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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.

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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))*

[Continued on next page]

(54) **Title**: SPEEDUP TECHNIQUES FOR RATE DISTORTION OPTIMIZED QUANTIZATION

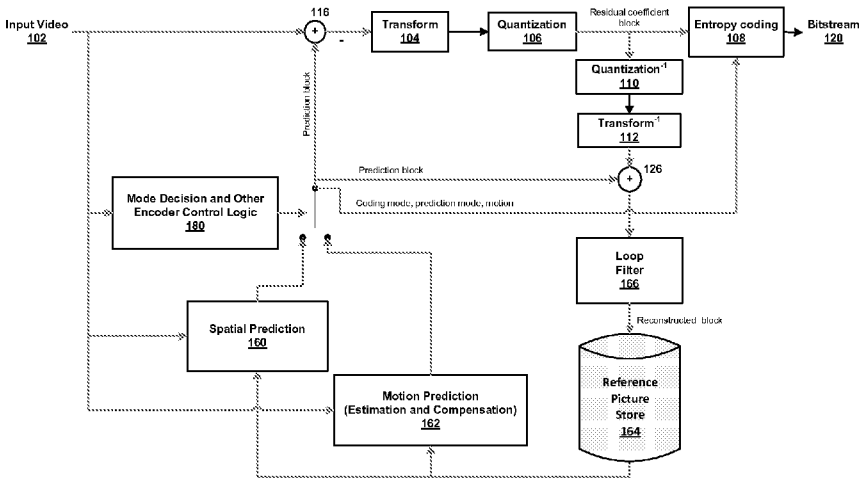


FIG. 1

(57) **Abstract**: Techniques for selecting a coding mode for an image coding process are described. Coding modes can be selected through a coding mode transition state machine, a re-quantization process, selection of an optimal transform size, by skipping some quantization parameters, or by performing motion search.

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Published:

— *with international search report (Art. 21(3))*

— *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:
15 September 2011

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/26 H04N7/50
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)
H04N

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.
Y	WO 2009/105732 A1 (QUALCOMM INC [US]; YE YAN [US]; KARCZEWICZ MARTA [US]; PEISONG CHEN [U) 27 August 2009 (2009-08-27) abstract page 5, line 1 - page 6, line 20 page 7, lines 2-18 page 13, lines 9-10 ----- -/--	1-7, 11-14, 18-20, 41-45

[X] Further documents are listed in the continuation of Box C.

[X] 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	Date of mailing of the international search report
8 July 2011	18/07/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Santos Luque, Rocio

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/048029

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.

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WIN-BIN HUANG ET AL: "Two-Stage Mode Selection of H.264/AVC Video Encoding with Rate Distortion Optimization", ACOUSTICS, SPEECH AND SIGNAL PROCESSING, 2006. ICASSP 2006 PROCEEDINGS . 2006 IEEE INTERNATIONAL CONFERENCE ON TOULOUSE, FRANCE 14-19 MAY 2006, PISCATAWAY, NJ, USA,IEEE, PISCATAWAY, NJ, USA, 14 May 2006 (2006-05-14), pages 893-896, XP031386524, DOI: DOI:10.1109/ICASSP.2006.1660487 ISBN: 978-1-4244-0469-8 page 895, left-hand column, line 5 - line 12	1-7, 11-14, 18-20, 41-45
A	EP 1 921 863 A2 (ST MICROELECTRONICS NV [NL]) 14 May 2008 (2008-05-14) paragraph [0109] - paragraph [0117]	1-20
A	YEH J ET AL: "Complexity scalable mode-based H.263 video transcoding", PROCEEDINGS 2003 INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (CAT. NO.03CH37429), BARCELONA, SPAIN, 14-17 SEPT. 2003; [INTERNATIONAL CONFERENCE ON IMAGE PROCESSING], IEEE PISCATAWAY, NJ, USA, vol. 1, 14 September 2003 (2003-09-14), pages 169-172, XP010669770, ISBN: 978-0-7803-7750-9 the whole document	1-20
A	LEFOL D ET AL: "Mode Refinement Algorithm for H.264 Intra Frame Requantization", 2006 IEEE INTERNATIONAL SYMPOSIUM ON CIRCUITS AND SYSTEMS 21-24 MAY 2006 ISLAND OF KOS, GREECE, IEEE - PISCATAWAY, NJ, USA, 21 May 2006 (2006-05-21), pages 4459-4462, XP010939681, DOI: DOI:10.1109/ISCAS.2006.1693619 ISBN: 978-0-7803-9389-9 the whole document	1
X	WO 2009/080928 A1 (THOMSON LICENSING [FR]; HIRON FRANCK [FR]; OLIVIER YANNICK [FR]; GUILL) 2 July 2009 (2009-07-02) abstract page 7, lines 15-20 page 8, lines 1-5 page 9, lines 28-32 page 10, lines 17-24 page 12, lines 21-31 page 14, lines 2-7,17-32 figures 1,2	21,25-31

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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	US 2007/009025 A1 (KWON ET AL) 11 January 2007 (2007-01-11) paragraphs [0006], [0037] - [0039] -----	21
X	US 2004/264571 A1 (ZHANG ET AL) 30 December 2004 (2004-12-30) paragraphs [0022] - [0024], [0 37], [0055], [0064], [0068], [0071], [0075] -----	32
A	DAVID DREZNER ET AL: "RDO Transform Selection for a Multi-Transform Video Encoder", INFORMATION TECHNOLOGY: RESEARCH AND EDUCATION, 2006. ITRE '06. INTERN ATIONAL CONFERENCE ON, IEEE, PI, 1 October 2006 (2006-10-01), pages 172-178, XP031112940, ISBN: 978-1-4244-0858-0 the whole document -----	32-35
X	W-N LIE ET AL: "Two-pass rate-distortion optimized rate control technique for H.264/AVC video", VISUAL COMMUNICATIONS AND IMAGE PROCESSING; 12-7-2005 - 15-7-2005; BEIJING,, 12 July 2005 (2005-07-12), XP030080948, abstract page 1064, lines 12-31 -----	36
X	DO-KYOUNG KWON ET AL: "Rate Control for H.264 Video With Enhanced Rate and Distortion Models", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 16, no. 5, 1 May 2007 (2007-05-01), pages 517-529, XP011179787, ISSN: 1051-8215 page 518, right-hand column, second paragraph page 519, left-hand column, lines 11-15 -----	37-39
Y	KARCZEWICZ ET AL.: "R-D based quantization in H.264", APPLICATIONS OF DIGITAL IMAGE PROCESSING XXXII. PROCEEDINGS OF THE SPIE, vol. 7443, August 2009 (2009-08), pages 744314-1-744314-8, XP040501316, the whole document -----	40
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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.
Y	DAMIEN LEFOL ET AL: "Mode Refinement Algorithm for H.264 Inter Frame Requantization", IMAGE PROCESSING, 2006 IEEE INTERNATIONAL CONFERENCE ON, IEEE, PI, 1 October 2006 (2006-10-01), pages 845-848, XP031048769, ISBN: 978-1-4244-0480-3 abstract page 845, right-hand column, lines 3-19 page 846, right-hand column, lines 1-20 -----	40

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/048029

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009105732 A1	27-08-2009	CA 2713414 A1	27-08-2009
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		JP 2011514056 A	28-04-2011
		KR 20100120691 A	16-11-2010
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WO 2009080928 A1	02-07-2009	EP 2225888 A1	08-09-2010
		FR 2925819 A1	26-06-2009
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US 2004264571 A1	30-12-2004	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-20, 41-45

   State machine of possible mode transitions.

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2. claims: 21-31

   Re-quantization of the best coding modes

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3. claims: 32-35

   Selection among a plurality of transforms for coding

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4. claims: 36-39

   Selection of quantization parameter values to be skipped

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5. claim: 40

   Optimized motion search for different quantization parameters

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