

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 February 2010 (04.02.2010)

PCT

(10) International Publication Number
WO 2010/014663 A3

(51) International Patent Classification:
H04R 3/04 (2006.01)

(21) International Application Number:
PCT/US2009/052042

(22) International Filing Date:
29 July 2009 (29.07.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/137,377 29 July 2008 (29.07.2008) US

(71) Applicant (for all designated States except US): DOLBY LABORATORIES LICENSING CORPORATION [US/US]; 100 Potrero Avenue, San Francisco, CA 94103-4813 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): FELLERS, Matthew, C. [US/US]; 100 Potrero Avenue, San Francisco, CA 94103-4813 (US). DAVIDSON, Grant, A. [US/US]; 100 Potrero Avenue, San Francisco, CA 94103-4813 (US). YU, Rongshan [SG/US]; 1445 Lyon Street #2, San Francisco, CA 94115 (US). BENJAMIN, Eric, M. [US/US]; 1229 Springwood Way, Pacifica, CA 94044 (US). GUNDRY, Kenneth, J. [GB/US]; 100 Potrero Avenue, San Francisco, CA 94103-4813 (US).

(74) Agents: ANDERSEN, Robert, L. et al.; Dolby Laboratories, Inc., Intellectual Property Group, 999 Brannan Street, San Francisco, CA 94103-4938 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,

DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
- of inventorship (Rule 4.17(iv))

Published:

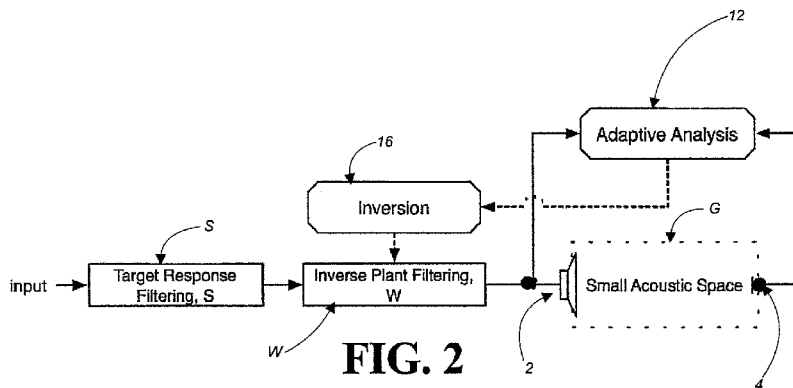
- with international search report (Art. 21(3))

(88) Date of publication of the international search report:
15 July 2010

(15) Information about Correction:

Previous Correction:
see Notice of 27 May 2010

(54) Title: METHOD FOR ADAPTIVE CONTROL AND EQUALIZATION OF ELECTROACOUSTIC CHANNELS



(57) Abstract: An electroacoustic channel soundfield is altered. An audio signal is applied by an electromechanical transducer to an acoustic space, causing air pressure changes therein. Another audio signal is obtained by a second electromechanical transducer, responsive to air pressure changes in the acoustic space. A transfer function estimate of the electroacoustic channel is established, responsive to the second audio signal and part of the first audio signal. The transfer function estimate is derived to be adaptive to temporal variations in the electroacoustic channel transfer function. Filters are obtained with transfer functions based on the transfer function estimate. Part of the first audio signal is filtered therewith.

WO 2010/014663 A3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/052042

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04R3/04
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)
H04R

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, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JOHN N. MOURJOPOULOS: "Digital Equalization of Room Acoustics" JOURNAL OF THE AUDIO ENGINEERING SOCIETY, vol. 42, no. 11, November 1994 (1994-11), pages 884-900, XP002552216	1-8, 11, 14-16
Y	abstract	12, 13
A	figure 1 section "0. Introduction" section "3. RTF Equalization by Vector Quantization" "section 4. Performance of the VQ equalization method"	9, 10
A	US 6 415 034 B1 (HIETANEN JARMO [FI]) 2 July 2002 (2002-07-02) column 6, line 22 - line 33 ----- -/-- -----	3

 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

"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

8 April 2010

Date of mailing of the international search report

19/04/2010

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

Authorized officer

Guillaume, Mathieu

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/052042

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>MOURJOPOULOS J N ET AL: "A vector quantization approach for room transfer function classification" SPEECH PROCESSING 1. TORONTO, MAY 14 - 17, 1991; [INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH & SIGNAL PROCESSING. ICASSP], NEW YORK, IEEE, US, vol. CONF. 16, 14 April 1991 (1991-04-14), pages 3593-3596; XP010043646 ISBN: 978-0-7803-0003-3 abstract section "2. Room Transfer Function and All-pole Approximation"</p>	4
A	<p>JEAN-MARC JOT ET AL: "Binaural Simulation of Complex Acoustic Scenes for Interactive Audio" PROCEEDINGS OF THE INTERNATIONAL AES CONFERENCE, XX, XX, vol. 121, 1 January 2006 (2006-01-01), pages 1-20, XP007905995 section "2.3 Multi-channel binaural synthesis"</p>	7
A	<p>ELLIOTT S J ET AL: "MULTIPLE-POINT EQUALIZATION IN A ROOM USING ADAPTIVE DIGITAL FILTERS" JOURNAL OF THE AUDIO ENGINEERING SOCIETY, AUDIO ENGINEERING SOCIETY, NEW YORK, NY, US, vol. 37, no. 11, 1 November 1989 (1989-11-01), pages 899-907, XP000142129 ISSN: 1549-4950 figures 1,2,11 section "0. Introduction" section "1. Single-Channel Equalization" section "3. Adaptive Algorithms"</p>	1-8,11, 14-16
A	<p>MATTI KARJALAINEN ET AL.: "Frequency-Zooming ARMA Modeling of Resonant and Reverberant Systems" JOURNAL OF THE AUDIO ENGINEERING SOCIETY, vol. 50, no. 12, December 2002 (2002-12), pages 1012-1029, XP002552217 section "2. ARMA Modeling" section "3. Frequency-Zooming ARMA (FZ-ARMA)" section "4.1 Modeling of Room Impulse Responses" section "4.2 Loudspeaker-Room Equalization"</p> <p style="text-align: center;">----- -/--</p>	4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/052042

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 441 835 A (SONAPTIC LTD [GB]; WOLFSON MICROELECTRONICS PLC [GB]) 19 March 2008 (2008-03-19) figures 2-9 page 1, line 1 - page 3, line 26 page 4, line 15 - page 5, line 7 page 14, line 5 - page 16, line 30 page 18, line 16 - page 19, line 3 -----	1,2, 8-10,12, 13
Y	KUO S M ET AL: "ACTIVE NOISE CONTROL: A TUTORIAL REVIEW" PROCEEDINGS OF THE IEEE, IEEE. NEW YORK, US LNKD- DOI:10.1109/5.763310, vol. 87, no. 6, 1 June 1999 (1999-06-01), pages 943-973, XP011044219 ISSN: 0018-9219 section "B. Secondary-Path Effects"; page 945 section "A. Adaptive Feedback ANC Systems"; page 953 - page 954; figures 14,15 -----	12,13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/052042

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: 1-8, 11, 14-16

a method for altering the sound field in an acoustic space

1.1. claims: 1-5, 8, 11, 14-16

Claim 3 relates to a method for altering the sound field in an acoustic space which uses a time average of temporal variations in the transfer function of the electroacoustic channel in order to obtain a transfer function estimate

1.2. claims: 6, 7

claim 6 relates to a method for altering the sound field in an acoustic space wherein the group of transfer functions from which a transfer function estimate is obtained includes the impulse responses of the electroacoustic channel across a range of variations in impulse responses with time

2. claims: 9, 10

a method for altering the soundfield in a small acoustic space partially bounded by an over-the-ear or an around-the-ear cup

3. claims: 12, 13

a combined method for altering the soundfield and cancelling audio disturbance in an acoustic space

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/052042

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6415034	B1	02-07-2002 FI 963173 A	14-02-1998
GB 2441835	A	19-03-2008 GB 2460972 A	23-12-2009
		WO 2008096125 A2	14-08-2008
		US 2010061564 A1	11-03-2010