



- (51) International Patent Classification:
G10K 11/178 (2006.01)
- (21) International Application Number:
PCT/US2012/035807
- (22) International Filing Date:
30 April 2012 (30.04.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/493,162 3 June 2011 (03.06.2011) US
13/310,380 2 December 2011 (02.12.2011) US
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- (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, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, 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, RS, 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 the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

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

[Continued on next page]

(54) Title: EAR-COUPLING DETECTION AND ADJUSTMENT OF ADAPTIVE RESPONSE IN NOISE-CANCELING IN PERSONAL AUDIO DEVICES

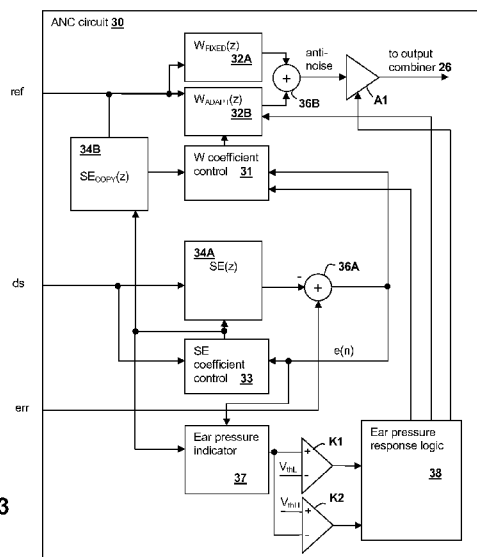


Fig. 3

(57) Abstract: A personal audio device, such as a wireless telephone, includes an adaptive noise canceling (ANC) circuit that adaptively generates an anti-noise signal from a reference microphone signal and injects the anti-noise signal into the speaker or other transducer output to cause cancellation of ambient audio sounds. An error microphone is also provided proximate the speaker to estimate an electro-acoustical path from the noise canceling circuit through the transducer. A processing circuit determines a degree of coupling between the user's ear and the transducer and adjusts the adaptive cancellation of the ambient sounds to prevent erroneous and possibly disruptive generation of the anti-noise signal if the degree of coupling lies either below or above a range of normal operating ear contact pressure.

WO 2012/166272 A3



— *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))*

(88) Date of publication of the international search report:
1 August 2013

INTERNATIONAL SEARCH REPORT

International application No PCT/US2012/035807

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G10K11/178
 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)
 G10K

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.
X	US 2010/322430 A1 (ISBERG PETER [SE]) 23 December 2010 (2010-12-23)	1-3,9, 12-14, 20, 23-25,31
A	abstract; figures 1,3,4 paragraphs [0006], [0036] - [0040], [0042], [0045] - [0048], [0051] - [0058] -----	4,15,26
X	WO 2010/117714 A1 (BOSE CORP [US]; BURGE BENJAMIN D [US]; GAUGER DANIEL M [US]; GREENBURG) 14 October 2010 (2010-10-14) abstract; figures 1a,1b,3e paragraphs [0065], [0068] - [0073], [0077], [0127], [0132] - [0134] -----	1,12,23
A	US 2004/264706 A1 (RAY LAURA R [US] ET AL) 30 December 2004 (2004-12-30) abstract; figure 1 paragraphs [0033] - [0039] -----	4,15,26

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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 6 March 2013	Date of mailing of the international search report 11/06/2013
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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 de Jong, Frank
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2012/035807
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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2010322430	A1	23-12-2010	CN 102461206 A	16-05-2012
			EP 2443840 A1	25-04-2012
			US 2010322430 A1	23-12-2010
			WO 2010145723 A1	23-12-2010

WO 2010117714	A1	14-10-2010	CN 102365875 A	29-02-2012
			EP 2415276 A1	08-02-2012
			WO 2010117714 A1	14-10-2010

US 2004264706	A1	30-12-2004	EP 1744713 A2	24-01-2007
			JP 2007536877 A	13-12-2007
			KR 20070010166 A	22-01-2007
			US 2004264706 A1	30-12-2004
			WO 2005112849 A2	01-12-2005

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/035807

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.:

1-4, 9, 12-15, 20, 23-26, 31

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: 1-4, 9, 12-15, 20, 23-26, 31

ANC system with estimation of the acoustic coupling between a loudspeaker and a person's ear, wherein the ANC system ensures a smooth transition to a stable set of ANC parameters when an change in coupling occurs.

2. claims: 5-8, 16-19, 27-30

ANC system with estimation of the acoustic coupling between a loudspeaker and a person's ear, wherein ineffective use of the ANC for a degree of coupling below the normal operating range is prevented.

3. claims: 10, 11, 21, 22, 32, 33

ANC system with estimation of the acoustic coupling between a loudspeaker and a person's ear, wherein the method of determining a degree of coupling is improved.
