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[Continued on next page]

(54) Title: SYSTEMS AND METHODS FOR AUDIO SIGNAL PROCESSING

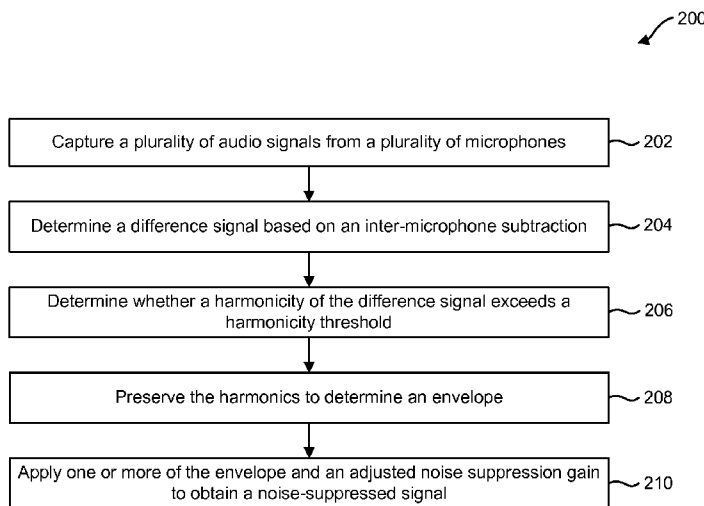


FIG. 2

(57) Abstract: A method for signal level matching by an electronic device is described. The method includes capturing a plurality of audio signals from a plurality of microphones. The method also includes determining a difference signal based on an inter-microphone subtraction. The difference signal includes multiple harmonics. The method also includes determining whether a harmonicity of the difference signal exceeds a harmonicity threshold. The method also includes preserving the harmonics to determine an envelope. The method further applies the envelope to a noise-suppressed signal.





MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/037117

A. CLASSIFICATION OF SUBJECT MATTER
INV. G10L21/0208 G10L21/0316
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)
G10L H04B

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	ESFANDIAR ZAVAREHEI ET AL: "Noisy Speech Enhancement Using Harmonic-Noise Model and Codebook-Based Post-Processing", IEEE TRANSACTIONS ON AUDIO, SPEECH AND LANGUAGE PROCESSING, IEEE SERVICE CENTER, NEW YORK, NY, USA, vol. 15, no. 4, 1 May 2007 (2007-05-01), pages 1194-1203, XP011177226, ISSN: 1558-7916, DOI: 10.1109/TASL.2007.894516	1-3, 5-16, 18-29, 31-41, 43-50
A	the whole document ----- -/--	4,17,30, 42

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

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/037117

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/257967 A1 (EVERY MARK [US] ET AL) 20 October 2011 (2011-10-20) In particular paragraphs 0032, 0039 and 0043 -----	1-3, 5-16, 18-29, 31-41, 43-50
Y	US 2007/021958 A1 (VISSER ERIK [US] ET AL) 25 January 2007 (2007-01-25) In particular paragraphs 0055 and 0059 -----	1-3, 5-16, 18-29, 31-41, 43-50
Y	US 2006/053003 A1 (SUZUKI TETSU [JP] ET AL) 9 March 2006 (2006-03-09) In particular paragraph 0214 -----	1-3, 5-16, 18-29, 31-41, 43-50
X	DIETHORN ET AL: "Subband Noise Reduction Methods for Speech Enhancement", 1 January 2004 (2004-01-01), AUDIO SIGNAL PROCESSING FOR NEXT-GENERATION MULTIMEDIA COMMUNICATION SYSTEMS, BOSTON, MA : KLUWER ACADEMIC PUBL, US, PAGE(S) 91 - 115, XP008167324, ISBN: 978-1-4020-7768-5 In particular Section 5.2.2, paragraph 3, Equation 4.35 -----	51-54
X	DIETHORN E J: "A subband noise-reduction method for enhancing speech in telephony and teleconferencing", APPLICATIONS OF SIGNAL PROCESSING TO AUDIO AND ACOUSTICS, 1997. 1997 I EEE ASSP WORKSHOP ON NEW PALTZ, NY, USA 19-22 OCT. 1997, NEW YORK, NY, USA, IEEE, US, 19 October 1997 (1997-10-19), page 4pp, XP010248196, ISBN: 978-0-7803-3908-8 In particular Sections, 2.1 and 2.3 -----	51-54
X	US 2004/052384 A1 (ASHLEY JAMES PATRICK [US] ET AL) 18 March 2004 (2004-03-18) In particular, Figures 5, 7 and 8, Equation 1, paragraph 0032 ----- -/--	51-54

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/037117

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>Frédéric Mustiere ET AL: "EFFICIENT SNR-BASED SUBBAND POST-PROCESSING FOR RESIDUAL NOISE REDUCTION IN SPEECH ENHANCEMENT ALGORITHMS", EUSIPCO 2011, Proceedings of, 23 August 2010 (2010-08-23), pages 1558-1561, XP055101329, Retrieved from the Internet: URL:http://www.eurasip.org/Proceedings/Eusipco/Eusipco2010/Contents/papers/1569293653.pdf [retrieved on 2014-02-11] In particular Section 2, Figure 2, Equation 2</p> <p style="text-align: center;">-----</p>	51-54

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/037117

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/ISA/ 210

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

1. claims: 1-50

Signal level matching comprising a difference signal, a harmonicity threshold, preserving harmonics and applying an envelope

2. claims: 51-54

Signal level matching comprising segmenting an input into multiple bands, a signal-to-noise threshold, a target spectrum and adjusting a gain

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2013/037117

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011257967	A1	20-10-2011	JP 2013525843 A
			KR 20130061673 A
			TW 201207845 A
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			WO 2004111996 A1

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