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(71) Applicant and

(72) Inventor: **ANGELSEN, Bjørn A.J.** [NO/NO]; Bugges
vei 4B, N-7051 Trondheim (NO).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HANSEN, Rune**
[NO/NO]; Wilhelm K. Størens veg 11, N-7048 Trond-
heim (NO). **JOHANSEN, Tonni F.** [NO/NO]; Nordal

Griegs vei 13, N-7024 Trondheim (NO). **MÅSØY, Svein-
Erik** [NO/NO]; Rosenborg gate 34 B, N-7014 Trondheim
(NO). **NÅSHOLM, Sven, Peter** [SE/SE]; Lektorsvägen 8
a, N-35240 Växjö (SE). **TANGEN, Thor, Andreas** [NO/
NO]; Griffenfeldsgt. 1A, N-7012 Trondheim (NO).

(74) Agent: **ABC-PATENT, SIVILING. ROLF CHR. B.
LARSEN A.S.**; Brynsveien 5, N-0667 Oslo (NO).

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(54) Title: NONLINEAR ELASTIC IMAGING WITH TWO-FREQUENCY ELASTIC PULSE COMPLEXES

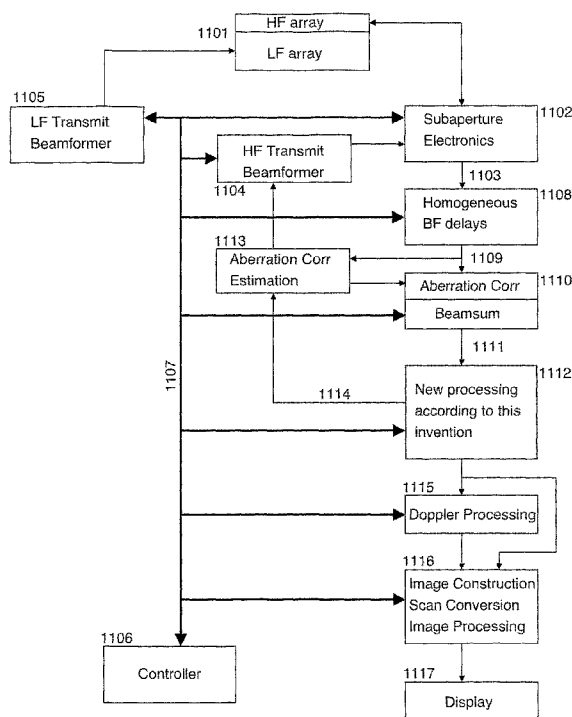


FIG. 11

(57) Abstract: Methods and instruments for suppression of multiple scattering noise and extraction of nonlinear scattering components with measurement or imaging of a region of an object with elastic waves, where at least two elastic wave pulse complexes are transmitted towards said region where said pulse complexes are composed of a high frequency (HF) and a low frequency (LF) pulse with the same or overlapping beam directions and where the HF pulse is so close to the LF pulse that it observes the modification of the object by the LF pulse at least for a part of the image depth. The frequency and/or amplitude and/or phase of said LF pulse relative to said HF pulse varies for each transmitted pulse complex in order to non-linearly manipulate the object elasticity observed by the HF pulse along at least parts of its propagation, and where received HF signals are picked up by transducers from one or both of scattered and transmitted components of the transmitted HF pulses. Said received HF signals are processed to form measurement or image signals for display, and where in the process of forming said measurement or image signals said received HF signals are one or both of delay corrected with correction delay in the fast time (depth-time), and pulse distortion corrected in the fast time, and combined in slow time to form noise suppressed HF signals or nonlinear scattering HF signals that are used for further processing to form measurement or image signals. The methods are applicable to elastic waves where the material elasticity is nonlinear in relation to the material deformation.



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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ANGELSEN B A J ET AL: "SURF Imaging - A New Method for Ultrasound Contrast Agent Imaging" ULTRASONICS SYMPOSIUM, 2007. IEEE, IEEE, PISCATAWAY, NJ, USA, 30 October 2007 (2007-10-30), pages 531-541, XP031195031 ISBN: 978-1-4244-1383-6 abstract; figures 1-7 Sections I., II. and IV. ----- -/--	1-47

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MASOY, SVEIN-ERIK ET. AL.: "SURF Imaging: In vivo demonstration of an ultrasound contrast agent detection technique" INTERNET, 19 September 2007 (2007-09-19), pages 1-20, XP002530972 Trondheim abstract; figures 1-10 Sections I.-V.	1-47
P,X	S-E MASOY ET AL: "SURF Imaging: In Vivo Demonstration of an Ultrasound Contrast Agent Detection Technique" IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL, IEEE, US, vol. 52, no. 5, 1 May 2008 (2008-05-01), pages 1112-1121, XP011227253 ISSN: 0885-3010 abstract; figures 1-10 Sections I.-V.	1-47
A	KAUPANG, HALVARD ET.AL.: "Second-Harmonic Aberration Correction" INTERNET, 4 November 2007 (2007-11-04), pages 1-4, XP002530973 the whole document	1-47
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A	AYACHE BOUAKAZ ET AL: "Radial Modulation of Microbubbles for Ultrasound Contrast Imaging" IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL, IEEE, US, vol. 54, no. 11, 1 November 2007 (2007-11-01), pages 2283-2290, XP011198609 ISSN: 0885-3010 the whole document	1-47

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CHERIN E ET AL: "10C-3 Radial Modulation Imaging of Microbubbles at High Frequency" ULTRASONICS SYMPOSIUM, 2007. IEEE, IEEE, PISCATAWAY, NJ, USA, 1 October 2007 (2007-10-01), pages 888-891, XP031195118 ISBN: 978-1-4244-1383-6 the whole document -----	1-47