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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, RO, RS, RU, 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.

[Continued on next page]

- (54) Title: SYSTEMS, METHODS, APPARATUS, AND COMPUTER-READABLE MEDIA FOR CODING OF HARMONIC SIGNALS

- (57) Abstract: A scheme for coding a set of transform coefficients that represent an audio-frequency range of a signal uses a harmonic model to parameterize a relationship between the locations of regions of significant energy in the frequency domain.

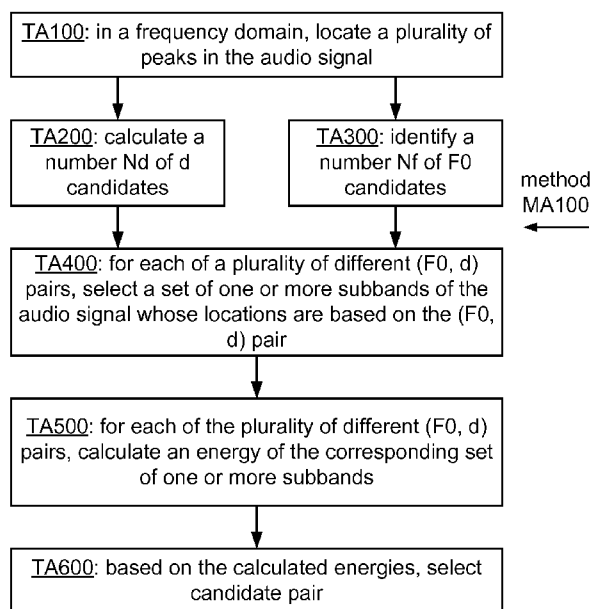


FIG. 1A

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- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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).
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- Published:**
- *with international search report (Art. 21(3))*
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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
 INV. G10L11/04 G10L19/08
 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

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, 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	BARTKOWIAK MACIEJ ET AL: "Harmonic Sinusoidal + Noise Modeling of Audio Based on Multiple F0 Estimation", AES CONVENTION 125; OCTOBER 2008, AES, 60 EAST 42ND STREET, ROOM 2520 NEW YORK 10165-2520, USA,	15-19
A	1 October 2008 (2008-10-01), XP040508748, *Sections 1-3 and 5.2*	1-14, 20-48
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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	"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 document 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 February 2012	Date of mailing of the international search report 13/02/2012
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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 Bensa, Julien
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/045837

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>CHUNGHSIN YEH ET AL: "Multiple Fundamental Frequency Estimation Of Polyphonic Music Signals", 2005 IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING - 18-23 MARCH 2005 - PHILADELPHIA, PA, USA, IEEE, PISCATAWAY, NJ, vol. 3, 18 March 2005 (2005-03-18), pages 225-228, XP010792370, DOI: 10.1109/ICASSP.2005.1415687 ISBN: 978-0-7803-8874-1 abstract *Sections 2,3*</p> <p style="text-align: center;">-----</p>	1,15,20, 34,48
A	<p>PAIVA RUI PEDRO ET AL: "A Methodology for Detection of Melody in Polyphonic Musical Signals", AES CONVENTION 116; MAY 2004, AES, 60 EAST 42ND STREET, ROOM 2520 NEW YORK 10165-2520, USA, 1 May 2004 (2004-05-01), XP040506771, *Section 2.1*</p> <p style="text-align: center;">-----</p>	1,15,20, 34,48
A	<p>DOVAL B ET AL: "Estimation of fundamental frequency of musical sound signals", 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 3657-3660, XP010043661, DOI: 10.1109/ICASSP.1991.151067 ISBN: 978-0-7803-0003-3 *Sections Theory and Implementation*</p> <p style="text-align: center;">-----</p>	1,15,20, 34,48
A	<p>WO 03/015077 A1 (AMUSETEC CO LTD [KR]; JUNG DOILL [KR]; SEO HUNSEOK [KR]) 20 February 2003 (2003-02-20) claims 1,2</p> <p style="text-align: center;">-----</p>	1,15,20, 34,48

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/045837

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03015077	A1	20-02-2003	
		AT 377821 T	15-11-2007
		CN 1539136 A	20-10-2004
		DE 60223391 T2	28-08-2008
		EP 1425735 A1	09-06-2004
		JP 2004538525 A	24-12-2004
		US 2004225493 A1	11-11-2004
		WO 03015077 A1	20-02-2003
