Title: ULTRASOUND IMAGING SYSTEM AND METHOD

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Declarations under Rule 4.17:
— of inventorship (Rule 4.17(iv))
Published:
— with international search report (Art. 21(3))

[Continued on nextpage]

(57) Abstract: A method and system of producing an ultrasound image of an imaging region of a body, the image comprising pixels, the method comprising: a) transmitting time-varying ultrasound into the imaging region, over a time interval, from a surface of the body, the transmitted ultrasound simultaneously having an angular spread in the imaging region corresponding to a plurality of the pixels of the image; and b) receiving echoes of the transmitted ultrasound, and recording the received signals of the echoes; c) combining the received signals at the different sub-intervals of the time interval based on said time varying, according to expected ultrasound propagation times to scatterers localized at different pixels, to find image densities at the pixels.
— 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/IB2012/052624

A. **CLASSIFICATION OF SUBJECT MATTER**

LVN. A61B8/14

ADD.

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)

A61B

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 practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>US 4 105 018 A (GREENLEAF JAMES F ET AL) 8 August 1978 (1978-08-08) col umn 4, l ine 5-40; claims; figures col umn 5, l ine 1 - col umn 10, l ine 17 col umn 11, l ine 1 - col umn 12, l ine 12</td>
<td>1-6, 8-10,52, 72</td>
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<td>A</td>
<td>US 2010/268503 AI (SPECHT DONALD F [US] ET AL) 21 October 2010 (2010-10-21) the whole document</td>
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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 application or patent but published on or after the international filing date

**L** document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

**O** document referring to an oral disclosure, use, exhibition or other means

**P** document published prior to the international filing date but later than the priority date claimed

**T** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

**X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

**Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

**Z** document member of the same patent family

**Date of the actual completion of the international search**

7 September 2012

**Date of mailing of the international search report**

06/12/2012

**Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016**

[Authorised officer]
### 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).

### 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.:

   1-6, 9, 10, 52, 72 (completely) ; 8(partially)

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

1. claims: 1-6, 9, 10, 52, 72(completely) ; 8(partially)
   are directed to various methods for combining the received ultrasound signals to produce an ultrasound image.

2. claims: 7, 30-36, 44(completely) ; 8, 13, 39, 40, 47(partially)
   are directed to various transmission signal properties of the ultrasound transducer.

3. claims: 16(completely) ; 14(partially)
   are directed to the property of the imaging region to be scanned.

4. claim: 48(partially)
   is directed to reception signal properties of the ultrasound transducer.

5. claims: 11, 12, 17, 18(completely) ; 13-15(partially)
   are directed to the properties the image density of the pixels.

6. claims: 37, 38, 41, 45, 46(completely) ; 15, 39, 40, 42, 43, 47-50(partially)
   are directed to the constructional features of the system.

7. claims: 19-28, 53-56, 59(completely) ; 42, 43, 57, 58, 60-69(partially)
   are methods directed to movement of positions of transmission/reception transducers and systems directed to various paths of movement along the object to be scanned, by the transmitter and the receiver of a system for calculating density pixels of an ultrasound image.

8. claim: 29
   is directed to correction of expected ultrasound propagation time.
9. claims: 51(completely) ; 49, 50(partially)
   are directed to the property of the ultrasound image.
   ---

10. claims: 57, 58, 6Q-64(all partially)
    are directed to the constructional features of a location
    changing device of a system for calculating density pixels
    of an ultrasound image.
    ---

11. claims: 65-69(partially)
    are directed to various features of the transmission and
    reception circuitry of a system for calculating density
    pixels of an ultrasound image.
    ---

12. claim: 70
    directed to a method of forming an image of an imaging
    region in a body wherein the image has a resolution in a
    direction lateral to depth into the body, that decreases by
    less than 30%, over at least one portion of the imaging
    region in which the depth increases by a factor of 2 or more
    ---

13. claim: 71
    directed to a system for reconstructing ultrasound images of
    an imaging region in a body using an acoustically
    transparent window.
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<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
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