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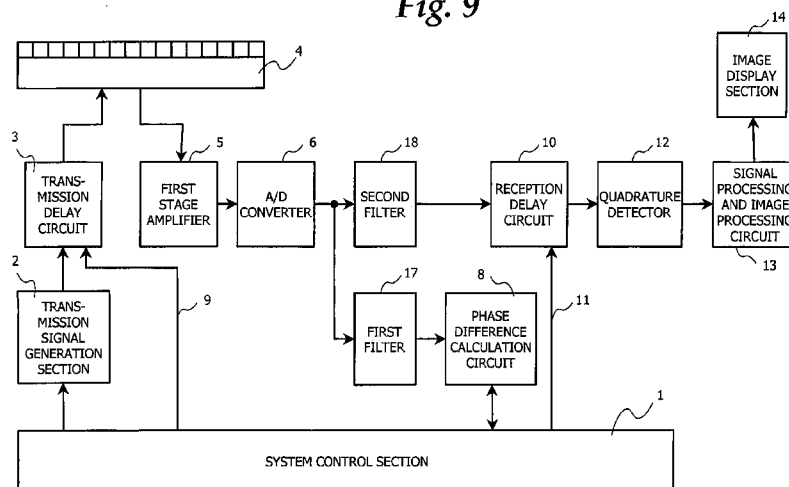
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[Continued on next page]

(54) Title: IMAGE FORMING METHOD USING ULTRASOUND AND ABERRATION CORRECTION METHOD

Fig. 9



(57) Abstract: An ultrasound image forming method comprises a first step of receiving a first signal reflected from the object, a second step of obtaining an aberration correction value based on the first signal thus received, a third step of receiving a second signal reflected from the object when a second ultrasound corrected based on the aberration correction value is transmitted to the object, and a fourth step of forming an image from the aberration correction value and the second signal. The center frequency of the second ultrasound is between 0.5 MHz and 20 MHz, the center frequency of the first ultrasound is between 3/16 and 9/20 of the center frequency of the second ultrasound. By this method, an accurate aberration correction value can be obtained and an ultrasound imaging with high resolution can be achieved even if aberrations are large and difficult to correct.

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- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

INTERNATIONAL SEARCH REPORT

International application No

PCT/JP2009/057299

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G01S7/52 G01S15/89

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/006272 A1 (VORTMAN KOBI [IL] ET AL) 8 January 2004 (2004-01-08)	1-3,6-8, 12
Y	abstract; figures 1-9 paragraph [0001] - paragraph [0021] paragraph [0032] - paragraph [0069] paragraph [0083] - paragraph [0096]	9-11,13
X,P	TAKI H ET AL: "Evaluation of aberration parameters estimated from a low frequency transmission for medical acoustic imaging" ULTRASONICS SYMPOSIUM, 2008. IUS 2008. IEEE, IEEE, PISCATAWAY, NJ, USA, 2 November 2008 (2008-11-02), pages 1278-1281, XP031443572 ISBN: 978-1-4244-2428-3	1-8,12
Y,P	the whole document	9-11,13
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *&* document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

PCT/JP2009/057299

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/002333 A1 (ANGELSEN BJORN A J [NO] ET AL) 3 January 2002 (2002-01-03) the whole document -----	1-8,12
A	US 2005/277835 A1 (ANGELSEN BJORN A [NO] ET AL) 15 December 2005 (2005-12-15) the whole document -----	1-8,12
A	EP 1 777 543 A2 (SIEMENS MEDICAL SOLUTIONS [US]) 25 April 2007 (2007-04-25) the whole document -----	1-8,12
A	US 5 052 394 A (CARPENTER DAVID A [AU] ET AL) 1 October 1991 (1991-10-01) the whole document -----	1-8,12
A	MASOY, SVEIN-ERIK ET AL: "Estimation of ultrasound wave aberration with signals from random scatterers" JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, AIP / ACOUSTICAL SOCIETY OF AMERICA, MELVILLE, NY, US, vol. 115, no. 6, 1 June 2004 (2004-06-01), pages 2998-3009, XP012072329 ISSN: 0001-4966 the whole document -----	1-8,12
A	HAWORTH ET AL: "Towards Aberration Correction of Transcranial Ultrasound Using Acoustic Droplet Vaporization" ULTRASOUND IN MEDICINE AND BIOLOGY, NEW YORK, NY, US, vol. 34, no. 3, 23 October 2007 (2007-10-23), pages 435-445, XP022492739 ISSN: 0301-5629 the whole document -----	1-8,12
Y	JP 07 079972 A (FUJITSU LTD) 28 March 1995 (1995-03-28) cited in the application abstract; figure 2 paragraph [0029] - paragraph [0038] -----	9-11,13
A	WO 99/53309 A1 (ACUSON [US]) 21 October 1999 (1999-10-21) the whole document -----	9-11,13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/057299

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8, 12

Aberration correction using the successive transmission of pulses with changing center frequencies

2. claims: 9-11, 13

Aberration correction using broadband pulse transmission and filtering

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2009/057299

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