGS., 1997 IEEE TORONTO, ONT., CANADA 5-8 OCT. 1997, NEW YORK, NY, USA,IEEE, US,<br>5 October 1997 (1997-10-05), pages 1567-1570, XP010271433<br>ISBN: 0-7803-4153-8<br>* abstract; figure 1 *<br>* page 1567, left-hand column - page 1568, right-hand column *<br>----- | 1-3,9,17                                                                                                                                                                                                                                                                              | TECHNICAL FIELDS<br>SEARCHED (Int.Cl.7)<br>G01S |
| D,A                                                                                                                                                                                                                                                    | AKIYAMA I, KOIDE T, KUMAKURA Y:<br>"Reflection imaging of nonlinearity parameter distribution"<br>11TH SYMPOSIUM ON ULTRASONIC ELECTRONICS, vol. 30, no. suppl.30-1,<br>20 December 1990 (1990-12-20), pages 221-223, XP009034539<br>KYOTO<br>* the whole document *<br>-----<br>-/--                                                                                                                  | 1-18                                                                                                                                                                                                                                                                                  |                                                 |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                       |                                                 |
| Place of search<br>Munich                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                        | Date of completion of the search<br>5 August 2004                                                                                                                                                                                                                                     | Examiner<br>Reuss, T                            |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                                                                                                                                                                                                                                        | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                                 |

EPO FORM 1503 03.82 (P04G01)



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 01 10 3458

| 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) |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE 30 08 553 A (KRETZTECHNIK GMBH)<br>25 September 1980 (1980-09-25)<br>* the whole document *  | 1-18                                              |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 4 414 850 A (MIWA HIROHIDE ET AL)<br>15 November 1983 (1983-11-15)<br>* the whole document * | 1-18                                              |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                 |                                                   | TECHNICAL FIELDS SEARCHED (Int.Cl.7)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                 |                                                   |                                              |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                 |                                                   |                                              |
| Place of search<br>Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                 | Date of completion of the search<br>5 August 2004 | Examiner<br>Reuss, T                         |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                 |                                                   |                                              |

EPO FORM 1503 03.82 (P04C01)

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

EP 01 10 3458

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.

05-08-2004

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---|---------------------|----------------------------|---------------------|
| DE 3008553                                | A | 25-09-1980          | AT 364438 B                | 27-10-1981          |
|                                           |   |                     | AT 180879 A                | 15-03-1981          |
|                                           |   |                     | DE 3008553 A1              | 25-09-1980          |
| -----                                     |   |                     |                            |                     |
| US 4414850                                | A | 15-11-1983          | JP 57000550 A              | 05-01-1982          |
|                                           |   |                     | DE 3167578 D1              | 17-01-1985          |
|                                           |   |                     | EP 0041403 A1              | 09-12-1981          |
| -----                                     |   |                     |                            |                     |

|                |                                                                                                                                                          |         |            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------|
| 专利名称(译)        | 超声诊断仪                                                                                                                                                    |         |            |
| 公开(公告)号        | <a href="#">EP1126287A3</a>                                                                                                                              | 公开(公告)日 | 2004-09-22 |
| 申请号            | EP2001103458                                                                                                                                             | 申请日     | 2001-02-14 |
| [标]申请(专利权)人(译) | 日立阿洛卡医疗株式会社                                                                                                                                              |         |            |
| 申请(专利权)人(译)    | ALOKA CO.LTD.                                                                                                                                            |         |            |
| 当前申请(专利权)人(译)  | ALOKA CO.LTD.                                                                                                                                            |         |            |
| 发明人            | TSAO, JING-WEN, C/O ALOKA CO.,LTD.<br>KUMASAKI, KENJI, C/O ALOKA CO.,LTD.<br>ITOH, TAKASHI, C/O ALOKA CO.,LTD.<br>WAKAMATSU, TATSUYA, C/O ALOKA CO.,LTD. |         |            |
| IPC分类号         | A61B8/14 G01S7/52 G01S15/89 G06T1/00                                                                                                                     |         |            |
| CPC分类号         | G01S15/8952 G01S7/52038 G01S7/5205 G01S15/8959                                                                                                           |         |            |
| 优先权            | 2000039174 2000-02-17 JP<br>2000271224 2000-09-07 JP                                                                                                     |         |            |
| 其他公开文献         | EP1126287A2<br>EP1126287B1                                                                                                                               |         |            |
| 外部链接           | <a href="#">Espacenet</a>                                                                                                                                |         |            |

#### 摘要(译)

在超声波诊断装置中，发送包括频率 $f_0$ 和频率 $f$ 的两个基波的第一发送信号，然后发送具有与第一发送信号相反的极性的第二发送信号。接收波束处理器22生成其中添加了两个发送信号的回波的信号和其中减去回波的信号。基波分量通过相加抵消，并且由非线性相互作用产生的二次谐波分量 $A_2$ 保留在和信号中。在减法信号中，基波分量保留，而二次谐波分量通过减法消除。从减法信号中提取频率 $2f_0$ 的基波分量 $A_{11}$ ，并且由除法器44计算比率（ $A_2 / A_{11}$ ）。然后由HPF 46执行微分处理以获得反映非线性参数在身体的每个深度。

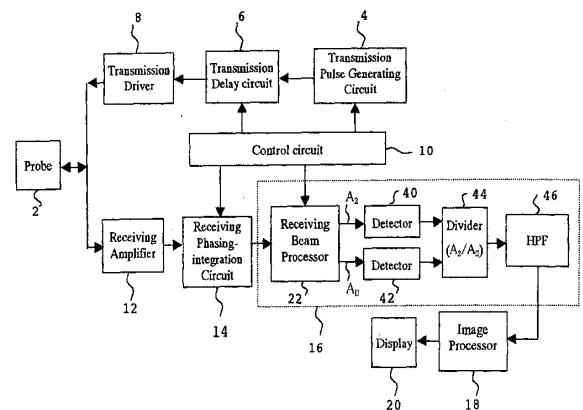


Fig. 2