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(54) Title: AUDIO TRANSMITTER PROCESSOR, AUDIO RECEIVER PROCESSOR AND RELATED METHODS AND COMPUTER PROGRAMS

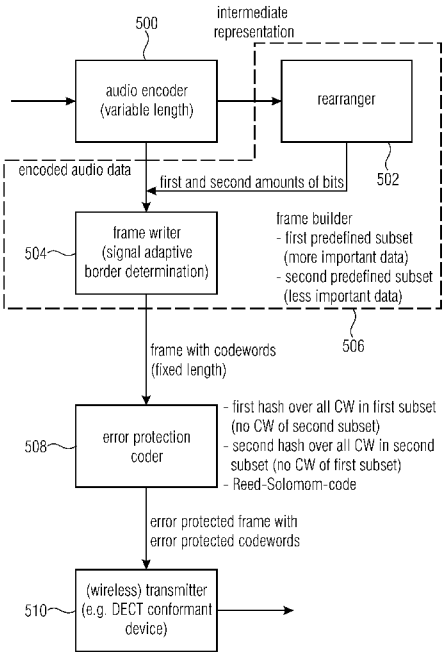

Fig. 5

(57) Abstract: An audio transmitter processor for generating an error protected frame using encoded audio data of an audio frame, the encoded audio data for the audio frame comprising a first amount of information units and a second amount of information units, comprises: a frame builder (506) for building a codeword frame having a codeword raster defining reference positions for a predefined total number of codewords, wherein the frame builder (506) is configured to write the information units of the first amount of information units starting at reference positions of a first predefined subset of the codewords; and to write the information units of the second amount of information units starting at reference positions of a second predefined subset of the codewords, wherein the frame builder (506) is configured to determine a border between the first amount of information units and the second amount of information units so that a starting information unit of the second amount of information units coincides with a codeword border; and an error protection coder (508) for processing one or more of the codewords of the first predefined subset of the codewords to obtain a first processing result or for processing one or more of the codewords of the second predefined subset of the codewords to obtain a second processing result and for adding the first processing result or the second processing result to the predefined number of codewords to obtain a plurality of processed codewords representing the error protected frame, or for processing the codewords of the first predefined subset of the codewords or of the second predefined subset of the codewords individually to obtain a plurality of processed codewords representing the error protected frame.

[Continued on next page]

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SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

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B. FIELDS SEARCHED

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/140359 A1 (EHRET ANDREAS [DE] ET AL) 21 June 2007 (2007-06-21)	1,2,4-6, 8,9, 15-17, 20-23, 25, 30-33, 43-46
Y	paragraphs [0004], [0006], [0008], [0012] paragraph [0032] - paragraph [0055] paragraph [0069] figures 2, 3	3,7, 10-14, 34-42
X	EP 0 936 772 A2 (LUCENT TECHNOLOGIES INC [US]) 18 August 1999 (1999-08-18) paragraphs [0034], [0038], [0039] figure 5	1,44,46

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

[X] See patent family annex.

* Special categories of cited documents :

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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	Stolte, Norbert

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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	US 5 148 271 A (KATO SHIRO [JP] ET AL) 15 September 1992 (1992-09-15) figures 2-b	7,10-14, 34,37-42
A	EP 0 732 855 A2 (TOSHIBA KK [JP]) 18 September 1996 (1996-09-18) figures 2c, 26	7,10-14, 34,37-42
X	BOLTZE T ET AL: "Audio services and applications", INTERNATIONAL SYMPOSIUM ON DIGITAL AUDIO BROADCASTING, XX, XX, no. ED. 2, 1 January 2003 (2003-01-01), pages 75-125, XP003011836, sections 3.7.1 - 3.7.4	23-25, 31,45
Y	US 6 301 558 B1 (ISOZAKI MASAAKI [JP]) 9 October 2001 (2001-10-09) column 4, line 18 - line 45 column 6, line 10 - line 27	35,36
A	US 2004/128128 A1 (WANG YE [SG] ET AL) 1 July 2004 (2004-07-01) paragraph [0048]	35
A	PERKINS C ET AL: "A SURVEY OF PACKET LOSS RECOVERY TECHNIQUES FOR STREAMING AUDIO", IEEE NETWORK, IEEE SERVICE CENTER, NEW YORK, NY, US, vol. 12, no. 5, 1 September 1998 (1998-09-01), pages 40-48, XP000875014, ISSN: 0890-8044, DOI: 10.1109/65.730750 the whole document	1-4, 6-17, 23-25, 30-32, 34-42, 44-46
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X	US 2013/254615 A1 (VIJAYASANKAR KUMARAN [US] ET AL) 26 September 2013 (2013-09-26) paragraphs [0042], [0048] figures 9, 10	11,18, 19, 26-29, 44,46
A	EP 0 798 888 A2 (NOKIA MOBILE PHONES LTD [FI]) 1 October 1997 (1997-10-01) page 5, line 21 - page 6, line 7 figure 6	11,18, 19, 26-29, 44,46

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2020/053617

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: 1-4, 6-17, 23-25, 30-32, 34-42, 44-46

Building a codeword frame having a codeword raster defining reference positions for a predefined total number of codewords, writing the information units of the first amount of information units starting at reference positions of a first predefined subset of the codewords; and writing the information units of the second amount of information units starting at reference positions of a second predefined subset of the codewords, and determining a border between the first amount of information units and the second amount of information units so that a starting information unit of the second amount of information units coincides with a codeword border (as defined in claim 1).

1.1. claim: 3

Generating the first and the second amounts of information units using a predefined time portion of an audio signal, wherein the information units comprise a number of obligatory information units and a variable number of residual information units, using a variable length coding rule resulting in a signal-dependent number of the obligatory information units for the predefined time portion, building the codeword frame so that the codeword frame has a fixed size of information units, and determining the variable number of residual information units as an information amount being equal to the difference derived from the fixed size of information units for the codeword frame and the number of obligatory information units (as defined in claim 3).

1.2. claims: 7, 10-14, 34, 37-42

Writing the information units of the first/second amount of information units in a first writing direction starting at reference positions of at least two codewords of the first/second predefined number of codewords, and in a second opposite writing direction starting at reference positions of at least two other codewords of the first/second predefined number of codewords (as defined in claim 7).

1.3. claims: 23-25, 30-32, 35, 36, 45

Performing frame loss concealment at the receiver, wherein the error protection processor is configured to check whether a second predefined subset of codewords of the encoded audio frame comprises an error, and wherein the error concealer or the error concealment indicator is configured to perform a partial frame loss concealment operation or to generate a partial frame loss concealment indication for concealing the error in the second predefined

subset of the codewords (as defined in claim 24).

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2. claims: 5, 33

At least one codeword of the second predefined subset of the codewords is located between two codewords of the first predefined subset of the codewords or vice versa (as defined in claim 5).

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3. claim: 18

A number of codewords of the second predefined subset of the codewords is derived from a characteristic of the error protection code, and/or a total size of the plurality of processed codewords (as defined in claim 18).

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4. claims: 19, 26-29

The error protection coder is configured to calculate the first processing result as a first Hash value, to calculate the second processing result as a second Hash value, to add the first Hash value to the first predefined subset of the codewords and to add the second Hash value to the second predefined subset of the codewords, and to apply a codeword-wise block code to obtain the error protected codewords (as defined in claim 19).

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5. claims: 20-22, 43

The audio encoder having an arithmetic encoder generating minimum size data portions in a first granularity of information units, wherein the error protection coder is configured to operate in a second granularity of information units, wherein the first granularity is different from the second granularity (as defined in claim 20).

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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