

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	9900-34860US6
	First Named Inventor	Jonatan Samuelsson
	Title	REFERENCE PICTURE SIGNALING
	Express Mail Label No.	

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☐ Fee Transmittal Form (PTO/SB/17 or equivalent) 2. ☐ Applicant asserts small entity status. See 37 CFR 1.27 3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent. 4. ☒ Specification [Total Pages <u>55</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement) 5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>12</u>] 6. Inventor's Oath or Declaration [Total Pages <u>2</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) 7. ☒ Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PAPERS 10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 11. ☐ 37 CFR 3.73(c) Statement ☒ Power of Attorney (when there is an assignee) 12. ☐ English Translation Document (if applicable) 13. ☒ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 14. ☐ Preliminary Amendment 15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. ☐ Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 18. ☐ Other: _____ _____ _____ _____ _____

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS					
☒ The address associated with Customer Number: <u>146825</u> OR ☐ Correspondence address below					
Name					
Address					
City	State	Zip Code			
Country	Telephone	Email			
Signature	/Kevin L. Wingate/		Date	June 13, 2019	
Name (Print/Type)	Kevin L. Wingate		Registration No. (Attorney/Agent)	38,662	

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**LENOVO
EXHIBIT 1002**

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

REFERENCE PICTURE SIGNALING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 16/048,556, filed on July 30, 2018, which is a continuation of U.S. Patent Application No. 15/718,374, filed on September 28, 2017, now U.S. Patent No. 10,063,882, which is a continuation of U.S. Patent Application No. 15/299,997, filed on October 21, 2016, now U.S. Patent No. 9,807,418, which is a continuation of U.S. Patent Application No. 13/508,442, filed on April 25, 2013, now U.S. Patent No. 9,706,223, which is a 35 U.S.C. § 371 national stage application of PCT International Application No. PCT/SE2012/050439, filed on April 26, 2012, which claims the benefit of priority from U.S. Provisional Application No. 61/503,019, filed June 30, 2011, the entire contents of each of which are incorporated by reference herein as if set forth in their entireties.

TECHNICAL FIELD

[0002] The embodiments generally relate to reference picture management in connection with video encoding and decoding, and in particular to reference picture signaling and buffer management.

BACKGROUND

[0003] H.264, also referred to as Moving Picture Experts Group-4 (MPEG-4) Advanced Video Coding (AVC), is the state of the art video coding standard. It consists of a block based hybrid video coding scheme that exploits temporal and spatial prediction.

[0004] High Efficiency Video Coding (HEVC) is a new video coding standard currently being developed in Joint Collaborative Team - Video Coding (JCT-VC). JCT-VC is a collaborative project between MPEG and International Telecommunication Union Telecommunication standardization sector (ITU-T). Currently, a Working Draft (WD) is defined that includes large macroblocks (abbreviated LCUs for Largest Coding Units) and a number of other new tools and is considerably more efficient than H.264/AVC.

[0005] At a receiver a decoder receives a bit stream representing pictures, i.e. video data packets of compressed data. The compressed data comprises payload and control information. The control information comprises e.g. information of which reference pictures should be stored in a reference picture buffer, also referred to as a decoded picture

buffer (DPB). This information is a relative reference to previous received pictures. Further, the decoder decodes the received bit stream and displays the decoded picture. In addition, the decoded pictures are stored in the decoded picture buffer according to the control information. These stored reference pictures are used by the decoder when decoding subsequent pictures.

[0006] A working assumption for the processes of decoded picture buffer operations in the working draft of HEVC is that they will be inherited from H.264/AVC to a very large extent. A simplified flow chart of the scheme as it is designed in H.264/AVC is shown in Fig. 1.

[0007] Before the actual decoding of a picture, the *frame_num* in the slice header is parsed to detect a possible gap in *frame_num* if Sequence Parameter Set (SPS) syntax element *gaps_in_frame_num_value_allowed_flag* is 1. The *frame_num* indicates the decoding order. If a gap in *frame_num* is detected, “non-existing” frames are created and inserted into the decoded picture buffer (DPB).

[0008] Regardless of whether there was a gap in *frame_num* or not the next step is the actual decoding of the current picture. If the slice headers of the picture contain Memory Management Control Operations (MMCO) commands, adaptive memory control process is applied after decoding of the picture to obtain relative reference to the pictures to be stored in the decoded picture buffer; otherwise a sliding window process is applied to obtain relative reference to the pictures to be stored in the decoded picture buffer. As a final step, the “bumping” process is applied to deliver the pictures in correct order.

[0009] A problem with H.264/AVC is its vulnerability to losses of pictures that contains MMCO of type 2, 3, 4, 5 or 6 as described in Table 1 below.

Table 1 – Memory management control operation values for H.264/AVC

<i>memory_management_control_operation</i>	Memory Management Control Operation
0	End <i>memory_management_control_operation</i> syntax element loop
1	Mark a short-term reference picture as “unused for reference”
2	Mark a long-term reference picture as “unused for reference”

3	Mark a short-term reference picture as “used for long-term reference” and assign a long-term frame index to it
4	Specify the maximum long-term frame index and mark all long-term reference pictures having long-term frame indices greater than the maximum value as “unused for reference”
5	Mark all reference pictures as “unused for reference” and set the <i>MaxLongTermFrameIdx</i> variable to “no long-term frame indices”
6	Mark the current picture as “used for long-term reference” and assign a long-term frame index to it

[0010] Loss of a picture that does not contain MMCO, or a picture that contains MMCO of type 0 or 1, is of course severe to the decoding process. Pixel values of the lost picture will not be available and may affect future pictures for a long period of time due to incorrect inter prediction. There is also a risk that reference picture lists for a few pictures following the lost picture will be wrong, for example if the lost picture contained MMCO that marked one short-term reference picture as “unused for reference” that otherwise would have been included in the reference picture list of the following picture. However, the decoding process can generally recover such a loss through usage of constrained intra blocks, intra slices or by other means.

[0011] But if a picture containing MMCO of type 2, 3, 4, 5 or 6 is lost there is a risk that the number of long term pictures in the DPB is different from what it would have been if the picture was received, resulting in an “incorrect” sliding window process for all the following pictures. That is, the encoder and decoder will contain a different number of short-term pictures resulting in out-of-sync behavior of the sliding window process. This loss cannot be recovered through usage of constrained intra blocks, intra slices or similar techniques (not even an open Group Of Picture (GOP) Intra picture). The only way to ensure recovery from such a loss is through an Instantaneous Decoder Refresh (IDR)

picture or through an MMCO that cancels the effect of the lost MMCO. What makes the situation even worse is that a decoder will not necessarily know that the sliding window process is out-of-sync and thus cannot report the problem to the encoder or request an IDR picture even in applications where a feedback channel is available.

[0012] One way to reduce the risk of losing important MMCO information is to use *dec_ref_pic_marking_repetition* Supplementary Enhancement Information (SEI) messages. However the encoder will not know if the decoder is capable of making use of *dec_ref_pic_marking_repetition* SEI messages. Further, there is a risk that the *dec_ref_pic_marking_repetition* SEI message is also lost.

[0013] There is, thus, a need for an efficient reference picture signaling and buffer management that do not suffer from the shortcomings and limitations of prior art solutions.

SUMMARY

[0014] It is a general objective to provide an efficient reference picture signaling and buffer management in connection with video encoding and decoding.

[0015] This and other objectives are met by embodiments disclosed herein.

[0016] An aspect of the embodiments relates to a method of decoding an encoded representation of a picture of a video stream of multiple pictures. The method comprises retrieving buffer description information defining at least one reference picture from the encoded representation of the picture. At least one picture identifier identifying a respective reference picture of the at least one reference picture is determined based on the buffer description information. The respective reference picture is to be used as decoding reference for the picture. A decoded picture buffer is updated based on the determined at least one picture identifier.

[0017] A related aspect of the embodiments defines a decoder configured to decode an encoded representation of a picture of a video stream of multiple pictures. The decoder comprises a data retriever configured to retrieve buffer description information defining at least one reference picture from the encoded representation of the picture. A picture identifier determiner of the decoder is configured to determine, based on the buffer description information, at least one picture identifier identifying a respective reference picture of the at least one reference picture as decoding reference for the picture. The

decoder also comprises a buffer manager configured to update a decoded picture buffer based on the at least one picture identifier.

[0018] Another related aspect of the embodiments defines a decoder comprising an input section configured to receive encoded representations of multiple pictures of a video stream. The decoder also comprises a processor configured to process code means of a computer program stored in a memory. The code means causes, when run on the processor, the processor to retrieve buffer description information defining at least one reference picture from an encoded representation of a picture. The processor is also caused to determine, based on the buffer description information, at least one picture identifier identifying a respective reference picture of the at least one reference picture as decoding reference for the picture. The code means further causes the processor to update a decoded picture buffer based on the at least one picture identifier. An output section of the decoder is configured to output decoded pictures of the video stream.

[0019] Another aspect of the embodiments relates to a method of encoding a picture of a video stream of multiple pictures. The method comprises determining, for the picture, at least one reference picture of the multiple pictures as encoding reference for the picture. The method also comprises providing, for each reference picture, a picture identifier identifying the reference picture. Buffer description information defining the at least one reference picture is generated based on the at least one picture identifier. The buffer description information is inserted in an encoded representation of the picture.

[0020] A related aspect of the embodiments defines an encoder configured to encode a picture of a video stream of multiple pictures. The encoder comprises a reference picture determiner configured to determine, for the picture, at least one reference picture of the video stream as encoding reference for the picture. The encoder also comprises a picture identifier provider configured to provide, for each reference picture, a picture identifier identifying the reference picture. A buffer description information generator is configured to generate buffer description information based on the at least one reference picture identifier. The buffer description information is inserted by a data inserter in an encoded representation of the picture.

[0021] Another related aspect of the embodiments defines an encoder comprising an input section configured to receive multiple pictures of a video stream and a processor configured to process code means of a computer program stored in a memory. The code means causes, when run on the processor, the processor to determine, for a picture of the

video stream, at least one reference picture of the video stream as encoding reference for the picture. The processor is also caused to provide, for each reference picture, a picture identifier identifying the reference picture and generate buffer description information based on the at least one picture identifier. The code means further causes the processor to insert the buffer description information in an encoded representation of the picture. The encoder further comprises an output section configured to output encoded representations of pictures.

[0022] In clear contrast to the prior art solutions in which correct reference picture management is dependent on that previously encoded pictures have been correctly received and decoded, the embodiments provide buffer description information that is used for reference pictures in an absolute and explicit way instead of a relative or implicit way. Thus, the encoded representation of a picture contains the information about which reference pictures to use for reference during decoding independent of the encoded representations of previous pictures in the video stream.

[0023] The embodiments thereby make reference picture management and signaling less vulnerable to errors since the decoder will only have to rely on information contained in the current picture for the reference picture management of the current picture instead of relying on correctly delivered and interpreted buffer operations in previous pictures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The invention, together with further objects and advantages thereof, may best be understood by making reference to the following description taken together with the accompanying drawings, in which:

[0025] Fig. 1 is a simplified flow chart of the H.264/AVC reference buffer scheme;

[0026] Fig. 2 is an example of a coding structure with two temporal layers;

[0027] Fig. 3 is a flow chart of a method of encoding a picture according to an embodiment;

[0028] Fig. 4 is a video stream of multiple pictures according to an embodiment;

[0029] Fig. 5 is an encoded representation of a picture according to an embodiment;

[0030] Fig. 6 is a flow chart of an additional, optional step of the method in Fig. 3;

[0031] Fig. 7 is a flow chart of additional, optional steps of the method in Fig. 3 and an embodiment of generating buffer description information in Fig. 3;

[0032] Fig. 8 is an example of a coding structure with (sub)GOP size 8;

- [0033] Fig. 9 is a flow chart of a method of decoding an encoded representation of a picture according to an embodiment;
- [0034] Fig. 10 is a flow chart of an embodiment of determining picture identifier in Fig. 9;
- [0035] Fig. 11 is a flow chart of an embodiment of retrieving buffer description information in Fig. 9;
- [0036] Fig. 12 is a flow chart of another embodiment of determining picture identifier in Fig. 9;
- [0037] Fig. 13 is a flow chart of additional, optional step of the method in Fig. 9;
- [0038] Fig. 14 is a flow chart of an additional, optional step of the method in Fig. 9;
- [0039] Fig. 15 is an example of a coding structure;
- [0040] Fig. 16 is a simplified flow chart of a reference buffer scheme according to an embodiment;
- [0041] Fig. 17 is a schematic block diagram of a transmitter according to an embodiment;
- [0042] Fig. 18 is a schematic block diagram of an encoder according to an embodiment;
- [0043] Fig. 19 is a schematic block diagram of an encoder according to another embodiment;
- [0044] Fig. 20 is a schematic block diagram of a receiver according to an embodiment;
- [0045] Fig. 21 is a schematic block diagram of a decoder according to an embodiment; and
- [0046] Fig. 22 is a schematic block diagram of a decoder according to another embodiment.

DETAILED DESCRIPTION

- [0047] Throughout the drawings, the same reference numbers are used for similar or corresponding elements.
- [0048] The present embodiments generally relate to encoding and decoding of pictures, also referred to as frames in the art, of a video stream. In particular, the embodiments relate to management of reference pictures in connection with video encoding and decoding and the signaling of such reference pictures from the encoder to the decoder.

[0049] Video encoding, such as represented by H.264/MPEG-4 AVC and HEVC, utilizes reference pictures as predictions or references for the encoding and decoding of pixel data of a current picture. This is generally referred to as inter coding in the art where a picture is encoded and decoded relative to such reference pictures. In order to be able to decode an encoded picture, the decoder thereby has to know which reference pictures to use for the current encoded picture and has to have access to these reference pictures. Generally, the decoder uses a decoded picture buffer (DPB), also denoted reference picture buffer herein, for storing the reference pictures. It is then important that the reference pictures stored in the decoded picture buffer are indeed the correct reference pictures when decoding an encoded picture otherwise the decoder will use wrong reference pictures during the decoding process causing a degradation of the quality of the presented video.

[0050] The prior art techniques may suffer from problems with regard to using incorrect reference pictures when a picture carrying MMCO information is unintentionally lost, which was discussed in the background section. This problem of the prior art can be illustrated by the following H.264-implemented example. Assume that the decoded picture buffer stores three short term pictures with picture identifiers 300, 302 and 303 and two long term pictures with picture identifiers 0 and 3. The encoder might then generate a new encoded picture with a MMCO type 2 command stating that the long term picture 0 should be unused for reference. If this encoded picture would have been correctly received at the decoder the long term picture 0 would have been marked as unused for reference and the reference picture list would have been {300, 302, 303, 3}. However, if the encoded picture with the MMCO type 2 command is lost, the decoder is not informed that the long term picture 0 should be marked as unused for reference and the reference picture list is therefore instead {300, 302, 303, 0, 3}. If a next encoded picture received at the decoder comprises information that reference picture at position 3 in the reference picture list is to be used as prediction for a macroblock in the picture there will be a problem if the MMCO type 2 command is lost. If the MMCO type 2 command had been correctly received at the decoder, the reference picture at position 3 in the reference picture list would correspond to the long term picture 3 as this reference picture occupies position 3 (if starting with 0) in the reference picture list. However, with a lost MMCO type 2 command position 3 in the reference picture list is instead occupied by the long term picture 0. This means that

pixel data from the long term picture 0 will be used as prediction basis instead of the correct pixel data from the long term picture identifier 3.

[0051] Thus, the prior art solution has a problem that correct reference picture management is dependant on that previously decoded pictures have been correctly received and decoded.

[0052] The present embodiments do not have these problems of the prior art techniques by using a fundamentally different approach for signaling reference pictures as compared to the prior art. The present embodiments instead specify which decoded pictures to be used for reference pictures in an absolute or explicit way instead of a relative or implicit way. Another way to put it is that the encoded representation, i.e. the bitstream, for a current picture contains the information about what pictures to use for reference, i.e. reference pictures, independent of the encoded representations of previous pictures. It can therefore be said that the logical responsibility for maintaining correct decoded picture buffer is moved from the decoder to the bitstream. One way to look at it is to say that the information about what reference pictures to use for inter prediction and motion vector prediction for a picture is included in the control information of the picture. Hence, the state of the decoded picture buffer is signaled for every picture that is encoded and decoded relative to other pictures.

[0053] According to an aspect of the embodiments a method is provided that creates buffer description information, e.g. a data structure, such as a general table with absolute information of which pictures to be used for reference pictures, i.e. stored in a decoded picture buffer (also referred to as a reference picture buffer) to be used for subsequent coding. At least a part of the buffer description information is inserted in the bitstream encoded by an encoder.

[0054] Fig. 3 is a flow chart of a method of encoding a picture according to an embodiment. The method generally starts in step S1 where at least one reference picture of a video stream of multiple pictures is determined as encoding reference. In an embodiment, step S1 determines one or more reference pictures that are used as encoding reference for a current picture to be encoded. Hence, the pixel data of the current picture is then encoded with reference to the one or more reference pictures. Alternatively, or in addition, at least one reference picture determined in step S1 could be used as encoding reference for a subsequent picture of the video stream, i.e. a picture to be encoded and decoded after the current picture. This subsequent picture is thereby after the current

picture according to a decoding order (and encoding order). In a particular embodiment S1 determines, for the current picture, any reference picture of the video stream as encoding reference for the current picture and any reference picture of the video stream as encoding reference for the subsequent picture. Hence, in a particular embodiment step S1 determines all reference pictures that are prior to the current picture in decoding order and that may be used for inter prediction for the current picture or any picture following the current picture according to the decoding order.

[0055] Fig. 4 schematically illustrates this concept by showing a video stream 1 of multiple pictures 10, 40, 42, 50. A current picture 10 may comprise one or more slices 20, 22 comprising pixel blocks 30, such as macroblocks, also referred to as treeblocks, or coding units, to be decoded. The arrows below the pictures 10, 40, 42, 50 indicate the decoding relationship. The current picture 10 is decoded in relation to a previous reference picture 40 and a subsequent reference picture 42. The preceding reference picture 40 is preceding and the subsequent reference picture 42 is subsequent with regard to the current picture 10 according to the output order but both are preceding the current picture 10 according to the decoding order. This subsequent reference picture 42 is furthermore used as reference picture for a subsequent picture 50 in the video stream 1. Hence, in a particular embodiment step S1 could determine reference pictures as pictures 40, 42 in Fig. 4.

[0056] A next step S2 of Fig. 3 provides a respective picture identifier for each reference picture of the at least one reference picture determined in step S1. The picture identifier is used, possibly together with other data, to unambiguously identify a reference picture. Hence, the picture identifier can be regarded as an absolute reference to pictures to be used as reference pictures. This means that it is possible to correctly identify the relevant reference picture given its picture identifier and optionally the other data.

[0057] There are various alternatives available that could be used as picture identifier according to the embodiments. For instance, the picture identifier could be the decoding order number, the display order number, the output order number or a combination of display order number and an additional identifier or indeed any other information that can be used to unambiguously identify the picture.

[0058] Examples of such picture identifiers include Picture Order Count (*POC*), frame number (*frame_num*) or *POC* and an additional identifier (*additional_picture_id*).

[0059] In a particular embodiment, the actual value of the picture identifier is used together with additional information or other data, such as the position of the picture identifier in buffer description information that is generated in step S3 to unambiguously identify the relevant reference picture. Hence, the buffer description identified or obtained by the buffer description information enables an unambiguously identification of the relevant reference picture(s). In an embodiment, the picture identifier itself, such as *POC* or *POC* plus an additional identifier, can be used to unambiguously identify the reference picture.

[0060] Unambiguously identify a reference picture is used herein to denote that the picture identifier itself or the picture identifier together with other information in the buffer description information, such as the order at which the buffer description information defines the picture identifiers, is used to explicitly identify a reference picture. Hence, given the picture identifier or the picture identifier and the other information enables identification of the relevant reference picture among the pictures of the video stream.

[0061] In a particular embodiment of step S1, the total number of reference pictures determined for the current picture could be restricted by a parameter that can be signaled from the encoder to the decoder, such as a parameter denoted *max_num_ref_frames*.

[0062] Step S2 is preferably performed for each reference picture determined in step S1, which is schematically illustrated by the line L1.

[0063] The picture identifier(s) provided in step S2 could be read from header portions of the reference picture(s) determined in step S1 or otherwise retrieved from the data representing the reference picture(s) from step S1.

[0064] The next step S3 generates information of a buffer description, also referred to as Reference Picture Set (RPS). This information is denoted buffer description information herein. The buffer description information is generated based on the picture identifier(s) provided in step S2. This buffer description information defines, preferably unambiguously defines, the at least one reference picture determined in step S1. Hence, it is possible to derive the respective picture identifier of the at least one reference picture from the buffer description information.

[0065] The generated buffer description information is inserted in step S4 in an encoded representation of the current picture. Hence, the encoded picture therefore carries the buffer description information that can be used at the decoder to define and identify the

reference pictures that are needed to decode the current picture and/or any subsequent picture of the video stream.

[0066] The buffer description information is therefore provided in control information of the encoded picture provided from the encoder to a decoder. At a minimum, the buffer description information contains information needed by the decoder to identify the reference pictures to be used in the decoded picture buffer.

[0067] The buffer description information can therefore be regarded as information identifying a buffer description that is a set of reference pictures associated with a current picture. It consists of all reference pictures that are prior to the current picture in decoding order and that may be used for inter prediction of the current picture or any picture following the current picture in decoding order.

[0068] In an embodiment, the buffer description information contains or defines information about each picture that is used by the decoder in the decoding process even if the picture is not used for inter prediction or motion vector prediction or any other prediction. Such information could include, but is not limited to, decoding order, display order, temporally layer information and view information.

[0069] As mentioned above, the number of reference pictures that can be signaled by the buffer description information could be restricted by the parameter *max_num_ref_frames*. However, the buffer description information may define fewer than this maximum number of pictures, in which case the remaining ones are interpreted as “empty”.

[0070] The method of Fig. 3 with steps S1 to S4 is preferably performed for each picture in the video stream except any Instantaneous Decoder Refresh (IDR) picture that cause a decoded picture buffer refresh and thereby does not need any buffer description information, which is schematically illustrated by the line L2. Hence, each encoded representation generated by the encoder preferably carries buffer description information defining the reference pictures used for encoding and decoding the current picture and/or any subsequent picture in the video stream.

[0071] This approach of the embodiments provides a significant advantage over the relative reference picture signaling of the prior art using MMCO command. The explicit signaling of reference pictures through the buffer description information in each encoded representation of the pictures in the video stream makes reference picture management less vulnerable to errors and increases the error robustness level of the decoder. Thus,

instead of relying on correctly delivered and interpreted buffer operations in previous pictures, the decoder will only have to rely on information contained in the encoded representation of the current picture.

[0072] In a particular embodiment, the buffer description information inserted in the encoded representation of the picture in step S4 is in fact the buffer description itself. Thus, the buffer description information then comprises a listing of the picture identifier(s) provided in step S2 or data allowing calculation of the picture identifier(s) provided in step S2. This latter case will be further described below in connection with Fig. 6.

[0073] For instance, the buffer description could define a list with picture identifiers 3, 5 and 6 as the reference pictures for a current picture. The buffer description information inserted in the encoded representation in step S4 would then include these picture identifiers 3, 5 and 6.

[0074] An alternative approach that is generally more bit efficient, i.e. generally requires fewer number of bits or symbols for defining the picture identifiers, is to signal the reference picture properties, i.e. picture identifiers, relative to the value of these properties as signaled for the current picture. For instance, if the current picture has a picture identifier 7 the list of reference pictures with identifiers 3, 5 and 6 could be defined as -1, -2 and -4, which typically can be represented by fewer bits as compared to 3, 5 and 6, in particular if variable length coding is employed for the picture identifiers.

[0075] Fig. 6 schematically illustrates this approach. The method continues from step S2 of Fig. 3. In a next step S10 a difference is calculated for each picture identifier provided in step S2, between the picture identifier and a picture identifier identifying the current picture. As a result of this calculation a difference or delta identifier or value is obtained. The method then continues to step S3 of Fig. 3, where the buffer description information is generated based on the calculated difference(s) or delta identifier(s).

[0076] The buffer description information could therefore in this case include the delta identifiers -1, -2 and -4 instead of 3, 5 and 6.

[0077] In an embodiment, delta display order information or *deltaPOC* is included in the buffer description encoded with a variable length code (VLC). In a particular embodiment *deltaPOC* is encoded with VLC for *absolute_delta_POC_minus_one* and a flag, i.e. a single bit, for *deltaPOC_sign* signaled only if *number_of_reorder_frames*>0, otherwise the sign is inferred to be negative.

[0078] In the above embodiments providing an explicit signaling of the picture identifiers, either the picture identifiers themselves or the delta identifiers, the buffer description information will in fact constitute the buffer description of the current picture. This buffer description information is then inserted in the encoded representation of the picture.

[0079] The buffer description information could be included as control information at a suitable position in the encoded representation. Fig. 5 schematically illustrates an example of an encoded representation 60 of a picture. The encoded representation 60 comprises video payload data 66 that represents the encoded pixel data of the pixel blocks in a slice. The encoded representation 60 also comprises a slice header 65 carrying control information. The slice header 65 forms together with the video payload and a Network Abstraction Layer (NAL) header 64 a NAL unit that is the entity that is output from an encoder. To this NAL unit additional headers, such as Real-time Transport Protocol (RTP) header 63, User Datagram Protocol (UDP) header 62 and Internet Protocol (IP) header 61, can be added to form a data packet that can be transmitted from the encoder to the decoder. This form of packetization of NAL units merely constitute an example in connection with video transport. Other approaches of handling NAL units, such as file format, MPEG-2 transport streams, MPEG-2 program streams, etc. are possible.

[0080] The buffer description information could then be included in the slice header 65, another picture header or another data structure specified by the standard to which the encoder and decoder conforms.

[0081] In another embodiment the buffer description information inserted in the encoded representation 60 of the picture does not necessarily have to be the same as the buffer description of the current picture but rather enables identification and retrieval of the buffer description. Thus, in this embodiment the buffer description information inserted in the encoded representation 60 of the picture indirectly defines the at least one reference picture determined in step S1 by pointing towards the buffer description which carries the picture identifiers or the data, such as delta identifiers, enabling calculation of the picture identifiers.

[0082] In such a case, the buffer description could be carried by a data structure associated to the encoded representation 60 of the picture. Examples of such data structures include a Picture Parameter Set (PPS) 67 and a Sequence Parameter Set (SPS) 68. The PPS 67 and/or the SPS 68 could be directly included in the encoded representation

60 but is typically associated thereto through the inclusion of a PPS identifier and/or SPS identifier in the encoded representation 60. For instance, each slice header 65 could include a PPS identifier notifying which PPS 67 to apply for the current picture. The relevant PPS 67 may in turn include an SPS identifier notifying which SPS 68 to apply for the PPS 67 and therefore for the current picture.

[0083] The buffer description could then be inserted in the PPS 67 or the SPS 68 assigned to the current picture. In such a case, the PPS identifier or SPS identifier that is inserted in the encoded representation 60 constitutes the buffer description information that is inserted in the encoded representation 60. This PPS identifier or SPS identifier enables retrieval of the buffer description that defines the picture identifiers of the reference pictures and the PPS identifier or SPS identifier therefore indirectly defines the picture identifiers.

[0084] PPS 67 and SPS 68 merely constitutes examples of data structures associated to encoded representations 60 of pictures and which can be used to carry buffer description information according to the embodiments.

[0085] Fig. 7 illustrates an alternative embodiment where one or more buffer descriptions are signaled in a data structure so that the same buffer description can be used for multiple pictures.

[0086] The method starts in step S20 where a data structure, such as a table, is generated. The data structure comprises multiple predefined buffer descriptions each defining at least one reference picture.

[0087] Each buffer description of the generated data structure could define the picture identifiers directly, i.e. include a list of picture identifiers. However, such an approach generally requires quite a few predefined buffer description in the data structure. A more efficient approach is to combine the usage of multiple predefined buffer descriptions with signaling of delta identifiers as discussed in the foregoing. In such a case, each predefined buffer description comprises at least one respective delta identifier, which is used at the decoder together with the picture identifier of the current picture to calculate the picture identifier(s) of a predefined buffer description.

[0088] Table 1 below illustrates an example of such a data structure with delta identifiers that can be used for a video stream as illustrated in Fig. 8. The video stream of Fig. 8 starts with an IDR picture, which is an Intra (I) frame that removes all dependencies to data transmitted prior to the IDR picture, i.e. it marks all reference pictures as “unused

for reference”. The IDR picture does not need a buffer description since it empties the decoded picture buffer. The video stream of Fig. 8 is in the form of layered video providing pictures in different temporal layers, identified by temporal identifiers (*temporal_id*) n , $n+1$ and $n+2$ in Fig. 8.

Table 1 – data structure with predefined buffer descriptions

Entry	Picture buffer 1	Picture buffer 2	Picture buffer 3	Picture buffer 4
0	dP: -1 tId: 2	dP: -2 tId: 1	dP: -4 tId: 0	dP: -8 tId: 0
1	dP: -1 tId: 0	dP: -2 tId: 2	dP: -5 tId: 0	dP: -9 tId: 0
2	dP: -1 tId: 2	dP: -2 tId: 0	dP: -6 tId: 0	dP: -10 tId: 0
3	dP: -1 tId: 1	dP: -2 tId: 2	dP: -3 tId: 0	dP: -7 tId: 0

[0089] Table 1 shows an example of a buffer description table where *deltaPOC* (dP) and *temporal_id* (tId) are indicated. The table is constructed using the scheme of including the two closest reference pictures (POC(current)-1 and POC(current)-2) and the two from the lowest temporal layer in the range from POC(current)-3 to POC(current)-10.

[0090] An example use of this table by the encoder is to, for a picture with POC= n , signal table entry ($n\%4$), i.e. n modulo 4, to the decoder. In this example, the decoded picture buffer consists of four pictures (picture buffer 1 to picture buffer 4). Which pictures depends on the POC of the current picture and what entry is used. For example if picture with POC=7 uses entry 3 the reference pictures in the decoded picture buffer will consist of pictures with POC {6, 5, 4, 0}.

[0091] The data structure generated in step S20 is signaled from the encoder to the decoder. This signaling can be performed according to various embodiments. The data structure could be carried in the PPS, the SPS, a novel parameter set or in another data structure specified by the standard to which the encoder and decoder conforms. This is schematically illustrated by step S21 where the data structure is inserted in a PPS or a SPS associated with an encoded representation of the video stream. In such a case, step S22 preferably inserts a PPS identifier or SPS identifier in the encoded representation of the picture, such in a slice header. This PPS identifier or SPS identifier then enables identification of the data structure that is available when decoding the current picture.

[0092] The method continues to steps S1 and S2 of Fig. 7 where reference pictures are determined and picture identifiers are provided for the current picture. A next step S23

selects, based on the at least one picture identifier provided in step S2, a buffer description from the data structure generated in step S20.

[0093] Once such a buffer description, such as an entry in Table 1, has been selected step S24 generates buffer description information comprising an identifier, such as entry number, of the selected buffer description. The method continues to step S4 where the buffer description information is inserted in the encoded representation of the picture.

[0094] Thus, in order to specify which buffer description to use for the current picture an identifier can be signaled for the current picture. An example of such an identifier is a non-negative integer signaled in the slice header(s) of the current picture representing the number of the buffer description in the order in which the buffer descriptions are signaled.

[0095] In a typical implementation step S20 is performed once for the video stream or once for a set of multiple pictures of the video stream. This means that a single such data structure is then generated for the video stream or for the set of multiple pictures. The following steps S21 to S24 of Fig. 7 are preferably performed for each picture in the video stream or the set of multiple pictures.

[0096] Thus, the data structure, such as table, may be created in the encoder and transmitted to the decoder. In the control information of the encoded bitstream the entry number to be used is provided. By using such a table the decoder can obtain absolute information of which pictures to be used as reference pictures by detecting the entry number in the decoded bitstream and using that entry number to look up the entry in the table. The entry is then used to determine which pictures to be stored in the decoded picture buffer.

[0097] Introducing buffer description entries in, for instance, the SPS reduces the bit overhead of signaling the buffer descriptions explicitly in the slice header. These buffer descriptions can be used for multiple slices/pictures in the same sequence, i.e. video stream, and thus reduce the number of bits required per picture.

[0098] For each buffer description entry in the PPS the *delta_POC* and *temporal_id* of all reference pictures could be present in an embodiment. The optional *additional_picture_id* is preferably inferred to be 0 for pictures described by an entry in the PPS.

[0099] According to a further embodiment, explicit signaling of buffer description and reference signaling to an entry in a general data structure with multiple predefined buffer descriptions, such as an entry in the table above, can be combined. In such a case, these

can be combined by the decoder to form a final buffer description for the current picture. One way to combine the explicit signaling and the reference signaling is to join the set of reference pictures described by explicit signaling with the set of reference pictures described by the reference signaling to form a joint set of reference pictures.

[0100] In such a case, step S3 of Fig. 3 preferably comprises generating the buffer description information to comprise the identifier of the buffer description selected in step S23 and to comprise information defining at least one reference picture. This information defining at least one reference picture could be the picture identifier of the reference picture itself or a delta identifier from which the picture identifier can be calculated.

[0101] A picture that is used for reference for a long period of time (long term reference picture) is preferably indicated by explicit description in the slice headers of the pictures for which it is available for reference. The reason is that it would be inconvenient to include every distance in POC numbers in the predefined buffer descriptions signaled in the PPS or SPS.

[0102] In a particular embodiment, the encoded representation of the picture preferably comprises a flag to indicate whether explicit signaling of the buffer description information and/or implicit signaling of the buffer description information has been selected for the current picture. This flag could, for instance, be included in the slice header of the encoded representation of the picture or in some other control information field.

[0103] In a particular embodiment, a picture 10 can be composed of one or multiple slices 20, 22 as shown in Fig. 4. In such a case, a slice 20, 22 is an independently decodable portion of the picture 10. In other words, an encoded slice can be decoded even if the data of another encoded slice of the same picture 10 is lost.

[0104] In such an approach step S1 of Fig. 3 preferably determines at least one reference picture of the video stream for each slice in the picture. It could then be possible that a first slice will use a first set of one or more reference pictures and a second slice will use a second set of one or more reference pictures. The second set could be equal to the first set or be different from the first set. It is also possible that at least one of the reference pictures is common for the first set and the second set.

[0105] Step S2 preferably determines the picture identifiers for all reference pictures determined in step S1 for at least one slice, preferably for all of the slices, in the picture. The buffer description information is then generated in step S3 based on these picture

identifiers and thereby defines the reference pictures. In an embodiment, the buffer description generated in step S3 is inserted in a respective slice header of the encoded representation of the picture for each slice. Thus, each slice header of the encoded representation of the picture preferably carries a respective instance of the buffer description information. More preferably, the buffer description information carried in the slice header of a first slice of the picture is the equal to the buffer description information carried in the slice header of a second slice of the picture.

[0106] Video encoding and decoding can also be applied to so-called scalable or layered video. For instance, temporal scalability is supported in H.264/MPEG-4 AVC and Scalable Video Coding (SVC) through the definition of subsequences and usage of *temporal_id* in SVC and insertion of “non-existing” frames. However, in order to support temporal scalability, the pictures in the higher temporal layers are restricted when it comes to usage of MMCO. The encoder is responsive of making sure that the MMCOs in one temporal layer does not affect pictures of lower temporal layers differently compared to if the temporal layer is dropped and “non-existing” pictures are inserted and sliding window process is applied.

[0107] This imposes restrictions on the encoder in selection of coding structure and reference picture usage. For instance, consider the example in Fig. 2. Assume that the maximum number of reference frames in the decoded picture buffer (*max_num_ref_frames*) is three even though each picture only uses two reference pictures for inter prediction. The reason is that each picture must hold one extra picture from the other temporal layer that will be used for inter prediction by the next picture.

[0108] In order to have picture POC=0 and picture POC=2 available when decoding picture POC=4, picture POC=3 must have an explicit reference picture marking command (MMCO) marking picture 1 as unavailable.

[0109] However, if temporal layer 1 is removed (for example by a network node) there will be gaps in *frame_num* for all odd numbered pictures. “Non-existing” pictures will be created for these pictures and sliding window process will be applied. That will result in having the “non-existing” picture POC=3 marking picture POC=0 as unavailable. Thus, it will not be available for prediction when picture POC=4 is decoded. Since the encoder cannot make the decoding process be the same for the two cases; when all pictures are decoded and when only the lowest layer is decoded; the coding structure example in Fig. 2 cannot be used for temporal scalability according to prior art.

[0110] Thus, prior art solutions have problems with temporal scalability for certain coding structures since the information about the reference pictures for the current picture is affected by the removal of a previous picture from the bitstream as the reference picture information is signaled in a relative way. Using the embodiments, temporal scalability will not be restricted as in the prior since the reference picture for the current picture is not affected by removal of previous pictures from the bitstream since it is signaled in an absolute way.

[0111] In the case of a scalable video stream with the pictures grouped into multiple layers step S2 of Fig. 3 preferably comprises providing picture identifier and temporal layer information identifying a layer of the multiple layers to which the reference picture belongs. The buffer description information is then generated in step S3 based on the at least one picture identifier and the temporal layer information. This means that the buffer description information thereby defines the at least one picture identifier and the temporal layer information.

[0112] For instance, temporal layer information, such as *temporal_id*, is included for each picture in the buffer description signaled using $\text{ceil}(\log_2(\text{max_temporal_layers_minus1}))$ bits for signaling of the *temporal_id*. Temporal scalability is merely an example of multi-layer video to which the embodiments can be applied. Other types include multi-layer video where each picture has a picture identifier and a view identifier. Further examples of scalability include spatial scalability, signal-to-noise ratio (SNR) scalability, bit-depth scalability and chroma format scalability.

[0113] The embodiments imply that temporal down-switching is always possible. Each temporal layer together with the lower layers will constitute a sub-sequence. Such sub-sequences need no explicit signaling.

[0114] Generally, the encoder is free to select which pictures to include in the buffer description and may base its selection on any aspect, such as the closest pictures in display order. Typically, an encoder selects the buffer description to try to achieve maximum compression while complying to a set of side constraints. One example of such a constraint is a maximum number of reference pictures due to memory size. Another example is that the video stream shall be decodable also when certain coded pictures in the bitstream are removed from the bitstream before decoding. A further example is that only pictures that are available for reference in the decoded picture buffer can be selected as reference pictures.

[0115] Thus, in an embodiment step S1 of Fig. 3 comprises determining the at least one reference picture for the current picture by maximizing compression efficiency of the encoded representation of the picture while complying to at least one side constraint. The at least one side constraint is then preferably selected from a predefined maximum number of reference pictures and generating a decodable encoded representation of the video stream also when at least one encoded representation of a picture is removed from the encoded representation of the video stream.

[0116] According to another aspect of the embodiments a method is provided in which an encoded video or data stream is received, buffer description information is detected in the encoded video stream and absolute reference to pictures to be used as reference pictures for decoding a current picture or as reference pictures for future decoding is determined based on the buffer description information. The pictures to be used as reference pictures are stored in a decoded picture buffer.

[0117] Fig. 9 is a flow chart of a method of decoding an encoded representation of a picture according to an embodiment. The method starts in step S30 where buffer description information defining at least one reference picture is retrieved from the encoded representation of the picture. The buffer description information is used in step S31 to determine at least one picture identifier that, preferably unambiguously, identifies a respective reference picture as decoding reference for the picture. The at least one reference picture identifier determined in step S31 is used in step S32 to update a decoded picture buffer.

[0118] Once the decoded picture buffer has been updated to comprise the correct reference pictures needed for decoding the picture the method typically continues to step S33 where the picture is decoded based on the encoded representation of the picture and at least one of the reference pictures comprised, present or stored in the decoded picture buffer and identified based on the buffer description information.

[0119] In a preferred embodiment, the decoding step S33 is performed after updating the decoded picture buffer as indicated in Fig. 9.

[0120] The updating of the decoded picture buffer in step S32 preferably implies that the reference picture identified by the determined picture identifier is marked as “used for reference” or marked as “used for prediction” to indicate that this reference pictures is to be used as decoding reference or prediction for the current picture and/or any subsequent

picture. In a particular embodiment, reference pictures could be marked as used for short-term reference or as used for long-term reference.

[0121] In a particular embodiment step S30 retrieves the buffer description information defining multiple reference pictures from the encoded representation of the picture. In such an embodiment, step S31 could determine, based on the buffer description information, i) at least one picture identifier identifying a respective reference picture as decoding reference for the picture and ii) at least one picture identifier identifying a respective reference picture as decoding reference for a subsequent, according to a decoding order, picture of the video stream. In alternative embodiments, the buffer description information identifies one or more picture identifiers of respective reference picture(s) as decoding reference for the current picture and/or one or more picture identifiers of respective reference picture(s) as decoding reference for a subsequent, according to the decoding order, picture of the video stream.

[0122] Step S32 preferably updates the decoded picture buffer to comprise the respective reference picture identified by the at least one picture identifier determined in step S31.

[0123] As previously discussed herein, the buffer description information can be provided in a slice header or another control information field of the encoded representation of the picture. In such a case, step S30 of Fig. 9 comprises retrieving the buffer description information from a slice header of the encoded representation of the picture. A multi-slice picture generally comprises multiple slice headers. In such a case each slice header preferably comprises the same buffer description information. It is then sufficient in step S30 to retrieve the buffer description information from the first slice header of the picture as any remaining slice headers of the picture will include the same buffer description information. The buffer description information in the other slice headers can then be used for error resilience if the first slice is lost.

[0124] The buffer description information could explicitly include the picture identifier(s) of the reference picture(s). In such a case, step S30 simply retrieves the at least one picture identifier from the buffer description information.

[0125] In an alternative embodiment, the buffer description information comprises delta values or delta identifiers. Fig. 10 is a flow chart illustrating an embodiment of step S31 in Fig. 9 for such a case. The method then continues from step S30 of Fig. 9. A next step S40 retrieves a respective delta identifier based on the buffer description information.

The delta identifier(s) is(are) used in step S41 together with a picture identifier of the current picture to calculate the picture identifier(s) of the reference picture(s). The method then continues to step S32 of Fig. 10.

[0126] Thus, in this embodiment information available for the current picture is used by the decoder to construct the final buffer description for the current picture from the signaled buffer description information. Such information includes, but is not limited to, current *POC* ($POC(curr)$), which together with a signaled *deltaPOC* can be used to calculate the *POC* of the reference picture ($POC(ref)$) as $POC(ref) = POC(curr) + deltaPOC$.

[0127] Another embodiment relates to using multiple predefined buffer descriptions. Fig. 11 schematically illustrates such an approach. In a first step S50 a data structure comprising multiple predefined buffer descriptions is retrieved. In a preferred embodiment, the data structure is retrieved based on information carried in the encoded representation of the picture. For instance, the data structure can be signaled from the encoder side to the decoder side as a part of the PPS or the SPS of the encoded representation of the picture. In such a case, the data structure is retrieved from the PPS or the SPS in step S50 based on a PPS identifier or SPS identifier used as part of the buffer description information in the encoded representation of the picture, such as in the slice header. Alternatively, a PPS identifier is retrieved from the slice header and the PPS in turn comprises an SPS identifier that can be used if the data structure is signaled as part of the SPS.

[0128] A next step S51 retrieves an identifier of a buffer description as part of the buffer description information from the encoded representation of the picture, such as from the slice header. This identifier is employed in order to identify which predefined buffer description from the data structure retrieved in step S50 to use for the current picture in step S52. The method then continues to step S31 of Fig. 1, where picture identifiers are determined from the identified predefined buffer description.

[0129] Using the embodiments it is possible to apply the optimal buffer scheme for any coding structure with very little overhead. What is needed in the slice header is simply a reference to the correct buffer description in the PPS or similar. Note that the buffer description can also be put in a picture header or similar, or a parameter set shared between all slices in a picture. The important property is that the buffer description to be used to decode a specific picture is sent with the picture and not with the previous picture

in decoding order as in the prior art. In addition, the buffer description information is used to signal all reference pictures in the decoded picture buffer that should be kept for decoding each respective picture in the video stream instead of signaling delta information that can cause long-term mismatches between the encoder side and the decoding side when a single data packet is unintentionally lost.

[0130] As previously disclosed herein, the explicit signaling of buffer description in the encoded representation of a picture and reference signaling to predefined buffer description in a data structure can be combined. One way to combine the explicit signaling and the reference signaling is to join the set of reference pictures described by explicit signaling with the set of reference pictures described by reference signaling to form a joint set of reference pictures. Then one or more reference pictures included in the set of reference pictures described by reference signaling but not included in the explicit signaling are possibly removed from the joint set of reference pictures in order to have a final buffer description with no more than a maximum number (*max_num_ref_frames*) of reference pictures. Preferably pictures are removed in the order that they are listed in the general buffer description, i.e. the predefined buffer description, starting with the last one going forward.

[0131] Fig. 12 is a flow chart illustrating such an approach. The method continues from step S30 in Fig. 9 and step S52 in Fig. 11. Hence, in this embodiment the buffer description information comprises both the identifier of the buffer description retrieved in step S51 of Fig. 11 and information defining at least one reference picture retrieved in step S30 of Fig. 9. This information retrieved in step S30 could be the actual picture identifier(s) or the previously mentioned delta identifier(s).

[0132] A next step S60 determines a first set of at least one picture identifier identifying a respective reference picture from the predefined buffer description identified in step S52 in Fig. 11. Correspondingly, a second set of at least one picture identifier identifying a respective reference picture is determined in step S61 from the information retrieved in step S30 of Fig. 9. Steps S60 and S61 could be performed sequentially in any order or at least partly in parallel.

[0133] The following step S62 forms a joint set of picture identifiers based on the first set determined in step S60 and the second set determined in step S61.

[0134] An optional but preferred following step S63 compares the total number of picture identifiers (IDS) in the joint set with a maximum number of reference pictures

(MAX), i.e. the parameter *max_num_ref_frames* typically signaled in the SPS. If the total number of picture identifiers in the joint set exceeds the maximum number of reference pictures that can be stored in the decoded picture buffer the method continues to step S64. This step S64 removes one or more picture identifiers included in the first set but not in the second set until the total number of picture identifiers in the joint set no longer exceeds the maximum number of reference pictures. Thus, the joint set is thereby updated by removing picture identifiers determined in step S60. The picture identifiers are preferably removed in the order that they are listed in the predefined buffer description identified in step S52 of Fig. 11 starting from the last picture identifier and going forward.

[0135] In a particular embodiment, the encoded representation of the picture preferably comprises a flag to indicate whether explicit signaling of the buffer description information and/or implicit signaling of the buffer description information has been selected for the current picture. In such a case, the decoder retrieves the flag from the encoded representation of the picture, such as from the slice header or from some other control information field, in order to determine which type of signaling of the buffer description information that has been used for the current picture.

[0136] Fig. 13 is a flow chart illustrating additional steps of the method in Fig. 9, whereby the decoded picture buffer updated in step S32 is used for decoding purposes.

[0137] Once the decoded picture buffer has been updated in step S32 pictures may be available in the decoded picture buffer but are not included in the buffer description. Hence, in an embodiment, pictures that are available in the decoded picture buffer but not included in the buffer description are removed by the decoder from the decoded picture buffer or marked as “unused for reference” or “unused for prediction”. Thus, in this embodiment removing reference pictures from the decoded picture buffer or marking of pictures as “unused for reference” is performed by the decoder prior to the picture decoding process of the picture containing the buffer description.

[0138] Step S70 illustrates this procedure by removing, from the decoded picture buffer, any reference picture stored in the decoded picture buffer and not being associated with any of the at least one picture identifier determined from the buffer description information. In an alternative embodiment of this step S70 the reference picture(s) is(are) not necessarily removed from the decoded picture buffer. This embodiment of step S70 marks any reference picture stored in the decoded picture buffer and not being associated with any of the at least one picture identifier determined from the buffer description

information as unused for reference or unused for prediction. This means that the marked reference picture will not be used as prediction basis for the current picture or for any subsequent picture in the video stream. The decoder can therefore output the marked reference picture if there is a need to get an available position in the decoded picture buffer. In a particular embodiment, a picture marked as unused for reference cannot be included in the buffer description and be re-marked as used for reference.

[0139] In a particular embodiment, any reference picture present in the decoded picture buffer and associated with any of the picture identifiers determined based on the buffer description information is preferably marked in step S70 as used for reference. In an embodiment, a reference picture could be marked as either used for short-term reference or used for long-term reference. The selection between these two particular alternatives is preferably performed based on the buffer description information.

[0140] Step S71 illustrates an additional optional embodiment. This embodiment outputs zero or more of the pictures that are marked as unused for reference by the decoder according to the buffer description for display by the decoder. One such example process for output is the bumping process from H.264/MPEG-4 AVC. Output refers herein to output for display. What pictures to use as reference pictures and what pictures to output, i.e. display, is separated in H.264 and HEVC. This means that a picture can be output before it is removed as reference picture, i.e. marked as unused for reference, or it can be removed as reference frame by marking it as unused for reference before it is output.

[0141] During the decoding process, it may happen that the buffer description contains information about pictures (also referred to as frames) that are not available and therefore can not be used for reference pictures. In an embodiment, a number of “non-existing” pictures is generated by the decoder if the buffer description contains information about pictures that are not available in the decoded picture buffer. Each such picture can be given values to variables holding information that is used by the decoder in the decoding process even if the picture is not used for inter prediction or motion vector prediction. Such information could include, but is not limited to, decoding order number, display order number, temporal layer information, view information, i.e. parameters such as *frame_num*, *POC*, *temporal_id* and *view_id*.

[0142] In an embodiment, the generation of non-existing pictures is performed by the decoder prior to the picture decoding process of the picture containing the buffer description information.

[0143] Steps S72 and S73 illustrate such an embodiment. Step S72 compares the at least one picture identifier determined from the buffer description information with picture identifiers associated with reference pictures already stored in the decoded picture buffer. If a determined picture identifier is not found among the picture identifiers of the reference pictures stored in the decoded picture buffer the picture associated with the determined picture identifier is determined to be missing or non-existing. In an embodiment, a non-existing picture is optionally generated in step S73 and stored in the decoded picture buffer. This non-existing picture is then assigned any parameters, such as picture identifier, obtained from the buffer description information with regard to this particular picture. The method then continues to step S33 of Fig. 9 where the decoding process can be started.

[0144] Pictures that are signaled in the buffer description but do not exist in the decoded picture buffer are preferably marked as “non-existing”. However since the *POC* and the *temporal_id* of such pictures are included in the buffer description, no explicit signaling of reference picture list modification is required. If the “non-existing” picture is not used for reference, the decoding process will proceed correctly without extra signaling (and without the overhead incorporated with signaling reference picture list modifications explicitly).

[0145] In an embodiment, the marking of zero or more pictures in step S70 is performed by the decoder in a first step. In a second step, zero or more pictures are output by the decoder in step S71. In a third step zero or more “non-existing” pictures are generated by the decoder in step S73.

[0146] In an alternative embodiment, the marking of zero or more pictures is performed by the decoder in a first step in step S70. Then an iterative process of outputting pictures (S71) and generating non-existing pictures (S73) is performed by the decoder for each picture described in the buffer description that is not available in the decoded picture buffer.

[0147] The embodiments are strengthened further by applying buffer operations, e.g. the picture marking process, before the picture decoding of the current picture, thus, having the explicit buffer description to apply to the current picture. This makes reference

picture management even less vulnerable to errors, improves the possibilities for temporal scalability and reduces the overhead introduced by reference picture list modification signaling.

[0148] In an embodiment, the buffer description may contain information that is used by the decoder in reference picture list initialization or reference picture list modification or reference picture list combination. An example is the order in which the pictures are listed in a buffer description can be used as the initial order for one of the reference picture lists in reference picture list initialization. Hence, the buffer description information can be used when the reference picture list is created.

[0149] Fig. 14 is a flow chart illustrating such an approach. The method continues from step S32 of Fig. 9. A next step S80 performs reference picture list initialization based on the buffer description information. In a particular embodiment of step S80, the reference picture list initialization is performed based on the buffer description information by ordering reference pictures in a reference picture list according to an order that the buffer description information defines the at least one picture identifier determined in step S31 of Fig. 9.

[0150] In an embodiment, restrictions are specified for the pictures included in the buffer description. An example restriction is that a picture A with *temporal_id* tId(A) described in the buffer description for a picture B with *temporal_id* tId(B) may not be a non-existing picture if $tId(A) < tId(B)$.

[0151] In an embodiment it is also possible to signal changes to the properties of pictures in the decoded picture buffer through buffer descriptions. An example is to change temporal layer and/or display order of pictures through signaling the new value for temporal layer and/or display order in the buffer description.

[0152] Fig. 16 is a simplified flow chart of a reference buffer scheme according to an embodiment. In this scheme all decoded picture buffer operations are applied after parsing of the first slice header of a picture but before the picture decoding, using a description of the decoded picture buffer as illustrated in Fig. 16. The buffer description is, for instance, signaled in the slice header either explicitly or by reference to a predefined structure signaled in a PPS.

[0153] The embodiments thereby provide large conceptual changes to the decoding process. In traditional H.264/MPEG-4 AVC and current design of HEVC, relative operations are given to the decoder either implicitly, i.e. sliding window, or explicitly,

MMCO, and the decoder is responsible for applying these relative operations and keeping track of the reference pictures, i.e. which pictures can be used for reference. In the proposed scheme the reference pictures, i.e. which pictures can be used for reference, is signaled within the current picture, such as in the slice header, thus removing the need of implicitly and explicitly signaled relative operations.

[0154] This means that each picture will have an absolute description of the reference pictures instead of a relative description as in H.264/MEPG-4 AVC where delta information is retrieved from MMCO or from using the sliding window process.

[0155] According to a particular embodiment, the buffer description contains *delta_POC*, *temporal_id* and *additional_picture_id* of all reference pictures in the decoded picture buffer in order to provide an absolute reference to the pictures to be used as reference pictures. The *delta_POC* is used to calculate the *POC* of a reference picture as $POC(ref) = POC(current) + delta_POC$. Pictures will, in an embodiment, be identified by the pair *POC* and *additional_picture_id*. *Temporal_id* is included in the buffer description to enable correct reference picture list modification in the case of lost or removed pictures, e.g. temporal scalability. The scheme is, though, not restricted to the codewords *delta_POC*, *temporal_id* and *additional_picture_id*. Any codeword that is associated with a picture and used in the reference picture handling can be used as picture identifier and may be included in the buffer description, either relative to the value of the current picture, e.g. *POC* and *delta_POC*, or absolute, e.g. *temporal_id*.

[0156] All pictures in the decoded picture buffer that are not part of the buffer description are preferably marked as unused for reference.

[0157] In H.264/MPEG-4 AVC the process that delivers pictures for output (referred to as “bumping” process in Fig. 1) is sometimes performed prior to decoding, i.e. if there was a gap in *frame_num*. The “bumping” process is also performed after decoding and picture marking.

[0158] In the proposed scheme of Fig. 16 the “bumping” process is applied prior to decoding. It could be argued that this imposes extra delay in the decoding process before delivery of pictures for output. However it should be noted that the first picture to display is uniquely defined already after the decoding process step as soon as the number of non-displayed pictures in decoded picture buffer is larger than or equal to *num_reorder_frames*. Thus, a decoder can deliver that picture for display directly after the

decoding process step. Thus the delay of the proposed scheme is equal to the delay of the current HEVC scheme.

[0159] In H.264/MPEG-4 AVC the syntax element *frame_num* is used to identify pictures in the decoded picture buffer and to detect gaps in *frame_num*. If *gaps_in_frame_num_allowed* is equal to 1 the decoder shall insert “non-existing” frames in the decoded picture buffer in order for the sliding window process to operate correctly.

[0160] In the proposed scheme illustrated in Fig. 16 the combination of *POC* and *additional_picture_id* can be used to identify pictures in the decoded picture buffer. The proposed scheme does not need to contain a sliding window process. Therefore, it is proposed to remove the syntax elements *frame_num* and *gaps_in_frame_num_allowed*.

[0161] Fig. 15 is an example of a coding structure to which the embodiments can be applied. In the example in Fig. 15, the second picture in decoding order will include POC 0 in its buffer description while the third picture in decoding order will include POC 0 and POC 4 in its buffer description. The fourth picture in decoding order must include not only POC 0 and POC 2 in its buffer description but also POC 4 since that picture will be used for reference in the future. The fifth picture in the decoding order does not need to include POC 0 in its buffer description unless it is going to be used for reference in the future. If POC 0 is not included in the buffer description it will be made unused for reference.

[0162] In the example in Fig. 15 *additional_picture_id* (or *additional_id*) is 0 for all pictures. It is recommended to set *additional_picture_id* to 0 unless there are two different pictures available for reference with the same *POC*, due to *POC* wrap-around. If *POC* is the same for two different pictures the *additional_picture_id* is preferably different in order to not unconditionally replace the older picture with the newer one.

Additional_picture_id can be used in order to provide all the functionalities and possibilities that are provided by long term pictures in H.264/MPEG-4 AVC. Hence, in a particular embodiment the *additional_picture_id* constituting a part of the picture identifier could be used to signal whether a reference picture is to be used for long-term reference or for short-term reference.

[0163] Consider an example where an encoder would like to use a picture A with POC 14 and *additional_picture_id* set to 0, as a “long term picture”. The encoder must then make sure that the picture A is included in the buffer description in the slice header of all pictures following A for as long as the encoder wants picture A to be available for reference. If the encoder would like to encode another picture with POC 14 (due to *POC*

wrap-around) while A is still available for reference, the encoder should select another value of *additional_picture_id*, for example 1, to avoid that A is replaced as a reference picture.

[0164] For pictures that will be used for reference for a short period of time (short term reference pictures) it is recommended to set *additional_picture_id* to 0, in order to minimize the bit overhead. For pictures that will be used for reference for a long period of time (long term pictures) it is recommended that the encoder makes sure that no two pictures with the same *POC* and the same *additional_picture_id* are available for prediction at the same time.

[0165] A further aspect of the embodiments defines an encoder configured to create buffer description information defining which pictures to be used for reference pictures, i.e. stored in a decoded picture buffer to be used for subsequent decoding. At least part of the buffer description information is inserted in the bitstream encoded by the encoder.

[0166] Fig. 18 is a schematic block diagram of an embodiment of an encoder 100. The encoder 100 is configured to encode a picture of a video stream comprising multiple pictures. The encoder 100 comprises a reference picture determiner 110 configured to determine at least one reference picture for the current picture among the multiple pictures of the video stream. The at least one reference picture is used as encoding reference for the current picture. A picture identifier provider 120 of the encoder 100 is configured to provide a respective picture identifier of each reference picture determined by the reference picture determiner 110. A picture identifier provided by the picture identifier provider 120 identifies its associated reference picture. The picture identifier(s) provided by the picture identifier provider 120 collectively constitute a buffer description for the current picture by listing picture identifier(s) of the reference picture(s) required for encoding and decoding the current picture and optionally also any previous reference picture(s) of the video stream required for encoding and decoding a subsequent picture of the video stream.

[0167] The encoder 100 also comprises a buffer description information generator 130 configured to generate information of the buffer description, i.e. the buffer description information, defining the at least one reference picture determined by the reference picture determiner 110. The buffer description information generator 130 is configured to generate this buffer description information based on the at least one picture identifier from the picture identifier provider 120.

[0168] A data inserter 140 is implemented in the encoder 100 to insert the buffer description information generated by the buffer description information generator 130 into an encoded representation of the current picture. Hence, the coded bitstream of the video stream with regard to the current picture carries the buffer description information. This means that the encoded representation of the picture will carry the buffer description information that defines the relevant information, i.e. picture identifiers, required by a decoder in order to update the decoded picture buffer for the current picture to thereby enable decoding of the encoded representation of the picture.

[0169] As has been previously discussed herein the reference picture determiner 110 is preferably configured to determine any reference picture of the video stream as encoding reference for not only the current picture but also any reference picture, preferably present in the video stream prior to the current picture in the decoding order, as encoding reference for one or more subsequent pictures according to the decoding order.

[0170] In a particular embodiment each picture can be composed of one or more slices. Each such slice may then be encoded and decoded independently of other slices of the same picture. Hence, the reference picture determiner 110 preferably determines, for at least one slice, preferably for each slice of the picture, at least one reference picture to be used for encoding and decoding the particular slice. The picture identifier provider 120 preferably provides respective picture identifiers for all reference pictures determined by the reference picture determiner 110 for the current picture, i.e. for all its slices. The buffer description information is thereby generated by the buffer description information generator 130 based on these provided picture identifiers. In a preferred embodiment, the data inserter 140 is configured to insert the buffer description information in a respective slice header of the encoded representation of the picture. In such a case, each slice header of the current picture preferably carries the same buffer description information. This enables decoding of a given slice even, though, another slice of the picture is unintentionally lost.

[0171] Also other positions among control information in the encoded representation of the picture are possible for carrying the buffer description information as previously discussed herein.

[0172] The buffer description of the embodiments could include the picture identifier(s) of the reference picture(s). Alternatively, the buffer description comprises the

previously discussed delta identifier(s) that can be used together with the picture identifier of the current picture to calculate the picture identifier(s) of the reference picture(s).

[0173] In such a case the encoder 100 preferably comprises an identifier calculator 150 that is configured to calculate, for each picture identifier provided by the picture identifier provider 120, a difference between the picture identifier and the picture identifier of the current picture. This difference corresponds to the delta identifier for the reference picture. The buffer description information generator 130 is then configured to generate the buffer description information based on the at least one difference/delta identifier calculated by the identifier calculator 150. The buffer description information thereby defines the at least one picture identifier of the reference picture(s) relative to the picture identifier of the current picture.

[0174] The encoded representation of the picture could carry the picture identifiers provided by the picture identifier provider 120 or the delta identifiers calculated by the identifier calculator 150 as buffer description information, for instance in the slice headers. This provides an explicit signaling of the buffer description in the encoded representation of the picture.

[0175] In an alternative embodiment, the encoder 100 comprises a data structure generator 160 configured to generate a data structure comprising multiple predefined buffer descriptions. Each such predefined buffer description thereby defines at least one reference picture. The data structure can thereby be used for multiple pictures in the video stream for the purpose of providing the buffer description to be used during decoding for the pictures. The buffer description information generator 130 is thereby configured to select a buffer description of the data structure based on the at least one picture identifier provided by the picture identifier provider 120 for the current picture. The buffer description that correctly matches the at least reference picture identifier is thereby selected and the buffer description information generated by the buffer description information generator 130 comprises an identifier of the selected buffer description.

[0176] The data structure generated by the data structure generator 160 could then be inserted in a control information field associated with an encoded representation of the video stream, such as in a PPS or SPS. An identifier of the relevant control information, i.e. a PPS identifier or an SPS identifier (could be in the form of a PPS identifier to a PPS that in turn comprises an SPS identifier to the relevant SPS), is preferably included in control information of the encoded representation of the current picture, such as in the

slice header. In an embodiment, the slice header or other control information field thereby carries the control information identifier and the identifier of the selected buffer description as the buffer description information.

[0177] The above description embodiments of explicit signaling of picture identifiers and reference signaling of picture identifiers can be combined. In such a case, the buffer description information generator 130 is configured to generate the buffer description information comprising the identifier of the selected buffer description, preferably also the control information identifier, and comprising information, such as delta identifier or explicit picture identifier, defining a picture identifier of a reference picture.

[0178] The encoder 100 could use any of the previously discussed examples of picture identifiers, such as POC value that unambiguously identifies a reference picture, or a POC value and an additional identifier.

[0179] The video stream could be a scalable video stream where the pictures are grouped into multiple layers. In such a case the picture identifier provider 120 is configured to provide, for each reference picture, the picture identifier and temporal layer information or identifier identifying a layer to which the reference picture belongs. The buffer description information generator 130 then generates the buffer description information based on the at least one picture identifier and based on the temporal layer information. Thus, the buffer description information preferably defines the at least one picture identifier and the temporal layer information.

[0180] The reference picture determiner 110 is preferably configured to determine the at least one reference picture as encoding reference for inter prediction and/or motion vector prediction for the current picture. The at least one reference picture can thereby be determined by maximizing the compression or coding efficiency of the encoded representation of the picture, i.e. minimizing the number of symbols, such as bits, required for representing the encoded representation. This compression maximization is preferably performed while complying with at least one side constraint selected from having a predefined maximum number of reference pictures and generating a decodable representation of the video stream also when at least one encoded representation of a picture is removed from the encoded representation of the video stream. A further alternative or additional side constraint is that a selected reference picture must be available for reference and prediction in the decoded picture buffer.

[0181] The encoder could be implemented at least partly in software. In such an embodiment as shown in Fig. 19, the encoder 300 comprises an input section 310 configured to receive multiple pictures of a video stream. The encoder 300 also comprises a processor 330 configured to process code means of a computer program stored in a memory 340. The code means causes, when run on the processor 330, the processor 330 to determine, for a picture of the video stream, at least one reference picture of the video stream as encoding reference for the picture. The processor 330 is also caused to provide, for each reference picture, a picture identifier identifying the reference picture and generate, based on the at least one picture identifier, buffer description information defining the at least one reference picture. The processor 330 is further caused to insert the buffer description information in an encoded representation of the picture. The encoder 300 also comprises an output section 320 configured to output the encoded representations of the pictures.

[0182] The processor 330 could be a general purpose or specially adapted computer, processor or microprocessor, such as a central processing unit (CPU). The software includes computer program code elements or software code portions effectuating the operation of at least the reference picture determiner 110, the picture identifier provider 120, the buffer description information generator 130, and the data inserter 140 of Fig. 18.

[0183] The program may be stored in whole or part, on or in one or more suitable volatile computer readable media or data storage means, such as RAM, or one or more non-volatile computer readable media or data storage means, such as magnetic disks, CD-ROMs, DVD disks, hard discs, in ROM or flash memory. The data storage means can be a local data storage means or is remotely provided, such as in a data server. The software may thus be loaded into the operating memory of a computer or equivalent processing system for execution by a processor. The computer/processor does not have to be dedicated to only execute the above-described functions but may also execute other software tasks. A non-limiting example of program code used to define the encoder 300 include single instruction multiple data (SIMD) code.

[0184] Alternatively, the encoder can be implemented in hardware. There are numerous variants of circuitry elements that can be used and combined to achieve the functions of the units 110-160 of the encoder 100 in Fig. 18. Such variants are encompassed by the embodiments. Particular examples of hardware implementation of the encoder 100 is implementation in digital signal processor (DSP) hardware and integrated circuit

technology, including both general-purpose electronic circuitry and application-specific circuitry.

[0185] According to an aspect of the embodiments a transmitter 200 as shown in Fig. 17 is provided. The transmitter 200 comprises an input section 210 configured to receive multiple pictures 10 of a video stream. The pictures 10 are forwarded to an encoder 100, such as illustrated in Fig. 18 or in Fig. 19, which is configured to encode the multiple pictures 10 to generate respective encoded representations of the multiple pictures. An output section 220 of the transmitter 200 is configured to output the respective encoded representations of the multiple pictures as a coded bitstream carrying the buffer description information of the embodiments.

[0186] An aspect of the embodiments relates to a decoder for detecting buffer description information and for determining absolute reference to pictures to be used as reference pictures for decoding based on the detected buffer description and a buffer for storing the pictures to be used as reference pictures.

[0187] Fig. 21 is a schematic block diagram of a decoder 400 according to an embodiment. The decoder 400 is configured to decode an encoded representation of a picture of a video stream comprising multiple pictures. The decoder 400 comprises a data retriever 410 configured to retrieve buffer description information defining at least one reference picture from the encoded representation of the picture. The buffer description information is used by a picture identifier determiner 420 that is configured to determine at least one picture identifier identifying a respective reference picture as decoding reference for the picture. The decoder 400 also comprises a buffer manager 430 configured to update a decoded picture buffer of or associated to the decoder 400 based on the at least one picture identifier determined by the picture identifier determiner 420.

[0188] In a particular embodiment, the data retriever 410 is configured to retrieve the buffer description information defining multiple picture identifiers from the encoded representation of the picture. The picture identifier determiner 420 is then configured to determine, based on the retrieved buffer description information, at least one picture identifier identifying a respective reference picture as decoding reference for the picture and at least one picture identifier identifying a respective reference picture as decoding reference for a subsequent, according to a decoding order, picture of the video stream.

[0189] The buffer manager 430 is preferably configured to update the decoded picture buffer to comprise the respective reference picture identified by the at least one picture identifier.

[0190] Thus, the buffer description information carried by the encoded representation of the picture is used to identify which reference picture(s) that need to be stored in the decoded picture buffer for decoding the current picture and for decoding a subsequent picture of the video stream. The buffer description information thereby provides the information to the decoder 400 required to update the decoded picture buffer to store the correct reference picture(s).

[0191] Once the buffer manager 430 has updated the decoded picture buffer the decoder 400 can decode the picture based on the encoded representation of the picture and at least one reference picture stored in the updated decoded picture buffer.

[0192] The buffer description information is preferably provided in control information of the encoded representation of the picture. For instance, the data retriever 410 could be configured to retrieve the buffer description information from a slice header of the encoded representation of the picture. In such a case the buffer description information is preferably retrieved from the first slice header received for the current picture since any remaining slice headers of the picture will preferably carry the same buffer description information.

[0193] The retrieved buffer description information could include explicit picture identifiers of the reference pictures to be stored in the decoded picture buffer. In an alternative embodiment, the buffer description information defines a respective delta identifier for the reference pictures. The picture identifier determiner 420 is then configured to retrieve the at least one delta identifier from the buffer description information and calculate the at least one picture identifier based on the respective delta identifier and the picture identifier of the current picture, preferably as a sum of the delta identifier and the picture identifier of the current picture.

[0194] Instead of explicit signaling of picture identifiers or delta identifiers in the encoded representation of the picture a reference signaling can be used. The data retriever 410 is in this embodiment configured to retrieve an identifier of a buffer description from the encoded representation of the picture. The decoder 400 preferably comprises a buffer description identifier 480 configured to identify a buffer description from a data structure

comprising multiple predefined buffer descriptions using the retrieved identifier of the buffer description.

[0195] The data retriever 410 is preferably in this embodiment also configured to retrieve the data structure defining the multiple predefined buffer descriptions from a control information field of or associated with an encoded representation of the video stream, such as from a PPS or SPS.

[0196] In a particular embodiment a control information field of the encoded representation of the picture, such as slice header, preferably comprises an identifier of the control information field, such as PPS or SPS, carrying the data structure. The data retriever 410 thereby retrieves this identifier and uses it to identify the relevant control information field with the data structure.

[0197] In another embodiment the buffer description information comprises the identifier of the buffer description and information, such as picture identifier or delta identifier, identifying at least one picture identifier. The picture identifier determiner 420 is then configured to determine a first set of at least one picture identifier from the identified buffer description, preferably from the data structure. The picture identifier determiner 420 also determines a second set of at least one picture identifier from the information defining at least one picture identifier, where this information has been explicitly signaled in the encoded representation of the picture, such as in the form of a picture identifier or a delta identifier. A joint set of picture identifiers is then formed from the first set and the second set by the picture identifier determiner 420.

[0198] In a particular embodiment the decoder 400 comprises a number comparator 440 configured to compare a total number of picture identifiers in the joint set with a maximum number of reference pictures that can be stored in the decoded picture buffer. If the total number of picture identifiers in the joints set exceeds the maximum number of reference pictures the picture identifier determiner 420 is configured to remove one or more picture identifiers included in the first set but not in the second set until the total number of picture identifiers in the joint set no longer exceeds the maximum number of reference pictures.

[0199] The buffer manager 430 of decoder 400 is configured, in a particular embodiment, to remove any reference picture present in the decoded picture buffer but not being associated with any of the at least one picture identifier determined from the buffer description information. Hence, any reference picture that is stored in the decoded picture

buffer but not identified from the buffer description information is preferably removed from the decoded picture buffer by the buffer manager 430.

[0200] In an alternative and preferred approach, the buffer manager 430 is configured to mark all reference pictures stored in the decoded picture buffer but not being associated with any of the at least one picture identifier from the buffer description information as unused for reference, also referred to as unused for prediction.

[0201] In a particular embodiment, any reference picture present in the decoded picture buffer and associated with any of the picture identifiers determined based on the buffer description information is preferably marked by the buffer manager 430 as used for reference. In an embodiment, a reference picture could be marked as either used for short-term reference or used for long-term reference. The selection between these two particular alternatives is preferably performed based on the buffer description information.

[0202] The buffer manager 430 of the decoder 400 is preferably configured to mark any reference picture prior to the decoder 400 decoding the current picture.

[0203] In a particular embodiment, the decoder 400 comprises an outputting section 450 configured to output zero or more pictures from the decoded picture buffer for display prior to the decoder 400 decoding the current picture. In a particular embodiment, the outputting section 450 outputs any reference picture marked as unused for reference by the buffer manager 430.

[0204] An optional embodiment of the decoder 400 comprises an identifier comparator 460 configured to compare the at least one picture identifier determined by the picture identifier determiner 420 with the picture identifier(s) of reference picture(s) stored in the decoded picture buffer. If any of the at least one picture identifier defined by the buffer description information does not have a matching reference picture in the decoded picture buffer the picture associated with the given picture identifier is determined by the picture identifier determiner 420 to be non-existing or missing.

[0205] In an optional embodiment, the picture identifier determiner 420 is configured to generate any non-existing picture and store such a generate picture in the decoded picture buffer. The picture identifier and any other information obtainable from the buffer description information with regard to the non-existing picture is preferably assigned to the generated picture by the picture identifier determiner 420.

[0206] The decoder 400 may also comprise a list manager 470 configured to perform reference picture list initialization based on the buffer description information. In a

particular embodiment, the list manager 470 is configured to perform the reference picture list initialization by ordering reference pictures in a reference picture list according to an order that the buffer description information defines the at least one picture identifier. Hence, the buffer description information not only defines the picture identifiers of the reference pictures but the order at which these are defined in the buffer description information also provides instructions to the list manager 470 with regard to forming the reference picture list.

[0207] The decoder could be implemented at least partly in software. In such an embodiment as shown in Fig. 22, the decoder 600 comprises an input section 610 configured to receive encoded representations of multiple pictures of a video stream. The decoder 600 also comprises a processor 630 configured to process code means of a computer program stored in a memory 640. The code means causes, when run on the processor 630, the processor 630 to retrieve buffer description information defining at least one reference picture from an encoded representation of a picture. The code means also causes the processor 630 to determine at least one picture identifier identifying a respective reference picture from the buffer description information. The respective reference picture is to be used as decoding reference for the picture. The processor 630 is further caused to update a decoded picture buffer 650 based on the at least one picture identifier. The decoder 600 also comprises an output section 620 configured to output the decoded pictures of the video stream.

[0208] The processor 630 could be a general purpose or specially adapted computer, processor or microprocessor, such as a central processing unit (CPU). The software includes computer program code elements or software code portions effectuating the operation of at least data retriever 410, the picture identifier determiner 420 and the buffer manager 430 of Fig. 21.

[0209] The program may be stored in whole or part, on or in one or more suitable volatile computer readable media or data storage means, such as RAM, or one or more non-volatile computer readable media or data storage means, such as magnetic disks, CD-ROMs, DVD disks, hard discs, in ROM or flash memory. The data storage means can be a local data storage means or is remotely provided, such as in a data server. The software may thus be loaded into the operating memory of a computer or equivalent processing system for execution by a processor. The computer/processor does not have to be dedicated to only execute the above-described functions but may also execute other software tasks. A non-

limiting example of program code used to define the decoder 600 include single instruction multiple data (SIMD) code.

[0210] Alternatively, the decoder can be implemented in hardware. There are numerous variants of circuitry elements that can be used and combined to achieve the functions of the units 410-480 of the decoder 400 in Fig. 21. Such variants are encompassed by the embodiments. Particular examples of hardware implementation of the decoder 400 is implementation in digital signal processor (DSP) hardware and integrated circuit technology, including both general-purpose electronic circuitry and application-specific circuitry.

[0211] According to an aspect of the embodiments a receiver 500 as shown in Fig. 20 is provided. The receiver 500 comprises an input section 510 configured to receive encoded representations of multiple pictures of a video stream. The encoded representation carries buffer description information according to the embodiments. The encoded representations are forwarded to a decoder 400, such as illustrated in Fig. 21 or in Fig. 22, which is configured to decode the encoded representations of the multiple pictures. An output section 520 of the receiver 500 is configured to output decoded pictures of the video stream. The receiver 500 also comprises a decoded picture buffer 530 storing reference pictures to be used by the decoder 400 when decoding the pictures.

ANNEX

[0212] The present annex presents a proposed syntax of an embodiment. In the annex added syntax element with regard to the prior art HEVC proposal is marked with underlining and removed syntax elements are marked with strikethrough.

Slice Header

slice_header() {	Descriptor
first_tb_in_slice	ue(v)
entropy_slice_flag	u(1)
if(!entropy_slice_flag) {	
slice_type	ue(v)
pic_parameter_set_id	ue(v)
frame_num	u(v)
<u>additional_picture_id</u>	<u>ue(v)</u>
if(IdrPicFlag)	
idr_pic_id	ue(v)
if(pic_order_cnt_type == 0)	
pic_order_cnt_lsb /*	u(v)
<u>if(!IdrPicFlag){</u>	
<u>buffer description reference flag</u>	<u>u(1)</u>
<u>if(buffer description reference flag == 1){</u>	
<u>buffer description id</u>	<u>ue(v)</u>
<u>}</u>	
<u>if(buffer description reference flag == 0){</u>	
<u>number of explicitly signaled pictures</u>	<u>ue(v)</u>
<u>for(number of explicitly signaled pictures) {</u>	
<u>additional_picture_id</u>	<u>ue(v)</u>
<u>if(num_reorder_frames > 0)</u>	
<u>delta_POC_sign</u>	<u>u(1)</u>
<u>absolute delta POC minus one</u>	<u>ue(v)</u>
<u>temporal_id</u>	<u>u(v)</u>
<u>}</u>	
<u>}</u>	
<u>}</u>	
<u>}</u>	
if(slice_type == P slice_type == B) {	
num_ref_idx_active_override_flag	u(1)

if(num_ref_idx_active_override_flag) {	
num_ref_idx_l0_active_minus1	ue(v)
if(slice_type == B)	
num_ref_idx_l1_active_minus1	ue(v)
}	
}	
ref_pic_list_modification()	
ref_pic_list_combination()	
~~if(nal_ref_idc != 0)~~	
~~dec_ref_pic_marking()~~	
if(entropy_coding_mode_flag && slice_type != I)	
cabac_init_idc	ue(v)
slice_qp_delta	se(v)
if(adaptive_loop_filter_enabled_flag)	
alf_param()	
if(deblocking_filter_control_present_flag) {	
disable_deblocking_filter_idc	
if(disable_deblocking_filter_idc != 1) {	
slice_alpha_c0_offset_div2	
slice_beta_offset_div2	
}	
}	
if(slice_type == B)	
collocated_from_l0_flag	u(1)
} else	
if(entropy_coding_mode_flag && slice_type != I)	
cabac_init_idc	ue(v)
}	

Picture Parameter Set

pic_parameter_set_rbsp() {	Descriptor
pic_parameter_set_id	ue(v)
seq_parameter_set_id	ue(v)
entropy_coding_mode_flag	u(1)
num_ref_idx_l0_default_active_minus1	ue(v)
num_ref_idx_l1_default_active_minus1	ue(v)
pic_init_qp_minus26 /* relative to 26 */	se(v)
constrained_intra_pred_flag	u(1)
<u>number of buffer descriptions</u>	<u>ue(v)</u>
for(number of buffer descriptions){	
<u>number of pictures in buffer description</u>	<u>ue(v)</u>
for(number of pictures in buffer description) {	
if(num_reorder_frames > 0)	
<u>delta_POC_sign</u>	<u>u(1)</u>
<u>absolute delta POC minus one</u>	<u>ue(v)</u>
<u>temporal id</u>	<u>u(v)</u>
}	
rbbsp_trailing_bits()	
}	

Proposed semanticsDecoding process for buffer description application

[0213] This process is invoked at the beginning of the decoding process for each I, P, or B picture, prior to decoding of the first Coding Unit in the first slice of the picture and prior to the decoding process for reference picture list construction.

[0214] The process may result in marking one or more picture as “unused for reference”.

[0215] The process may result in the construction of “non-existing” pictures as described in Creation of non-existing pictures.

[0216] A reference picture is identified for use in the decoding process by the variables *POC* and *additional_picture_id*.

[0217] A reference picture r in the decoded picture buffer is said to be a part of a buffer description if and only if $POC(r) = POC(curr) + \text{delta_POC}(i)$ and $\text{additional_picture_id}(r) = \text{additional_picture_id}(i)$ for any i in the range of 0 to $\text{number_pictures_in_buffer_description}$.

Sequence of operation for buffer description application

[0218] Buffer description application proceeds in the following ordered steps:

1. Depending on whether the current picture is an IDR picture, the following applies.
 - If the current picture is an IDR picture, all reference pictures are marked as unused for reference.
 - Otherwise (the current picture is not an IDR picture), the following ordered steps applies:
 - I. The buffer description information in the slice header of the first slice of the current picture is used to create a list of reference pictures, referred to as the buffer description as described in Creation of a buffer description.
 - II. All reference pictures (in the decoded picture buffer) that are not a part of the buffer description are marked as "unused for reference".
 - III. If one or more pictures that are included in the buffer description are not available for reference (i.e. existing in the reference buffer marked as "used for reference") the process described in Creation of non-existing pictures is invoked.
2. The slices of the current picture are decoded.

Creation of a buffer description

[0219] If $\text{buffer_description_reference_flag}$ is 1, a buffer description is created setting deltaPOC to the deltaPOC of the PPS buffer description entry identified by $\text{buffer_description_id}$, temporal_id to the temporal_id of the PPS buffer description entry identified by $\text{buffer_description_id}$ and $\text{additional_picture_id}$ to 0 for each picture i in the range from 0 to $\text{number_of_pictures_in_buffer_description}-1$.

[0220] If $\text{buffer_description_reference_flag}$ is 0, a buffer description is created setting deltaPOC to the deltaPOC of the explicitly signaled buffer description, temporal_id to the temporal_id of the explicitly signaled buffer description and $\text{additional_picture_id}$ to

additional_picture_id of the explicitly signaled buffer description for each picture *i* in the range from 0 to *number_of_explicitly_signaled_pictures*-1.

Creation of non-existing pictures

[0221] This process is preferably invoked for each picture that is included in the buffer description of the current picture but is not available in the decoded picture buffer. That is if the buffer description of the current picture contains an entry *i*, with a *POC(i)* and *additional_picture_id(i)* such that there is no picture *j* in the decoded picture buffer marked as “used for reference” with *POC(j) == POC(i)* and *additional_picture_id(j) == additional_picture_id(i)*.

[0222] For each such description a “non-existing” picture is generated with *POC* set to *POC(i)*, *additional_picture_id* set to *additional_picture_id(i)*, *temporal_id* set to *temporal_id(i)* and marked as “non-existing” and “used for reference”. The sample values of the generated frames may be set to any value. These generated frames which are marked as “non-existing” shall not be referred to in the inter prediction process.

[0223] The embodiments described above are to be understood as a few illustrative examples of the present invention. It will be understood by those skilled in the art that various modifications, combinations and changes may be made to the embodiments without departing from the scope of the present invention. In particular, different part solutions in the different embodiments can be combined in other configurations, where technically possible. The scope of the present invention is, however, defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:

retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and

updating a decoded picture buffer based on the reference picture identifier.

2. The method according to claim 1, wherein:

determining the reference picture identifier comprises determining, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.

3. The method according to claim 1, further comprising:

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

4. The method according to Claim 3, wherein generating the non-existing picture with parameters comprises at least one of:

- setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

- setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

- setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and

- marking the non-existing picture with a non-existing mark and a used for reference mark.

5. A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:

- retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

- determining, based on the buffer description information, a reference picture identifier that identifies a reference picture among the plurality of reference pictures that comprises a decoding reference for the picture;

- determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing;

- responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier;

- updating a decoded picture buffer based on the reference picture identifier.

6. The method according to Claim 5, wherein generating the non-existing picture with parameters comprises at least one of:

- setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

- setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and

marking the non-existing picture with a non-existing mark and a used for reference mark.

7. The method according to Claim 5, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier.

8. A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:

a data retriever configured to retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of the picture;

a picture identifier determiner configured to determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the picture identifier determiner is configured to i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, and ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and

a buffer manager configured to update a decoded picture buffer based on the reference picture identifier.

9. The decoder according to claim 8, wherein:

the data retriever is configured to retrieve the buffer description information defining multiple reference pictures from the encoded representation of the picture; and

the picture identifier determiner is configured to determine, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the multiple reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the multiple reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.

10. The decoder according to claim 8, wherein the picture identifier determiner is further configured to:

determine whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

11. The decoder according to Claim 10, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and

marking the non-existing picture with a non-existing mark and a used for reference mark.

12. A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:

a data retriever configured to retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of the picture;

a picture identifier determiner configured to:

determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture;

determine whether the reference picture identified by the reference picture identifier is one of missing or non-existing;

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; and

a buffer manager configured to update a decoded picture buffer based on the reference picture identifier.

13. The decoder according to Claim 12, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an `additional_picture_id` of the non-existing picture to an `additional_picture_id` of the reference picture;

setting a `temporal_id` of the non-existing picture to a `temporal_id` of the reference picture; and

marking the non-existing picture with a non-existing mark and a used for reference mark.

14. A receiver comprising:

an input section configured to receive encoded representations of multiple pictures in a video stream;

a decoder configured to decode the encoded representations of the multiple pictures; and

an output section configured to output decoded pictures of the video stream, wherein the decoder comprises:

a data retriever configured to retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of a picture;

a picture identifier determiner configured to determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the picture identifier determiner is configured to i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, and ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and

a buffer manager configured to update a decoded picture buffer based on the reference picture identifier.

15. The receiver according to claim 14, further comprising:
determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and
responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

16. The receiver according to Claim 15, wherein generating the non-existing picture with parameters comprises at least one of:
setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and
marking the non-existing picture with a non-existing mark and a used for reference mark.

17. A computer program product for decoding an encoded representation of a picture in a video stream of multiple pictures, the computer program product comprising:

a non-transitory computer readable medium storing program instructions that are executable by a processor of a node in an access network to perform operations comprising:

retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and

updating a decoded picture buffer based on the reference picture identifier.

18. The computer program product according to claim 17, wherein the instructions comprise further instructions that are executable by the processor of the node in the access network to perform operations comprising:

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

19. The computer program product according to Claim 18, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture; and

marking the non-existing picture with a non-existing mark and a used for reference mark.

ABSTRACT

An encoded representation of a picture of a video stream is decoded by retrieving buffer description from the encoded representation. The buffer description information is used to determine at least one picture identifier identifying a respective reference picture as decoding reference for the picture. A decoded picture buffer is updated based on the determined picture identifier. The encoded representation of the picture itself comprises the information needed by a decoder to identify the reference pictures required to decode the encoded representation.

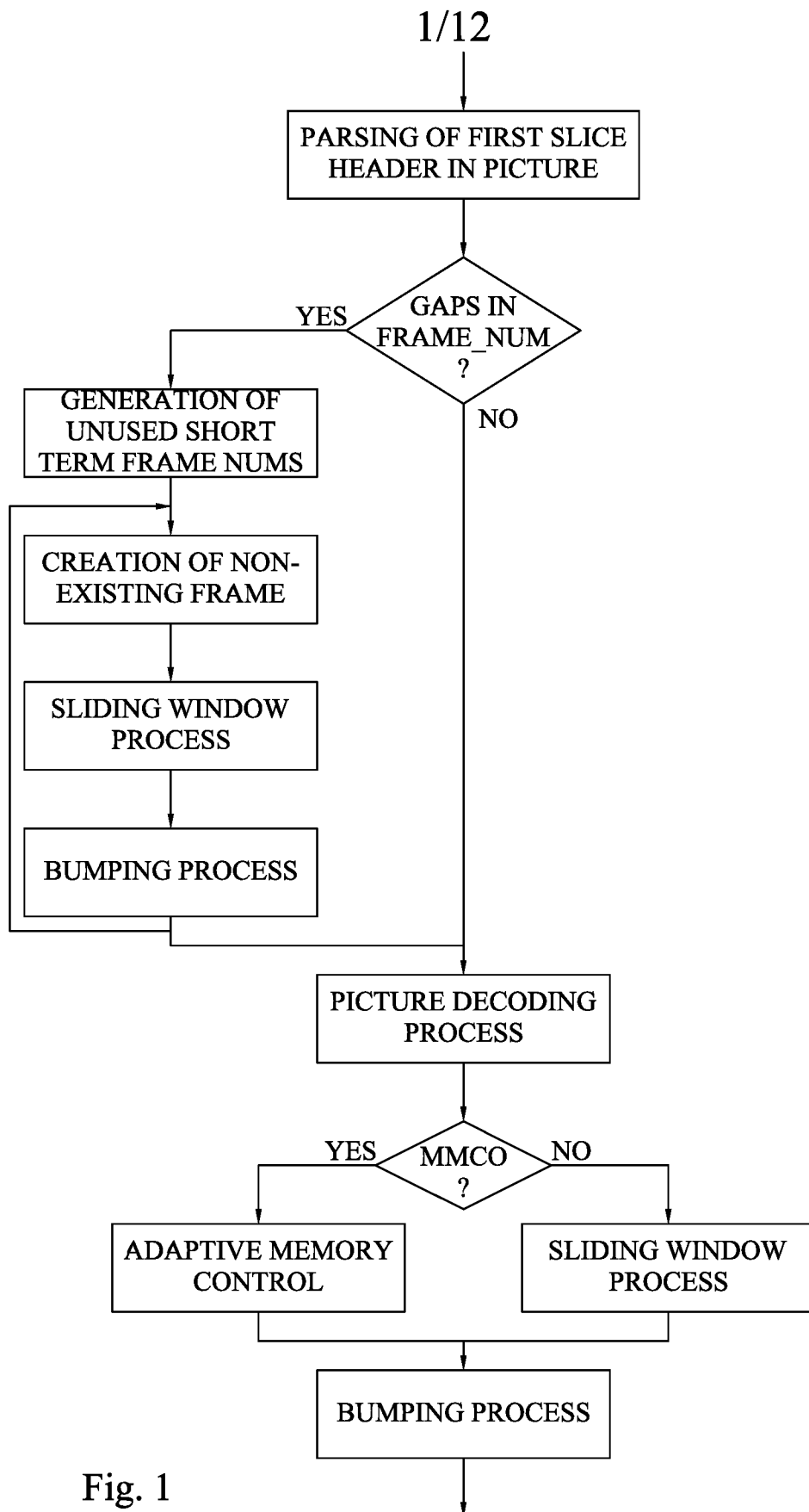


Fig. 1

Fig. 2

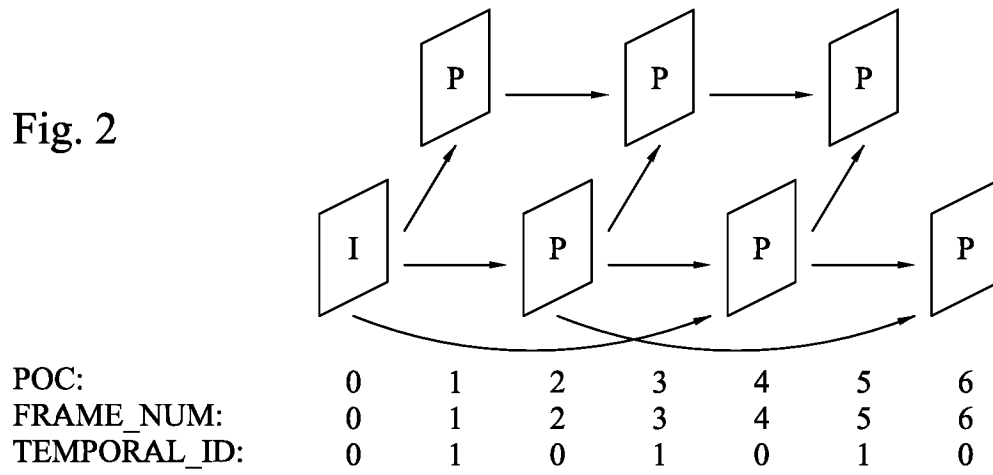
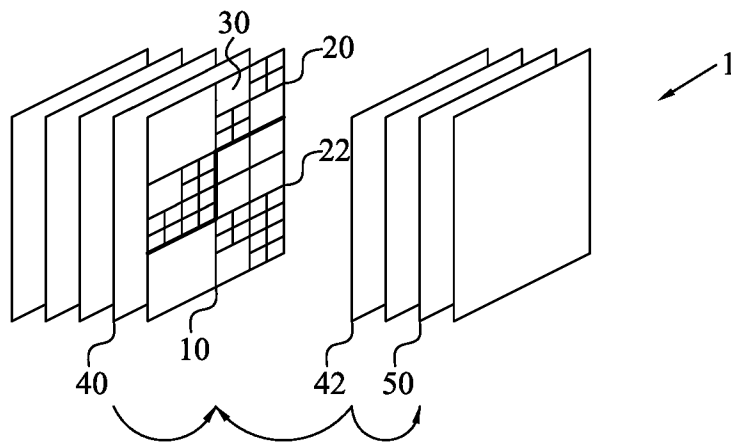
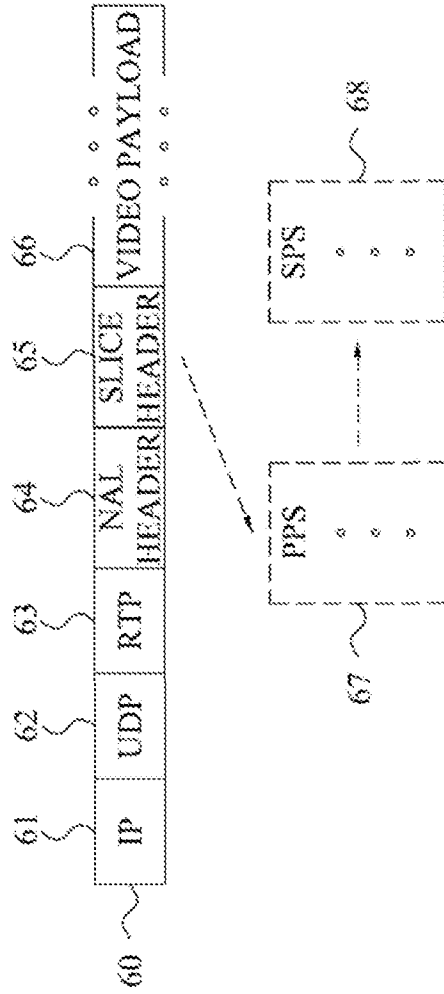
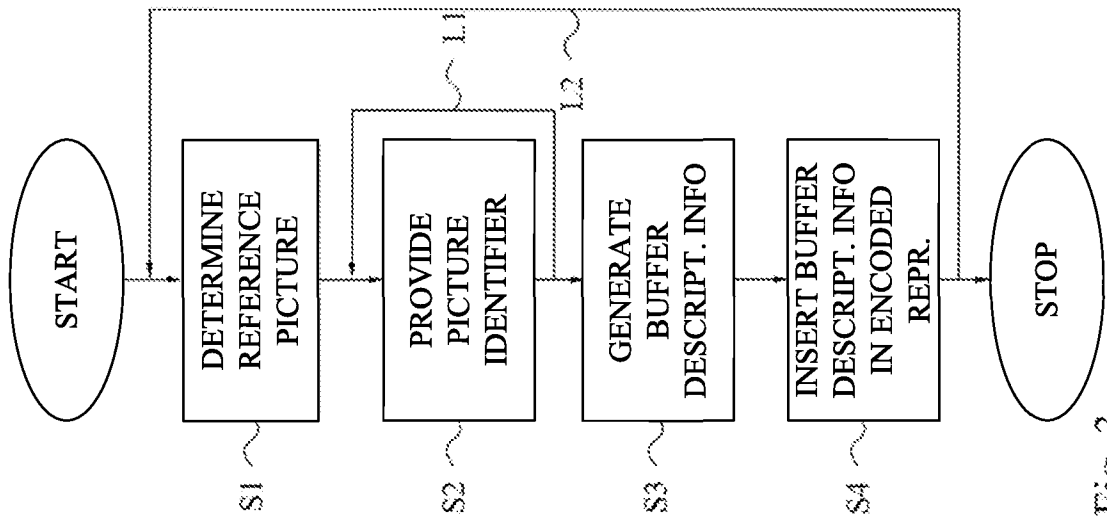


Fig. 4





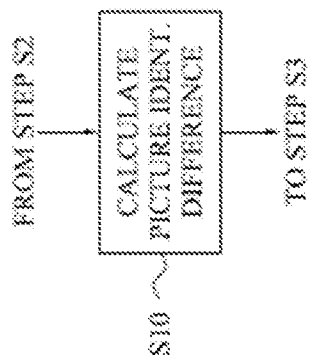


Fig. 6

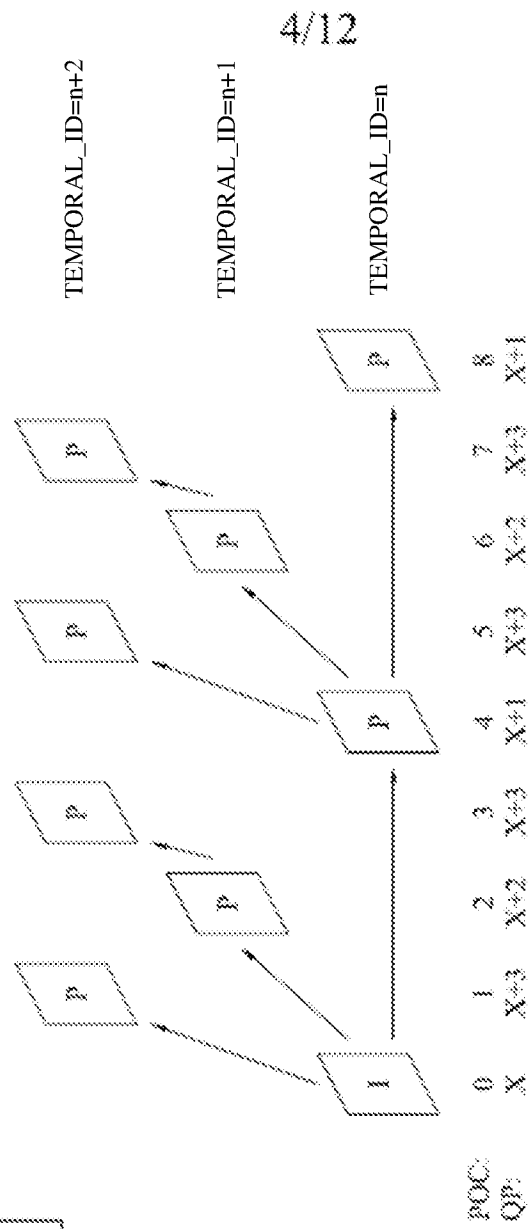


Fig. 8

5/12

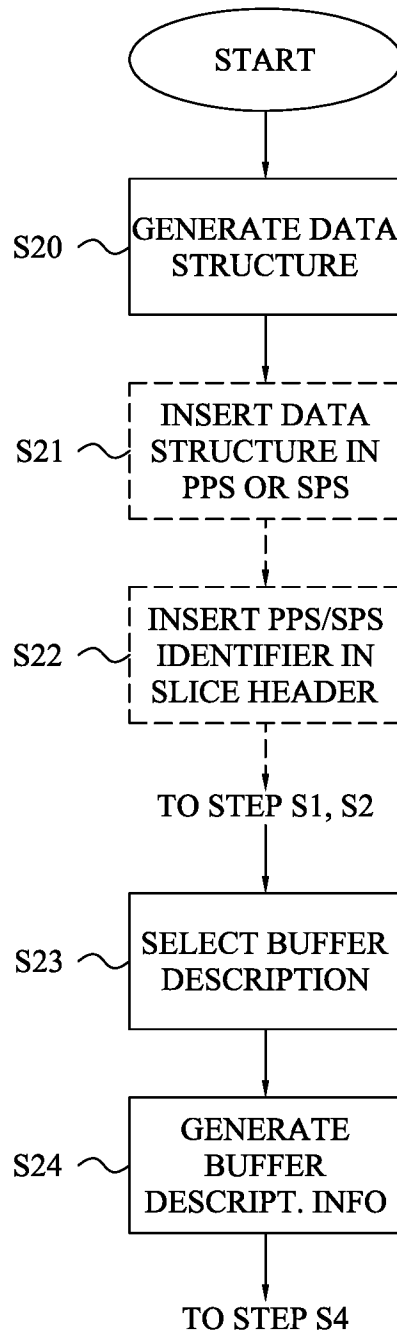
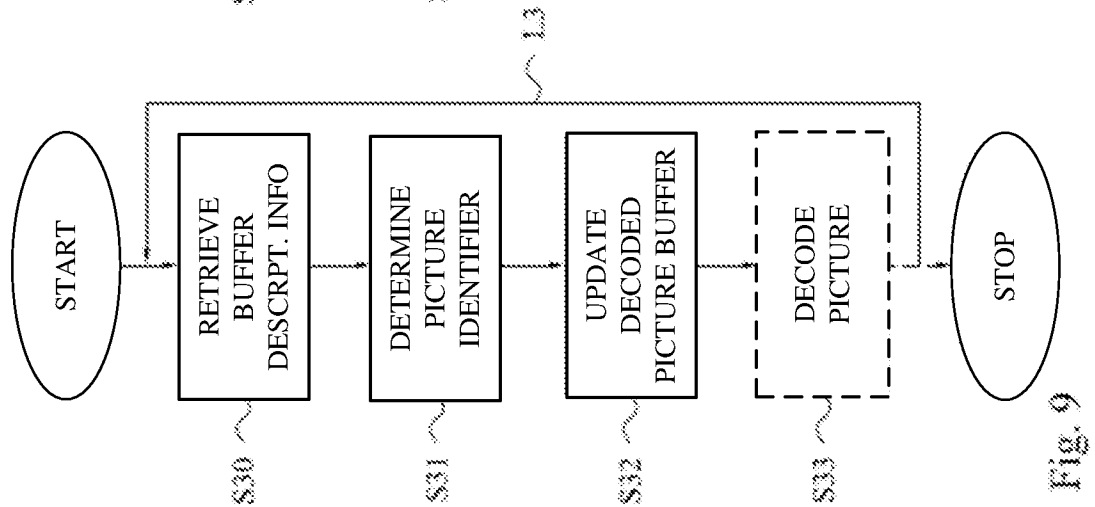
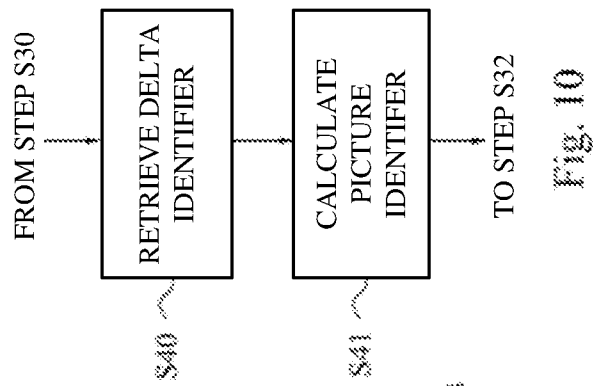
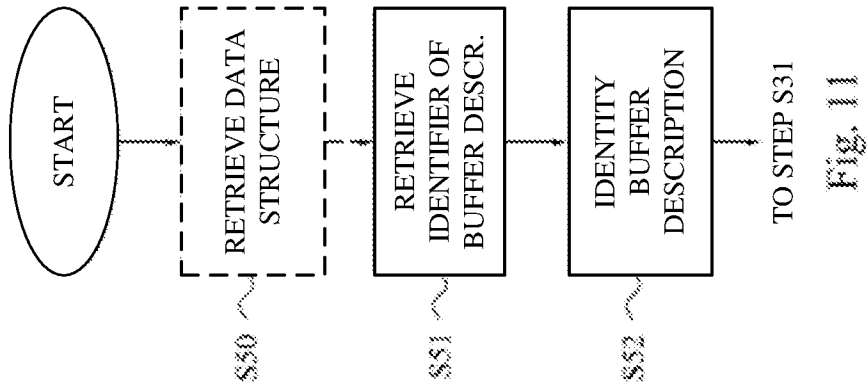


Fig. 7



7/12

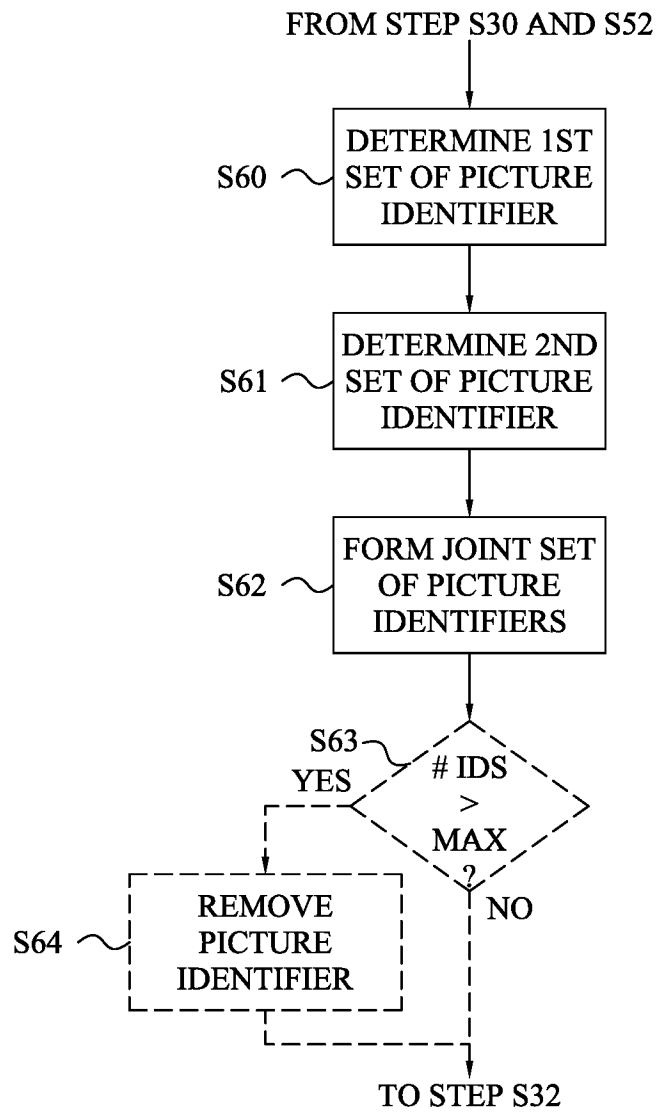


Fig. 12

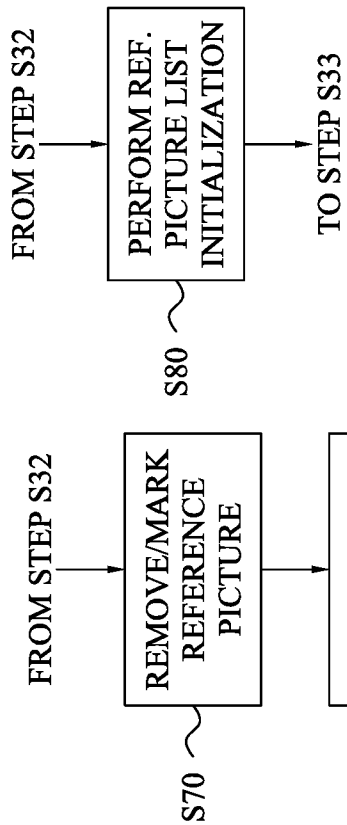


Fig. 14

8/12

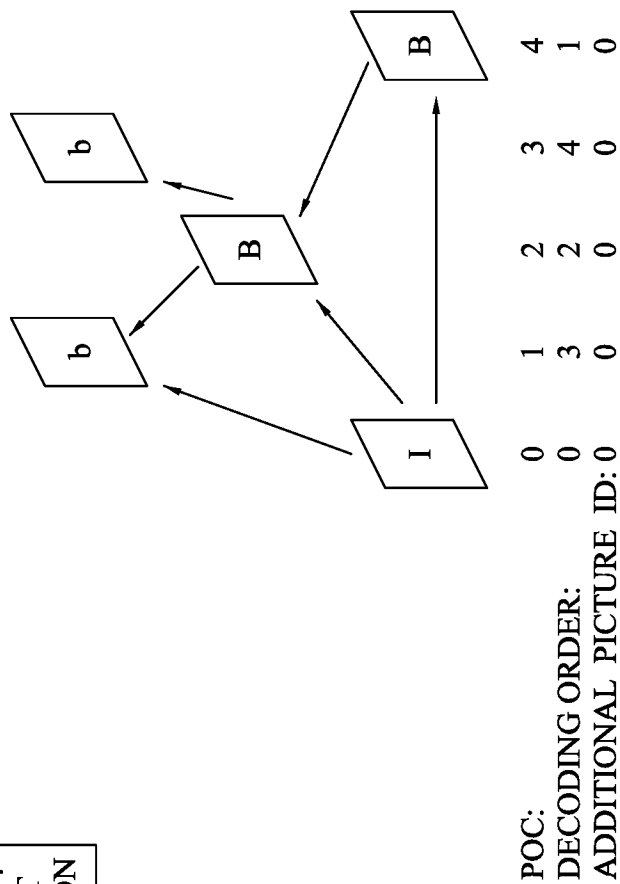


Fig. 15

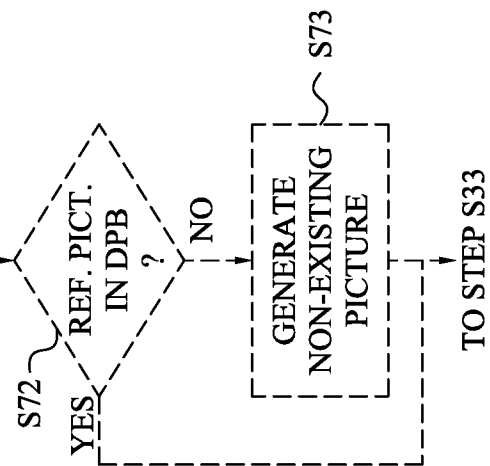


Fig. 13

9/12

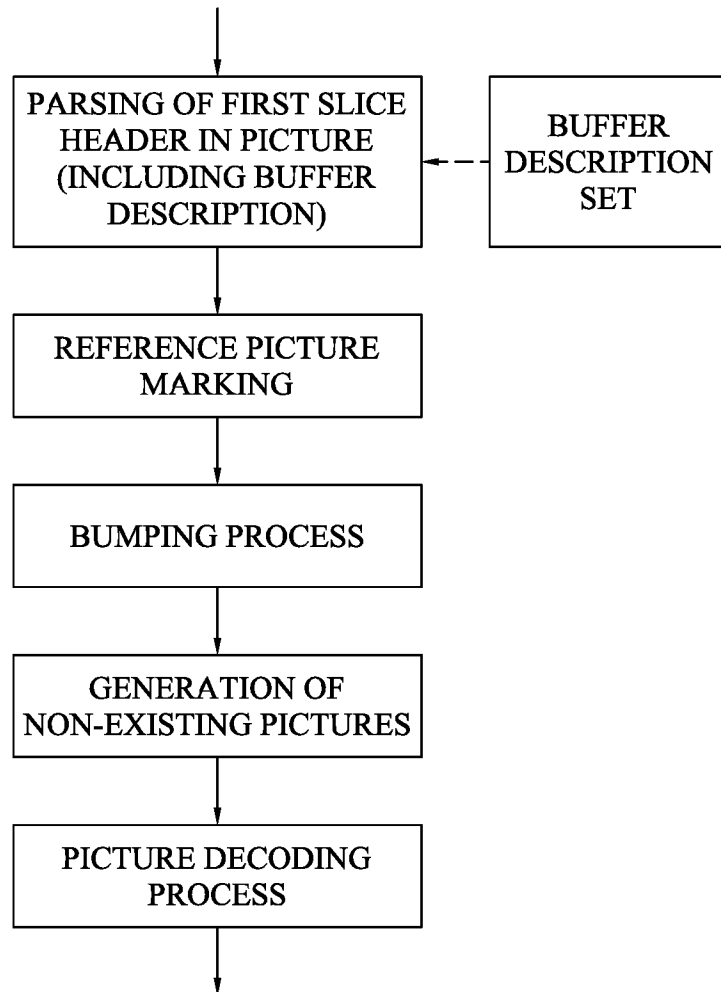


Fig. 16

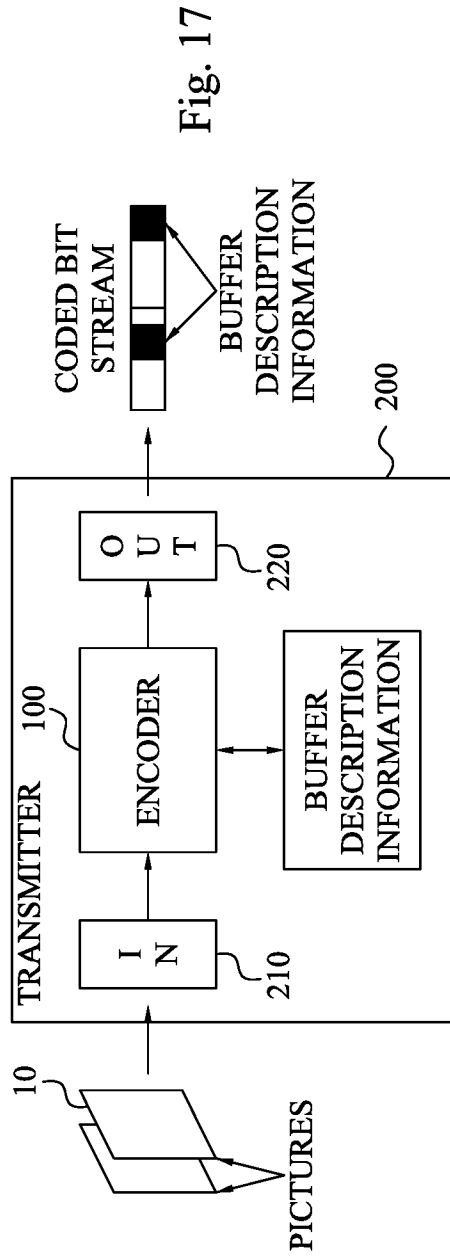


Fig. 17

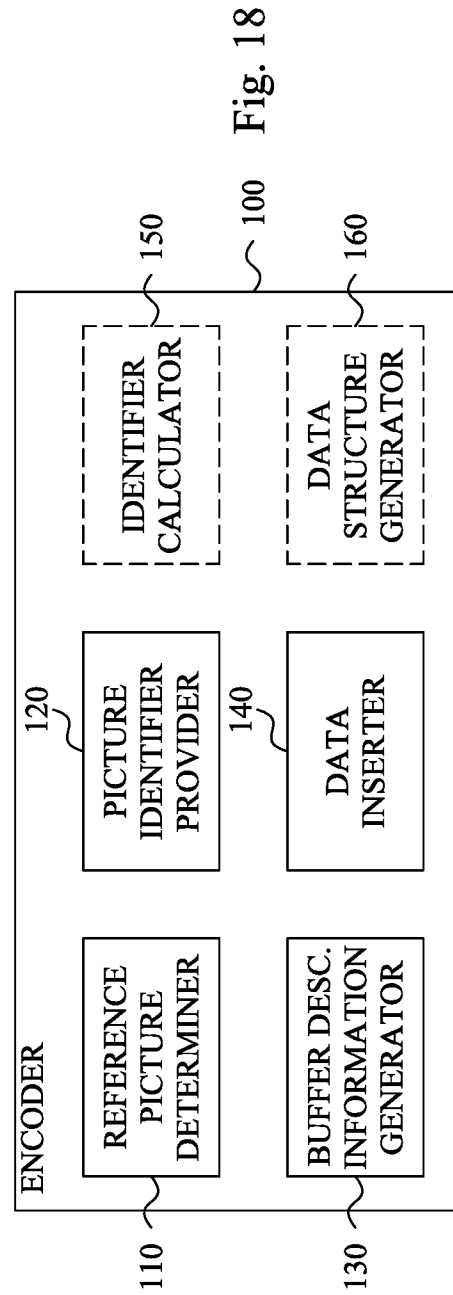
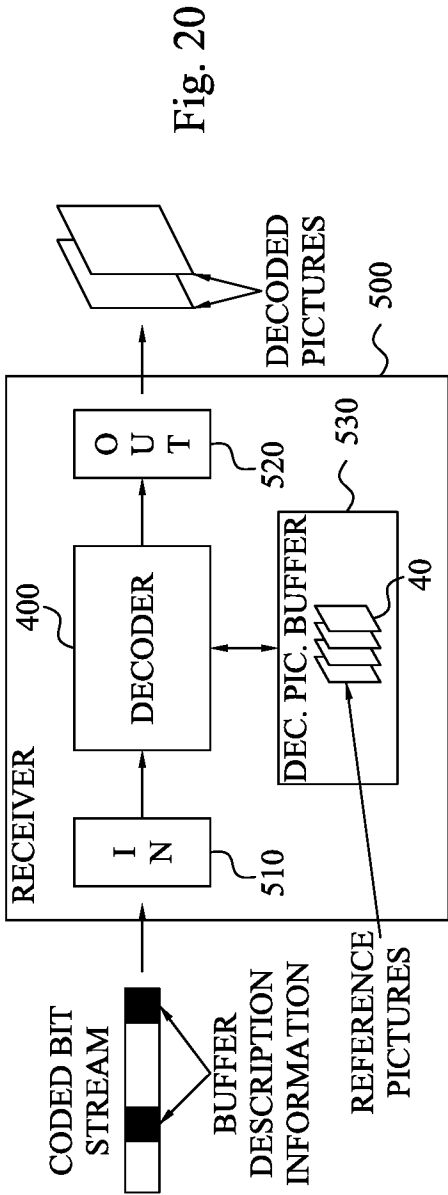
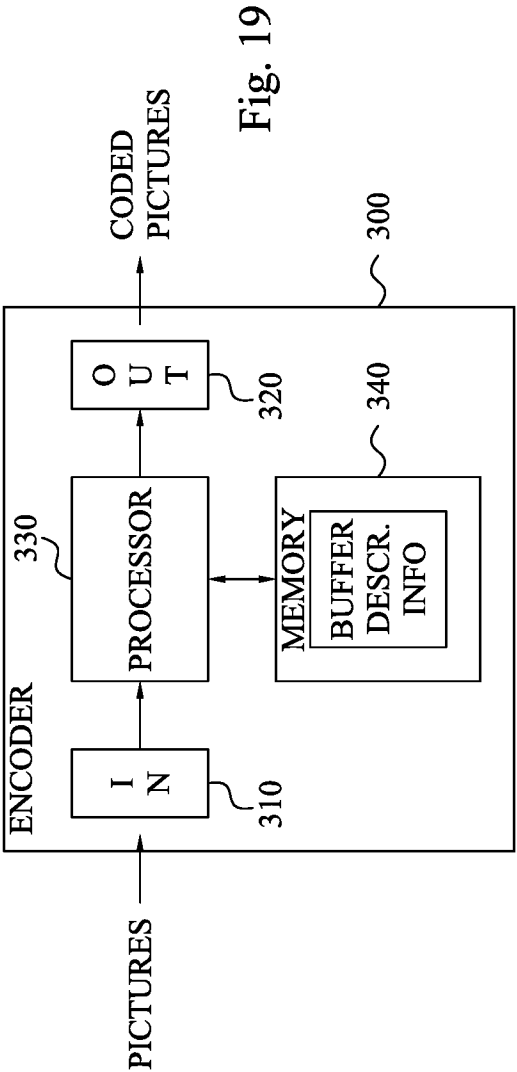


Fig. 18



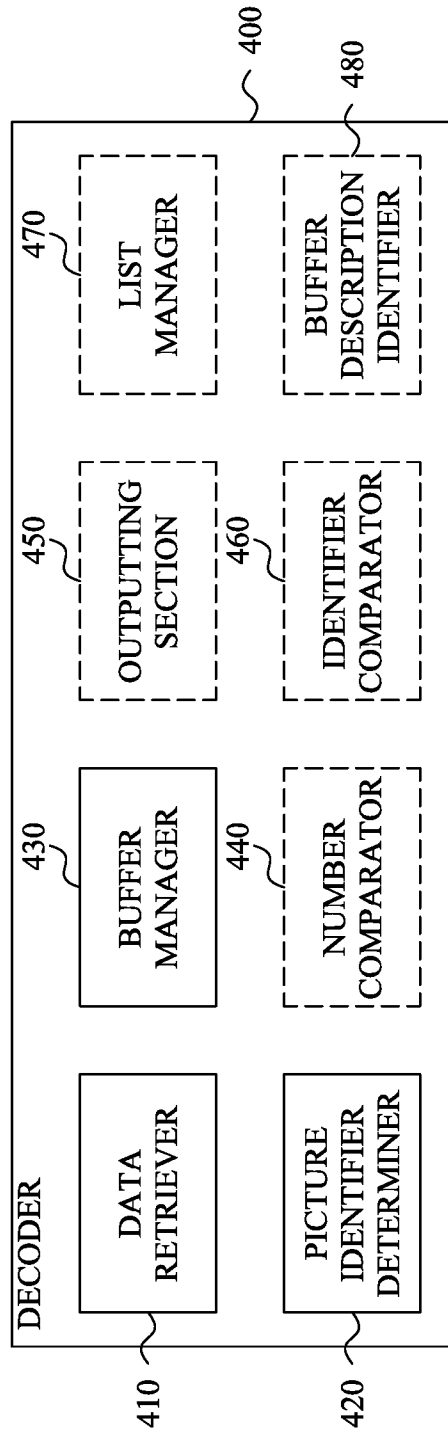


Fig. 21

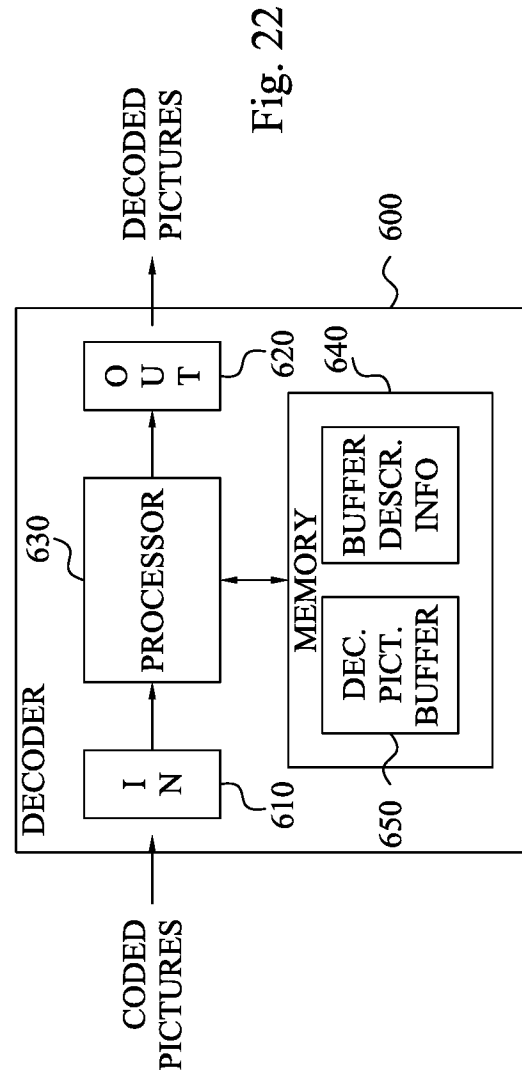
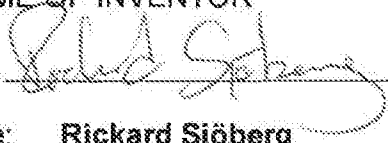


Fig. 22

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)	
Title of Invention	REFERENCE PICTURE SIGNALING
As a below named inventor, I hereby declare that:	
This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____, ☐ As amended on _____ (if applicable).	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.	
I am aware of the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56, including for continuation-in-part applications, material information that became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
LEGAL NAME OF INVENTOR	
Signature: <u></u> Date: <u>2016-10-07</u>	
Legal Name: Jonatan Samuelsson	

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)	
Title of Invention	REFERENCE PICTURE SIGNALING
As a below named inventor, I hereby declare that:	
This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____, ☐ As amended on _____ (if applicable).	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.	
I am aware of the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56, including for continuation-in-part applications, material information that became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
LEGAL NAME OF INVENTOR	
Signature: 	Date: <u>2016-10-07</u>
Legal Name: Rickard Sjöberg	

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jonatan		Samuelsson		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Stockholm		Country of Residence ⁱ	SE	

Mailing Address of Inventor:

Address 1	Stadshagsplan 1				
Address 2					
City	Stockholm	State/Province			
Postal Code	112 50	Country ⁱ	SE		

Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Rickard		Sjöberg		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Stockholm		Country of Residence ⁱ	SE	

Mailing Address of Inventor:

Address 1	Robert Almströmsgatan 9A				
Address 2					
City	Stockholm	State/Province			
Postal Code	113 36	Country ⁱ	SE		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

Add

Correspondence Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence information of this application.

Customer Number	146825		
Email Address	instructions@sagepat.com	Add Email	Remove Email

Application Information:

Title of the Invention	REFERENCE PICTURE SIGNALING		
Attorney Docket Number	9900-34860US6	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	Suggested Figure for Publication (if any)	3

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	146825		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation of	16/048556	2018-07-30		
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16/048556	Continuation of	15/718374	2017-09-28	10063882	2018-08-28
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15/718374	Continuation of	15/299997	2016-10-21	9807418	2017-10-31
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15299997	Continuation of	13508442	2013-04-25	9706223	2017-07-11
Prior Application Status	Expired		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
13508442	a 371 of international	PCT/SE2012/050439	2012-04-26		
Prior Application Status	Expired		Remove		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
PCT/SE2012/050439	Claims benefit of provisional	61503019	2011-06-30		
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here. ☒		
Organization Name	Telefonaktiebolaget LM Ericsson (publ)	
Mailing Address Information For Applicant:		
Address 1	SE-164 83	
Address 2		
City	Stockholm	State/Province
Country	SE	Postal Code
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Kevin L. Wingate/		Date (YYYY-MM-DD)	2019-06-13
First Name	Kevin L.	Last Name	Wingate	Registration Number
				38662
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	9900-34860US6
		Application Number	
Title of Invention	REFERENCE PICTURE SIGNALING		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
- 2 A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4 A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5 A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6 A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7 A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8 A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9 A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

POWER OF ATTORNEY

The undersigned, being a duly authorized representative of **TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)** (hereinafter referred to as "Ericsson") having its registered office at SE-164 83 Stockholm, Sweden, does hereby authorize **Sage Patent Group practitioners associated with United States Patent and Trademark Office Customer Number**

146825

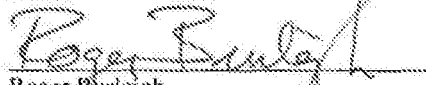
to represent Ericsson before the United States Patent and Trademark Office in any and all matters regarding patents or patent applications filed by Ericsson or wherein Ericsson is the assignee of the entire interest thereto in accordance with 37 CFR 3.73(c).

This Power of Attorney shall include the right for **Sage Patent Group practitioners associated with United States Patent and Trademark Office Customer Number 146825** to sign and submit in Ericsson's name and on Ericsson's behalf any document, notification, filing, petition or request in connection with any patent applications or patents owned by or assigned to Ericsson.

This Power of Attorney does not include the right to appoint substitutes but only the persons associated with the above United States Patent and Trademark Office Customer Number.

We hereby revoke all previous authorization, if any made, in respect of same matter or proceeding. This Power of Attorney may be revoked at any time by Ericsson.

TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)

By: 
Roger Burleigh
Director U.S. Patent Department, Ericsson

Date: 3/1/17

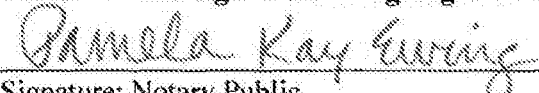
I, the undersigned, Pamela Kay Ewing Notary Public of Texas,
hereby certify that

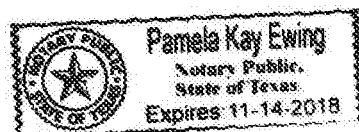
Roger Burleigh

duly authorized to sign for

TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)

has issued and signed the foregoing document.


Signature: Notary Public



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Jonatan SAMUELSSON et al.
Application No.: To Be Assigned
Filing Date: Concurrently Herewith
For: REFERENCE PICTURE SIGNALING

Date: June 13, 2019

Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL

Sir:

In accordance with 37 C.F.R. 1.56, 1.97, and 1.98, applicants' undersigned attorney brings to the attention of the Patent and Trademark Office the documents listed on the attached Information Disclosure Statement.

Pursuant to 37 CFR 1.98(d), copies of the references cited in the attached Information Disclosure Statement are not included because copies were provided in Information Disclosure Statements and/or cited by the U.S. Patent and Trademark Office in U.S. Patent Application Serial No. 16/048,556 filed July 30, 2018, of which the present application claims the priority benefit under 35 U.S.C. 120. However, copies can be provided if necessary.

In accordance with 37 CFR 1.97(g), the information disclosure statement shall not be construed as a representation that a search has been made.

In accordance with 37 CFR 1.97(h), the information disclosure statement shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as defined in §1.56(b).

No fee is believed due. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 60-1438.

Respectfully submitted,

/Kevin L. Wingate/

Kevin L. Wingate
Registration No. 38,662

Customer Number 146825
Sage Patent Group
P.O. Box 30789
Raleigh, NC 27622
984-219-3358
984-538-0416 (Fax)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>			Complete if Known		
			Application Number	To be assigned	
			Filing Date	Concurrently herewith	
			First Named Inventor	Jonatan Samuelsson	
			Art Unit		
			Examiner Name		
Sheet	A1	of	A2	Attorney Docket Number	9900-34860US6

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code (if known)			
	1.	US- 2007/0030903 A1	02-08-2007	Cote et al.	
	2.	US- 2007/0030904 A1	02-08-2007	Winger et al.	
	3.	US- 2007/0183494 A1	08-09-2007	Hannuksela	
	4.	US- 2008/0260034 A1	10-23-2008	Wang et al.	
	5.	US- 2009/0238269 A1	09-24-2009	Pandit et al.	
	6.	US- 2010/0098174 A1	04-22-2010	Adachi et al.	
	7.	US- 2010/0118944 A1	05-13-2010	Tanaka et al.	
	8.	US- 2010/0189182 A1	07-29-2010	Hannuksela	
	9.	US- 2010/0195721 A1	08-05-2010	Wu et al.	
	10.	US- 2010/0208828 A1	08-19-2010	Lu et al.	
	11.	US- 2010/0238822 A1	09-23-2010	Koyabu et al.	
	12.	US- 2011/0080949 A1	04-07-2011	Takahashi et al.	
	13.	US- 2012/0230401 A1	09-13-2012	Chen et al.	
	14.	US- 2009/0238261 A1	09-24-2009	Bhavani et al.	
	15.	US- 2005/0213661 A1	09-29-2005	Xiang et al.	
	16.	US- 2007/0019724 A1	01-25-2007	Tourapis et al.	
	17.	US- 8,638,847 B2	01-28-2014	Wang	
	18.	US- 2006/0256866 A1	11-16-2006	Ziauddin et al.	
	19.	US- 2012/0069903 A1	03-22-2012	Lim et al.	
	20.	US- 2011/0142130 A1	06-16-2011	Lin et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		Country Code, Number, Kind Code (if known)				
	21.	EP 1742480 A2	01-10-2007	MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD		
	22.	JP 2008-105389	05-08-2008	Kyodo Printing Co. Ltd.		A
	23.	JP 5616562 B2	10-29-2014	TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)		A
	24.	RU 2328090 C2	06-27-2008	LG ELECTRONICS INC		A
	25.	WO 2008-105389 A1	09-04-2008	Sony Corporation		A

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>			Complete if Known		
			Application Number	To be assigned	
			Filing Date	Concurrently herewith	
			First Named Inventor	Jonatan Samuelsson	
			Art Unit		
			Examiner Name		
Sheet	A2	of	A2	Attorney Docket Number	9900-34860US6

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	26.	Borgwardt, P., "Multi-picture Buffer Semantics for Interlaced Coding", Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG, 3 rd Meeting, Fairfax, Virginia, May 6-10, 2002, 18 Pages.	
	27.	Decision on Grant Corresponding to Russian Patent Application No. 2014102959/08; Date Mailed: April 12, 2016; Foreign Text, 9 Pages, English Translation Thereof, 7 Pages.	
	28.	European Examination Report Corresponding to European Application No. 12724780.7, Date Mailed: June 9, 2015, 8 pages.	
	29.	International Search Report and Written Opinion Corresponding to International Application No. PCT/SE2012/050439; Date of Mailing: July 19, 2012; 13 Pages.	
	30.	Japanese Office Action Corresponding to Japanese Patent Application No. 2014-185639; Date Mailed: November 13, 2015; Foreign Text, 3 Pages, English Translation Thereof, 3 Pages.	
	31.	Japanese Office Action Corresponding to Japanese Patent Application No. 2014-185640; Date Mailed: November 13, 2015; Foreign Text, 3 Pages, English Translation Thereof, 3 Pages.	
	32.	"JCT-VC Document Management System, screenshots relative to the meeting in Torino (July 2011)", JCT-VC Committee, 22 July 2011, pages 1-2, XP55162801, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (2 pages).	
	33.	Shen, Q. et al., "Buffer Requirement Analysis and Reference Picture Marking for Temporal Scalable Video Coding", <i>Packet Video, IEEE</i> , November 1, 2007, pages 91-97.	
	34.	Sjöberg R. et al., "Absolute signaling of reference pictures", Joint Collaborative Team on Video Coding of WP3 and ISO/IEC JCT1/SC29/WG11, 6 th Meeting, Torino, 2011, 10 Pages.	
	35.	SJOBERG et al., "Absolute signaling of reference pictures, Document JCTVC-F493, Version 8", 22 July 2011, pages 1-15, XP055193064, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (15 pages).	
	36.	SJOBERG et al., "Attachment to JCTVC-F493 (Absolute Signaling of Reference Pictures), Version 8: Proposed changes to the HEVC Working Draft", 22 July 2011, pages 1-28, XP055193072, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (28 pages).	
	37.	Letter reporting Office Action in corresponding Japanese Patent Application No. 2015-141592; Date Mailed: March 27, 2017; Reporting Letter 2 Pages, Japanese Office Action 2 Pages.	

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	REFERENCE PICTURE SIGNALING			
First Named Inventor/Applicant Name:	Jonatan SAMUELSSON			
Filer:	Kevin Wingate/Jennifer Jones			
Attorney Docket Number:	9900-34860US6			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	1201	3	460	1380
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				3100

Electronic Acknowledgement Receipt

EFS ID:	36292400
Application Number:	16440274
International Application Number:	
Confirmation Number:	8403
Title of Invention:	REFERENCE PICTURE SIGNALING
First Named Inventor/Applicant Name:	Jonatan SAMUELSSON
Customer Number:	146825
Filer:	Kevin Wingate/Jennifer Jones
Filer Authorized By:	Kevin Wingate
Attorney Docket Number:	9900-34860US6
Receipt Date:	13-JUN-2019
Filing Date:	
Time Stamp:	15:10:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$3100
RAM confirmation Number	061419INTEFSW15112300
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	P34860_US6_Application_Transmittal.pdf	276328	no	2
			261381a700ba441d9bcb089555ab58735e9e55c6		
Warnings:					
Information:					
2		P34860_US6_Continuation_Application.pdf	294405	yes	55
			0a68fd7535ce668ddc45a2319600dfd31726517f		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	46	
	Claims		47	54	
	Abstract		55	55	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	P34860_US6_Drawings.pdf	1078322	no	12
			4eda6002ba1637c891bb57d24f049b5f53ea8252		
Warnings:					
Information:					
4	Oath or Declaration filed	P34860_US6_Declaration.pdf	330774	no	2
			0759cea6279c14507a7d21f9d6c7c2ef6b9032c7		
Warnings:					
Information:					
5	Application Data Sheet	P34860_US6_ADS.pdf	1823468	no	9
			bbcc21e29ed8eadb9346df195f15dd0105c10542		

Warnings:					
Information:					
6	Power of Attorney	Executed_General_POA_146825.pdf	199846 fa60b996dde0234433677dc43d9afe9c9d8d9ad2	no	1
Warnings:					
Information:					
7	Transmittal Letter	P34860_US6_IDS_Transmittal.pdf	18383 376dc20839f4a9d1c513bb8f0abd3f26c3f32511	no	1
Warnings:					
Information:					
8	Information Disclosure Statement (IDS) Form (SB08)	P34860_US6_IDS_Listing_of_References.pdf	42372 37a0e49c444d6c2628f0e79c4316d6c8edc02edb	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
9	Fee Worksheet (SB06)	fee-info.pdf	36481 ae47990103b4fc17c3dca6fdbdecbb42ebdb9b	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			4100379		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/440,274			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)		
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300		
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660		
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760		
TOTAL CLAIMS (37 CFR 1.16(j))	19	minus 20 = *			OR	x 100 =	0.00		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6	minus 3 = *	3			x 460 =	1380		
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00		
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00		
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	3100		
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))						OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))						OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/440,274	06/13/2019		3100	9900-34860US6	19	6

CONFIRMATION NO. 8403

146825

Sage Patent Group/Telefonaktiebolaget LM Ericsson
PO BOX 30789
RALEIGH, NC 27622-0789

FILING RECEIPT



0000000109048297

Date Mailed: 06/20/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Jonatan Samuelsson, Stockholm, SWEDEN;
Rickard Sjöberg, Stockholm, SWEDEN;

Applicant(s)

Telefonaktiebolaget LM Ericsson (publ), Stockholm, SWEDEN;

Power of Attorney: The patent practitioners associated with Customer Number 146825

Domestic Priority data as claimed by applicant

This application is a CON of 16/048,556 07/30/2018
which is a CON of 15/718,374 09/28/2017 PAT 10063882
which is a CON of 15/299,997 10/21/2016 PAT 9807418
which is a CON of 13/508,442 04/25/2013 PAT 9706223
which is a 371 of PCT/SE2012/050439 04/26/2012
which claims benefit of 61/503,019 06/30/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/19/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/440,274**

Projected Publication Date: 09/26/2019

Non-Publication Request: No

Early Publication Request: No

Title

REFERENCE PICTURE SIGNALING

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6

CONFIRMATION NO. 8403

146825
Sage Patent Group/Telefonaktiebolaget LM Ericsson
PO BOX 30789
RALEIGH, NC 27622-0789

PUBLICATION NOTICE



OC000000111465498

Title:REFERENCE PICTURE SIGNALING

Publication No.US-2019-0297346-A1

Publication Date:09/26/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6	8403
146825	7590	12/12/2019		
Sage Patent Group/Telefonaktiebolaget LM Ericsson PO BOX 30789 RALEIGH, NC 27622-0789			EXAMINER RAHMAN, MOHAMMAD J	
			ART UNIT	PAPER NUMBER
			2487	
			NOTIFICATION DATE	DELIVERY MODE
			12/12/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

instructions@sagepat.com

Office Action Summary	Application No. 16/440,274	Applicant(s) Samuelsson et al.	
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 06/13/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**.

2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1-19 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1-3,5-10,12,14-15 and 17-18 is/are rejected.

8) ☒ Claim(s) 4,6,11,13,16 and 19 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☒ The drawing(s) filed on 06/13/2019 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date 06/13/2019.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Detailed Action

2. This office Action is in response to an application filed on 06/13/2019, is a CON of 16/048,556 filed on 07/30/2018 (PAT 10368088), is a CON of 15/718,374 filed on 09/28/2017 (PAT 10063882), is a CON of 15/299,997 filed on 10/21/2016 (PAT 9807418), is a CON of 13/508,442 filed on 04/25/2013 (PAT 9706223), is a 371 of PCT/SE2012/050439 filed on 04/26/2012, has PRO 61/503,019 filed on 06/30/20, in which claims 1-19 are pending and are being examined.

Information Disclosure Statement

3. This information disclosure statement (IDS) submitted on 06/13/2019. The submission is in compliance with the provisions of 37 CFR 1.97 and 37 CFR 1.98. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Interpretation

4. The following is a quotation of 35 U.S.C. 112(f):

(f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

5. This application includes one or more claim limitations that do not use the word “means,” but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier. Such claim limitation(s) is/are: “a data retriever”, “a picture identifier determiner”, “a buffer manager”, etc., in claims 8-16. A review of the current published specification shows the generic placeholders explained in Fig.21, [0017], [0188]-[0189], [0209], etc.

Because this/these claim limitation(s) is/are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, it/they is/are being interpreted to cover the corresponding structure described in the specification as performing the claimed function, and equivalents thereof.

If applicant does not intend to have this/these limitation(s) interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation(s) recite(s) sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

Double Patenting

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645

(Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

7. Claims 1, 5, 8, 12, 14, 17 and similar dependent claims are rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of Conflicting Patent PAT 10,368,088 B2, PAT 10,063,882 B2, PAT 9,807,418 B2 and PAT 9,706,223 B2. Although the claims at issue are not identical, they are not patentably distinct from each other because the subject matter claimed in the instant application is anticipated by the Conflicting Patent and is covered by the Patent since the Patent and the application are claiming common subject matter, below is a list of limitations that perform the same function, however, different terminology may be used in both sets to describe the limitations, as follows, Claim 5 is used as an example to analyze the common subject matter:

Conflicting Patent No. US 9,706,223 B2	Instant Application:-16/440,274
1. A method of decoding an encoded representation of a picture in a video stream of	5. A method of decoding an encoded representation of a picture in a video stream of

multiple pictures, said method comprising: retrieving, using a decoder configured to decode said encoded representation of said picture, buffer description information defining at least one reference picture from a data structure included in said encoded representation of said picture; determining, based on said buffer description information, at least one picture identifier identifying a respective reference picture among said at least one reference picture as decoding reference for said picture, wherein determining said at least one picture identifier comprises determining, based on said buffer description information, at least one picture order count (POC) value identifying said respective reference picture as decoding reference for said picture; and updating a decoded picture buffer based on said at least one picture identifier, wherein updating said decoded picture buffer comprises marking as unused for reference all reference pictures that are (i) present in said decoded picture buffer and (ii) not associated with any of said at least one picture identifier determined based on said buffer description information wherein the buffer description information explicitly defines said at least one reference picture by means of said encoded representation of said picture which contains, in said data structure, information about which reference picture to use for reference during decoding, independently of the encoded representation of previous pictures in the video stream. 13. The method according to claim 1, further comprising: comparing said determined at least one picture identifier with picture identifiers associated with reference pictures present in said decoded picture buffer; and determining a given picture as non-existing if a picture identifier identifying said given picture is found among said determined at least one picture identifier but said given picture is not present in said decoded picture buffer.	multiple pictures, the method comprising: retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures; determining, based on the buffer description information, a reference picture identifier that identifies a reference picture among the plurality of reference pictures that comprises a decoding reference for the picture; determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; updating a decoded picture buffer based on the reference picture identifier.
--	---

As demonstrated, the claim of US patent US 9,706,223 B2 anticipate the features of the claim of instant application 16/440,274.

A nonstatutory type (35 U.S.C. 101) double patenting rejection can be overcome by amending the conflicting claims so they are no longer coextensive in scope or filing of a terminal disclaimer.

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 17-19 rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. "A computer program product" is not a process, machine, manufacture, or composition of matter.

Claim Rejections - 35 USC § 112

10. The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claim limitation "a data retriever", "a picture identifier determiner", "a buffer manager", etc., in claims 8-16, invokes 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. However, the written description fails to disclose the corresponding structure, material, or acts for performing the entire claimed function and to clearly link the structure, material, or acts to the function. A review of the current published specification shows the generic placeholders explained in Fig.21, [0017], [0188]-[0189], [0209], etc., but no structure or complete algorithm is disclosed. Therefore, the claim is indefinite and is rejected under 35 U.S.C. 112(b) or pre-AIA 35 U.S.C. 112, second paragraph.

Applicant may:

- (a) Amend the claim so that the claim limitation will no longer be interpreted as a limitation under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph;

- (b) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the entire claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (c) Amend the written description of the specification such that it clearly links the structure, material, or acts disclosed therein to the function recited in the claim, without introducing any new matter (35 U.S.C. 132(a)).

If applicant is of the opinion that the written description of the specification already implicitly or inherently discloses the corresponding structure, material, or acts and clearly links them to the function so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant should clarify the record by either:

- (a) Amending the written description of the specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP §§ 608.01(o) and 2181.

Examiner's Note

12. Claims 1-4 refer to "A method of decoding", Claims 5-7 refer to "A method of decoding", Claims 8-11 refer to "A decoder", Claims 12-13 refer to "A decoder", Claims 14-16 refer to "A receiver", and Claims 17-19 refer to "A computer program product". Claims 5-19 are similarly rejected in light of rejection of claims 1-4, any obvious combination of the rejection of claims 1-4, or the differences are obvious to the ordinary skill in the art. It is well known in the art that encoding and decoding are reverse processes of video coding method/system.

Claim Rejections - 35 USC § 103

13. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Borgwardt et al. ("Multi-Picture Buffer Semantics for Interlace", JVT-C049, May 10 2002), hereinafter Borgwardt, in view of Lu et al. (US 20100208828 A1), hereinafter Lu. Borgwardt and Lu is cited by applicant in IDS.

Regarding claim 1, Borgwardt discloses a method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising (**1. Frames and Fields in the Multi-Picture Buffer, Paragraph 1**): retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures (**Section 8.2.13.1, status of the reference frames buffer, MMCO, decoder decodes the encoded picture using the reference picture**); determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier (**Section 8.2.11, Reference Picture selection**) comprises: (i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and (ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and updating a decoded picture buffer based on the reference picture identifier (**Section 8.2.12.3.1-8.2.13.1**).

Borgwardt discloses all the elements of claim 1 but Borgwardt does not appear to explicitly disclose retrieving, based on said buffer description information.

However, Lu from the same or similar endeavor teaches retrieving, based on said buffer description information **([0025], DPB, accessing reference pictures)**.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Borgwardt to incorporate the teachings of Lu to effectively manage memory space for storing pictures **(Lu, [0013])**.

Regarding claim 2, Borgwardt in view of Lu discloses the method according to claim 1, wherein: determining the reference picture identifier comprises determining, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream **(Borgwardt, Section 8.2.12.3.1-8.2.13.1, Lu, [0005])**.

Regarding claim 3, Borgwardt in view of Lu discloses the method according to claim 1, further comprising: determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier **(Borgwardt, Section 8.2.12.3.1-8.2.13.1, Lu, [0005], e.g., Ohbitsu, US 20080175326 A1, Fig. 10, [0011])**.

Regarding claims 5, 6-10, 12, 14-15, 17-18, See Examiner's Note.

Allowable Subject Matter

15. Claims 4, 6, 11, 13, 16 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MOHAMMAD J RAHMAN whose telephone number is (571)270-7190. The examiner can normally be reached on Monday-Friday 9AM-5PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Czekaj can be reached on (571) 272-7327. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mohammad J Rahman/
Primary Examiner, Art Unit 2487

<i>Notice of References Cited</i>	Application/Control No. 16/440,274		Applicant(s)/Patent Under Reexamination Samuelsson et al.	
	Examiner MOHAMMAD J RAHMAN		Art Unit 2487	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070195882-A1	08-2007	Tichelaar; Johannes Yzebrand	H04N19/159	375/240.16
*	B	US-20070160305-A1	07-2007	Demos; Gary	H04N19/13	382/244
*	C	US-8638847-B2	01-2014	Wang; Ye-Kui	H04N19/70	375/240.01
*	D	US-20080175326-A1	07-2008	OHBITSU; Toshiro	H04N19/51	375/240.27
*	E	US-9609341-B1	03-2017	Gu; Qunshan	H04N19/46	1/1
*	F	US-10051264-B2	08-2018	Wang; Ye-Kui	H04N19/70	1/1
*	G	US-6252873-B1	06-2001	Vines; Gregory O.	H04N21/23424	370/389
	H					
	I					
	J					
	K					
	L					
	M					

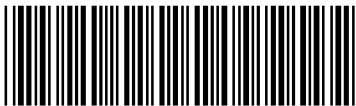
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/440,274	Applicant(s)/Patent Under Reexamination Samuelsson et al.
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487

CPC - Searched*		
Symbol	Date	Examiner
H04N19/\$, Limited text search	12/08/2019	JR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor search	12/08/2019	JR
Assignee search	12/08/2019	JR
EAST search, History included	12/09/2019	JR

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/Mohammad J Rahman/ Primary Examiner, Art Unit 2487	
--	--

Bibliographic Data

Application No: 16/440,274

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /Mohammad J Rahman/

Examiner's Signature

Initials

Title: REFERENCE PICTURE SIGNALING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/13/2019	375	2487	9900-34860US6
RULE			

APPLICANTS

Telefonaktiebolaget LM Ericsson (publ), Stockholm, SWEDEN

INVENTORS

Jonatan Samuelsson Stockholm, SWEDEN

Rickard Sjöberg Stockholm, SWEDEN

CONTINUING DATA

This application is a CON of 16048556 07/30/2018 PAT 10368088

16048556 is a CON of 15718374 09/28/2017 PAT 10063882

15718374 is a CON of 15299997 10/21/2016 PAT 9807418

15299997 is a CON of 13508442 04/25/2013 PAT 9706223

13508442 is a 371 of PCT/SE2012/050439 04/26/2012

PCT/SE2012/050439 has PRO of 61503019 06/30/2011

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/19/2019

STATE OR COUNTRY

SWEDEN

ADDRESS

Sage Patent Group/Telefonaktiebolaget LM Ericsson

PO BOX 30789

RALEIGH, NC 27622-0789

UNITED STATES

FILING FEE RECEIVED

\$3,100

INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>				Complete if Known	
				Application Number	To be assigned
				Filing Date	Concurrently herewith
				First Named Inventor	Jonatan Samuelsson
				Art Unit	
				Examiner Name	
Sheet	A1	of	A2	Attorney Docket Number	9900-34860US6

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code (if known)			
	1.	US- 2007/0030903 A1	02-08-2007	Cote et al.	
	2.	US- 2007/0030904 A1	02-08-2007	Winger et al.	
	3.	US- 2007/0183494 A1	08-09-2007	Hannuksela	
	4.	US- 2008/0260034 A1	10-23-2008	Wang et al.	
	5.	US- 2009/0238269 A1	09-24-2009	Pandit et al.	
	6.	US- 2010/0098174 A1	04-22-2010	Adachi et al.	
	7.	US- 2010/0118944 A1	05-13-2010	Tanaka et al.	
	8.	US- 2010/0189182 A1	07-29-2010	Hannuksela	
	9.	US- 2010/0195721 A1	08-05-2010	Wu et al.	
	10.	US- 2010/0208828 A1	08-19-2010	Lu et al.	
	11.	US- 2010/0238822 A1	09-23-2010	Koyabu et al.	
	12.	US- 2011/0080949 A1	04-07-2011	Takahashi et al.	
	13.	US- 2012/0230401 A1	09-13-2012	Chen et al.	
	14.	US- 2009/0238261 A1	09-24-2009	Bhavani et al.	
	15.	US- 2005/0213661 A1	09-29-2005	Xiang et al.	
	16.	US- 2007/0019724 A1	01-25-2007	Tourapis et al.	
	17.	US- 8,638,847 B2	01-28-2014	Wang	
	18.	US- 2006/0256866 A1	11-16-2006	Ziauddin et al.	
	19.	US- 2012/0069903 A1	03-22-2012	Lim et al.	
	20.	US- 2011/0142130 A1	06-16-2011	Lin et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		Country Code, Number, Kind Code (if known)				
	21.	EP 1742480 A2	01-10-2007	MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD		
	22.	JP 2008-105389	05-08-2008	Kyodo Printing Co. Ltd.		A
	23.	JP 5616562 B2	10-29-2014	TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)		A
	24.	RU 2328090 C2	06-27-2008	LG ELECTRONICS INC		A
	25.	WO 2008-105389 A1	09-04-2008	Sony Corporation		A

Examiner Signature	/Mohammad J Rahman/	Date Considered	11/09/2019
--------------------	---------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>			Complete if Known		
			Application Number	To be assigned	
			Filing Date	Concurrently herewith	
			First Named Inventor	Jonatan Samuelsson	
			Art Unit		
			Examiner Name		
Sheet	A2	of	A2	Attorney Docket Number	9900-34860US6

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	26.	Borgwardt, P., "Multi-picture Buffer Semantics for Interlaced Coding", Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG, 3 rd Meeting, Fairfax, Virginia, May 6-10, 2002, 18 Pages.	
	27.	Decision on Grant Corresponding to Russian Patent Application No. 2014102959/08; Date Mailed: April 12, 2016; Foreign Text, 9 Pages, English Translation Thereof, 7 Pages.	
	28.	European Examination Report Corresponding to European Application No. 12724780.7, Date Mailed: June 9, 2015, 8 pages.	
	29.	International Search Report and Written Opinion Corresponding to International Application No. PCT/SE2012/050439; Date of Mailing: July 19, 2012; 13 Pages.	
	30.	Japanese Office Action Corresponding to Japanese Patent Application No. 2014-185639; Date Mailed: November 13, 2015; Foreign Text, 3 Pages, English Translation Thereof, 3 Pages.	
	31.	Japanese Office Action Corresponding to Japanese Patent Application No. 2014-185640; Date Mailed: November 13, 2015; Foreign Text, 3 Pages, English Translation Thereof, 3 Pages.	
	32.	"JCT-VC Document Management System, screenshots relative to the meeting in Torino (July 2011)", JCT-VC Committee, 22 July 2011, pages 1-2, XP55162801, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (2 pages).	
	33.	Shen, Q. et al., "Buffer Requirement Analysis and Reference Picture Marking for Temporal Scalable Video Coding", <i>Packet Video, IEEE</i> , November 1, 2007, pages 91-97.	
	34.	Sjöberg R. et al., "Absolute signaling of reference pictures", Joint Collaborative Team on Video Coding of WP3 and ISO/IEC JCT1/SC29/WG11, 6 th Meeting, Torino, 2011, 10 Pages.	
	35.	SJOBERG et al., "Absolute signaling of reference pictures, Document JCTVC-F493, Version 8", 22 July 2011, pages 1-15, XP055193064, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (15 pages).	
	36.	SJOBERG et al., "Attachment to JCTVC-F493 (Absolute Signaling of Reference Pictures), Version 8: Proposed changes to the HEVC Working Draft", 22 July 2011, pages 1-28, XP055193072, Retrieved from Internet URL: http://phenix.int-evry.fr/jct/ , retrieved on 2015-01-16. (28 pages).	
	37.	Letter reporting Office Action in corresponding Japanese Patent Application No. 2015-141592; Date Mailed: March 27, 2017; Reporting Letter 2 Pages, Japanese Office Action 2 Pages.	

Examiner Signature	/Mohammad J Rahman/	Date Considered	11/09/2019
--------------------	---------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	16/440274.app.	US-PGPUB; USPAT	OR	OFF	2019/12/08 23:13
L2	221	(Samuelsson-Jonatan\$ S\$1berg-Rickard\$).in.	US-PGPUB; USPAT	OR	ON	2019/12/08 23:21
L3	31865	(ericsson).as.	US-PGPUB; USPAT	OR	ON	2019/12/08 23:21
L4	66800	(H04N19/\$).cpc.	US-PGPUB; USPAT	OR	ON	2019/12/08 23:21
L5	36	(buffer and reference and (picture list) and (missing non\$1existing)).clm.	US-PGPUB; USPAT	OR	ON	2019/12/08 23:24
L6	8	L5 and L2	US-PGPUB; USPAT	OR	ON	2019/12/08 23:25
L7	3	L5 and L3	US-PGPUB; USPAT	OR	ON	2019/12/08 23:56
L8	21	L5 and L4	US-PGPUB; USPAT	OR	ON	2019/12/08 23:56
L9	4	("10368088" "10063882" "9807418" "9706223").pn.	US-PGPUB; USPAT	OR	ON	2019/12/09 00:06
L10	302	(buffer and reference and (picture list) and (relative delta)).clm.	US-PGPUB; USPAT	OR	ON	2019/12/09 00:38
L11	5	(@ad< "20110630") and L10 and L4 and (delta with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:38
L12	0	(@ad< "20110630") and L5 and (delta with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:53
L13	43	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and (picture with count)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:53
L14	43	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and (picture with count) and (missing non\$1existing)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:54
L15	0	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and	US-PGPUB; USPAT	OR	ON	2019/12/09 00:54

		(picture with count) and ((missing non\$1existing) near5 reference)				
L16	0	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and (picture with count) and ((missing non\$1existing) with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:54
L17	0	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and ((missing non\$1existing) with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:54
L18	0	(@ad< "20110630") and (delta with reference with picture) and (decoded with picture with buffer) and ((missing non\$1existing) with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:55
L19	0	(@ad< "20110630") and (delta with reference) and (decoded with picture with buffer) and ((missing non\$1existing) with reference)	US-PGPUB; USPAT	OR	ON	2019/12/09 00:55

12/ 9/ 2019 12:55:58 AM
C:\ Users\ mrahman7\ Documents\ EAST\ Workspaces\ 16440274.wsp

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16440274		
Filing Date	13-Jun-2019		
First Named Inventor	Jonatan Samuelsson		
Attorney Docket Number	9900-34860US6		
Title of Invention	REFERENCE PICTURE SIGNALING		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
Telefonaktiebolaget LM Ericsson (publ)		100%	
The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s) 10368088 9706223 9807418 10063882			

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

- ☐ Small Entity
- ☐ Micro Entity
- ☒ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 38662

☐ A sole inventor

☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

☐ A joint inventor; all of whom are signing this request

Signature	/Kevin L. Wingate/
Name	Kevin L. Wingate

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16440274			
Filing Date:	13-Jun-2019			
Title of Invention:	REFERENCE PICTURE SIGNALING			
First Named Inventor/Applicant Name:	Jonatan Samuelsson			
Filer:	Kevin Wingate/Jeffery Steen			
Attorney Docket Number:	9900-34860US6			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16440274

Filing Date: 13-Jun-2019

Applicant/Patent under Reexamination: Samuelsson

Electronic Terminal Disclaimer filed on February 11, 2020

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	38554489
Application Number:	16440274
International Application Number:	
Confirmation Number:	8403
Title of Invention:	REFERENCE PICTURE SIGNALING
First Named Inventor/Applicant Name:	Jonatan Samuelsson
Customer Number:	146825
Filer:	Kevin Wingate/Jeffery Steen
Filer Authorized By:	Kevin Wingate
Attorney Docket Number:	9900-34860US6
Receipt Date:	11-FEB-2020
Filing Date:	13-JUN-2019
Time Stamp:	14:58:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 160
RAM confirmation Number	E20202AE58481830
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	34864	no	3
			6562407bd08811e6bfd3ba060ff9670b71f75400		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30428	no	2
			30bed6bc94fb0c1d2ee78877e106d33fe456f126		
Warnings:					
Information:					
Total Files Size (in bytes):			65292		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Jonatan SAMUELSSON et al.
Application No.: 16/440,274
Filed: June 13, 2019
For: REFERENCE PICTURE SIGNALING

Confirmation No.: 8403
Examiner: Rahman, Mohammad J
Art Unit 2487

February 11, 2020

Mail Stop Amendment
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

AMENDMENT RESPONSIVE TO 12 DECEMBER 2019 NON-FINAL OFFICE ACTION

Sir:

This paper is responsive to the Non-Final Office Action mailed December 12, 2019 regarding the above-referenced patent application. Please amend this application as follows and reconsider the rejections of the claims for at least the reasons presented in the following remarks.

If any extension of time for the accompanying response or submission is required, Applicants request that this be considered a petition therefor. The Commissioner is hereby authorized to charge any additional fee, which may be required, or credit any refund, to our Deposit Account No. 60-1438.

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on Page 10 of this paper.

In the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:

retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and

updating a decoded picture buffer based on the reference picture identifier.

2. (Original) The method according to claim 1, wherein:

determining the reference picture identifier comprises determining, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the plurality of reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the plurality of reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.

3. (Original) The method according to claim 1, further comprising:

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

4. (Original) The method according to Claim 3, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and

marking the non-existing picture with a non-existing mark and a used for reference mark.

5. (Currently Amended) A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:

retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

determining, based on the buffer description information, a reference picture identifier that identifies a reference picture among the plurality of reference pictures that comprises a decoding reference for the picture;

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing;

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; and

updating a decoded picture buffer based on the reference picture identifier.

6. (Original) The method according to Claim 5, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and

marking the non-existing picture with a non-existing mark and a used for reference mark.

7. (Original) The method according to Claim 5, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture;
and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier.

8. (Currently Amended) A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:

at least one processor; and

a memory storing instructions which, when executed by the at least one processor causes the decoder to:

~~a data retriever configured to~~ retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of the picture;

~~a picture identifier determiner configured to~~ determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the ~~picture identifier determiner~~ decoder is configured to i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier

and a picture identifier identifying the picture, and ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and
a buffer manager configured to update a decoded picture buffer based on the reference picture identifier.

9. (Currently Amended) The decoder according to claim 8, wherein the memory stores further instructions which, when executed by the at least one processor causes the decoder to:

~~the data retriever is configured to~~ retrieve the buffer description information defining multiple reference pictures from the encoded representation of the picture; and

~~the picture identifier determiner is configured to~~ determine, based on the buffer description information, i) a picture identifier identifying a respective reference picture among the multiple reference pictures as the decoding reference for the picture and ii) a picture identifier identifying a respective reference picture among the multiple reference pictures as a decoding reference for a subsequent, according to a decoding order, picture in the video stream.

10. (Currently Amended) The decoder according to claim 8, wherein ~~the picture identifier determiner is~~ memory stores further instructions which, when executed by the at least one processor causes the decoder to further configured to:

determine whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

11. (Original) The decoder according to Claim 10, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and
marking the non-existing picture with a non-existing mark and a used for reference mark.

12. (Currently Amended) A decoder configured to decode an encoded representation of a picture in a video stream of multiple pictures, the decoder comprising:

a data retriever circuit configured to retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of the picture;

a picture identifier determiner circuit configured to:

determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture;

determine whether the reference picture identified by the reference picture identifier is one of missing or non-existing;

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generate a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier; and

a buffer manager circuit configured to update a decoded picture buffer based on the reference picture identifier.

13. (Original) The decoder according to Claim 12, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and

marking the non-existing picture with a non-existing mark and a used for reference mark.

14. (Currently Amended) A receiver comprising:

an input section circuit configured to receive encoded representations of multiple pictures in a video stream;

a decoder circuit configured to decode the encoded representations of the multiple pictures; and

an output section circuit configured to output decoded pictures of the video stream, wherein the decoder circuit comprises:

a data retriever circuit configured to retrieve buffer description information defining a plurality of reference pictures, wherein the buffer description information is retrieved from the encoded representation of a picture;

a picture identifier determiner circuit configured to determine, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein the picture identifier determiner is configured to i) retrieve, based on the buffer description information, a respective delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, and ii) calculate the reference picture identifier based on the picture identifier and the respective delta identifier; and

a buffer manager circuit configured to update a decoded picture buffer based on the reference picture identifier.

15. (Currently Amended) The receiver according to claim 14, wherein the decoder circuit is further configured to perform operations comprising:

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and

responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

16. (Currently Amended) The receiver according to Claim 15, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;

setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;

setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and

marking the non-existing picture with a non-existing mark and a used for reference mark.

17. (Currently Amended) A computer program product comprising a non-transitory computer-readable medium storing program instructions for decoding an encoded representation of a picture in a video stream of multiple pictures, ~~the computer program product~~ instructions when executed by a processor of a node in an access network cause the node to perform operations comprising:

~~a non-transitory computer readable medium storing program instructions that are executable by a processor of a node in an access network to perform operations comprising:~~

retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;

determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:

(i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and

(ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and

updating a decoded picture buffer based on the reference picture identifier.

18. (Original) The computer program product according to claim 17, wherein the instructions comprise further instructions that are executable by the processor of the node in the access network to perform operations comprising:

determining whether the reference picture identified by the reference picture identifier is one of missing or non-existing; and
responsive to determining the reference picture identified by the reference picture identifier is one of missing or non-existing, generating a non-existing picture with parameters set to parameters of the reference picture identified by the reference picture identifier.

19. (Original) The computer program product according to Claim 18, wherein generating the non-existing picture with parameters comprises at least one of:

setting a picture order count (POC) of the non-existing picture to a POC of the reference picture;
setting an additional_picture_id of the non-existing picture to an additional_picture_id of the reference picture;
setting a temporal_id of the non-existing picture to a temporal_id of the reference picture;
and
marking the non-existing picture with a non-existing mark and a used for reference mark.

REMARKS

Applicant appreciates the detailed examination evidenced by the Office Action mailed December 12, 2019 (hereinafter "Office Action"). Applicant respectfully submits that all of the pending claims are in condition for allowance, in view of the above amendments and for the reasons that will be described in detail below.

Status of the Claims

Claims 4, 6, 11, 13, 16 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 1, 5, 8, 14, 17, and similar dependent claims are provisionally rejected on the ground of non-statutory double patenting as being unpatentable over claims of U.S. Patent No. 10,368,088, U.S. Patent No. 10,063,882, U.S. Patent No. 9,807,418 and U.S. Patent No. 9,706,223. (Office Action, page 4.)

Claims 8-16 are being interpreted under pre-AIA 35 U.S.C. 112, sixth paragraph due to alleged generic placeholders. (Office Action, page 3.)

Claims 17-19 stand rejected under 35 U.S.C. 101 as allegedly being directed to non-statutory subject matter. (Office Action, page 6.)

Claims 8-16 stand rejected under 35 U.S.C. 112(b) or pre-AIA 35 U.S.C. 112, second paragraph as being indefinite. (Office Action, page 6.)

Claims 1-3, 5, 6-10, 12, 14-15, and 17-18 stand rejected under 35 U.S.C. 103 as being unpatentable over non-patent literature (NPL) document "Multi-Picture Buffer Semantics for Interlace", JVT-C049, May 10 2002 to Borgwardt et al. (hereinafter "Borgwardt") in view of U.S. Patent Application Publication No. 20100208828 to Lu et al (hereinafter "Lu"). (Office Action, p. 8.)

The Non-Statutory Double Patenting Rejection Has Been Overcome

In keeping with the goal of compact prosecution, a terminal disclaimer is being filed herewith. In view of the preceding, Applicant respectfully requests that the non-statutory double patenting rejection be withdrawn.

Claims 8-16 Should Not Be Interpreted Under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph

The Office in previous applications has allowed claims with recitations of “a data retriever,” “a picture identifier determiner,” “a buffer manager,” “an output section”, “an input section,” “an output section,” “a picture identifier provider,” “a reference picture determiner,” “a buffer description information generator”, and “a data inserter.” without stating that the claim limitations are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, and without being interpreted to cover the corresponding structure described in the specification as performing the claimed function, and equivalents thereof. Applicant respectfully requests the court case(s) that has resulted in the Patent Office changing its interpretation of the claims

Furthermore, Applicant respectfully disagrees with the claims being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. Furthermore, the claims have been amended to clarify the above cited recitations are circuits, which should not be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

Claims 17-19 Are Patent Eligible

The Office Action states that "A "computer program product" is not a process, machine, manufacturer, or composition of matter." Applicant respectfully disagrees. Applicant respectfully submits that a computer program product is a manufacture as a product clearly is a manufacture.

Applicant notes that Claim 17 already recites that the computer program comprises a non-transitory computer readable medium. Non-transitory computer readable mediums are patent eligible per Director Kappos' January 2010 memorandum. For this reason alone, the 35 U.S.C. 101 rejection should be withdrawn.

However, in keeping with the goal of compact prosecution, Claim 17 has been amended to further clarify that the computer program comprises a non-transitory computer readable medium by reciting the non-transitory computer readable medium in the preamble directly after the recitation of the computer program.

In view of the foregoing, Applicant respectfully requests that the 35 U.S.C. 101 rejection of Claims 17-19 be withdrawn.

Claims 8-16 Are Definite

The Examiner has interpreted the recitations of a “reference picture determiner,” a “picture identifier provider,” a “buffer description information generator,” a “data inserter,” a “data retriever,” a “picture identifier determiner,” a “buffer manager,” an “input section,” etc. as being indefinite. Applicant disagrees that these recitations are not supported by the specification. For example, Figures 18 and 22 show these recitations. Paragraphs [0166]-[0180] of the application as published describe how the “reference picture determiner,” the “picture identifier provider,” the “buffer description information generator,” and the “data inserter” work and paragraphs [0181]-[0184] of the application as published describe how these components are implemented. Paragraphs [0187]-[0207] of the application as published describe how the “data retriever,” the “picture identifier determiner,” the “buffer manager,” and the “input section” work and paragraphs [0207]-[0210] of the application as published describe how these components are implemented.

In particular, these components are either effectuated by a processor or implemented in hardware circuitry as stated in paragraphs [0181]-[0184] and [0187]-[0207] of the application as published. Thus, these recitations are supported by the specification and are definite.

However, even though these recitations are definite, in keeping with the goal of compact prosecution, Claims 8-11 have been amended to recite a memory and at least one processor that executes instructions stored in memory to perform the recited operations and Claims 12-16 have been amended to recite that the input section, decoder, output section, data retriever, picture identifier determiner, and buffer manager are circuits.

In view of the foregoing, Applicant respectfully requests that the rejection under 35 U.S.C. 112(b) or pre-AIA 35 U.S.C. 112, second paragraph be withdrawn.

Claims 1, 5, 8, 12, 14, and 17 Are Patentable Over the Cited References

Claim 1 recites:

1. A method of decoding an encoded representation of a picture in a video stream of multiple pictures, the method comprising:
retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures;
determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture

among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises:

- (i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and
 - (ii) calculating the reference picture identifier based on the picture identifier and the delta identifier; and
- updating a decoded picture buffer based on the reference picture identifier.

For the recitations of "retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures", the Office Action refers to Section 8.2.13.1 of Borgwardt, stating "status of the reference frames buffer, MMCO, decoder decodes the encoded picture using the reference picture."

Section 8.2.13.1 of Borgwardt describes memory management control operation (MMCO). Specifies a control operation to be applied to manage a multi picture buffer memory. The MMCO commands specify the necessary buffer status for the decoding of subsequent pictures in the bitstream. For example, the MMC values can specify that a short-term frame is marked as unused, mark a long-term frame as unused, assign a long-term index to a frame, specify a maximum long term picture index, and reset. None of these values define buffer description information that define a plurality of reference pictures. Thus, Section 8.2.13.1 of Borgwardt fails to disclose or suggest the recitations of "retrieving, from the encoded representation of the picture, buffer description information defining a plurality of reference pictures. Lu has not been cited for these recitations and fails to disclose or suggest these recitations.

For the recitations of "determining, based on the buffer description information, a reference picture identifier that identifies a respective reference picture among the plurality of reference pictures, the respective reference picture comprising a decoding reference for the picture, wherein determining the reference picture identifier comprises: (i) retrieving, based on the buffer description information, a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture; and (ii) calculating the reference picture identifier based on the picture identifier and the delta identifier," the Office

Action refers to Sections 8.2.11 and 8.2.12.3.1 to 8.2.13.1 of Borgwardt and paragraph [0025] of Lu.

Section 8.2.11 of Borgwardt describes a reference picture selection layer indicator (RPSLI) that indicates whether or not a reference picture selection layer is sent. A reference picture selection layer fails to disclose or suggest a delta identifier, a picture identifier, or a calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Section 8.2.12.3.1 of Borgwardt describes an absolute difference of picture numbers (ADPN), which represents the absolute difference between the picture number of the currently re-mapped picture and the prediction value for that picture number. The absolute difference between the picture number of the currently re-mapped picture and the prediction value for that picture number fails to disclose or suggest a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, a picture identifier identifying a picture, or calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Section 8.2.12.3.2 of Borgwardt describes a long-term picture index for re-mapping (LIPR), which represents the long-term picture index to be remapped. A long-term picture index fails to disclose or suggest a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, a picture identifier identifying a picture, or calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Section 8.2.13 of Borgwardt describes a reference picture buffering type (RPBT), which specifies the buffering type of the currently decoded picture and thus decides how the multi-picture buffer will be modified after the current picture is decoded. There are two types of RPBT buffer types described. The first type is a sliding window and the second type is an adaptive memory control. In the "sliding window" buffering type, the current decoded picture shall be added to the buffer with default relative index 0, and any marking of pictures as "unused" in the buffer is performed automatically in a first-in-first-out fashion among the set of short-term pictures. In the "Adaptive Memory Control" buffering type, the encoder explicitly specifies any addition to the buffer or marking of data as "unused" in the buffer, and may also assign long-term indices to short-term frames. The sliding window and adaptive memory control buffering types fails to disclose or suggest a delta identifier comprising a difference between the reference picture

identifier and a picture identifier identifying the picture, a picture identifier identifying a picture, or calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Section 8.2.13.1 of Borgwardt describes a memory management control operation (MMCO). The MMCO specifies a control operation to be applied to manage the multi picture buffer memory. The MMCO commands specify the necessary buffer status for the decoding of subsequent pictures in the bitstream. The control operation to be applied and the MMCO commands fail to disclose or suggest a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, a picture identifier identifying a picture, or calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Paragraph [0025] of Lu describes a decoded picture buffer (DPB) controller that is specified for accessing all the reference pictures and decoded pictures required for decoding and displaying a picture. Once a reference picture is not needed, the DPB controller can determine when to release the memory space of the unused reference picture according to a video display order and some other information. Determining when to release the memory space of the unused reference picture fails to disclose or suggest a delta identifier comprising a difference between the reference picture identifier and a picture identifier identifying the picture, a picture identifier identifying a picture, or calculation of a reference picture identifier, much less the above cited recitations of Claim 1.

Thus, the combination of Borgwardt and Lu fails to disclose or suggest all of the recitations of Claim 1, the allowance of which is therefore respectfully requested. Claims 5, 8, 12, 14, and 17 recites similar recitations to the recitations of Claim 1 and are therefore also patentable. The allowance of Claims 5, 8, 12, 14, and 17 is also therefore respectfully requested.

The Dependent Claims Are Patentable Over the Cited References

The dependent claims are patentable at least per the patentability of the independent claims from which they depend. As each of the dependent claims are patentable at least per the patentability of the respective base claims from which they depend, Applicant does not believe that it is necessary to argue the allowability of each dependent claim individually. Applicant does not necessarily concur with the Examiner's interpretation of these claims, or with the bases of

In re: Jonatan SAMUELSSON et al.
Application No.: 16/440,274
Filed: June 13, 2019
Page 16 of 16

rejection set forth in the Office Action. Applicant therefore reserves the right to address the patentability of these claims individually as necessary in the future.

Conclusion

As all of the claims are in condition for allowance, Applicant respectfully requests allowance of the claims and passing of the application to issue in due course. Favorable reconsideration of this application, as amended, is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the undersigned representative at the telephone number indicated below to discuss any outstanding issues relating to the allowability of the application.

Respectfully submitted,

/Kevin L. Wingate/

Kevin L. Wingate
Registration No. 38,662

USPTO Customer No. 146825
Sage Patent Group
Post Office Box 30789
Raleigh, North Carolina 27622-0789
Telephone: 984/219-3358
Facsimile: 984/538-0416

Electronic Acknowledgement Receipt

EFS ID:	38554694
Application Number:	16440274
International Application Number:	
Confirmation Number:	8403
Title of Invention:	REFERENCE PICTURE SIGNALING
First Named Inventor/Applicant Name:	Jonatan Samuelsson
Customer Number:	146825
Filer:	Kevin Wingate/Jeffery Steen
Filer Authorized By:	Kevin Wingate
Attorney Docket Number:	9900-34860US6
Receipt Date:	11-FEB-2020
Filing Date:	13-JUN-2019
Time Stamp:	15:04:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		P34860_US6_Response_to_12_Dec_2019_Non_Final_Office_Action.pdf	85637 b0be1965dead89e99acd3e3a25eea6016dca08c3d	yes	16

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Amendment/Req. Reconsideration-After Non-Final Reject		1	1
Claims		2	9
Applicant Arguments/Remarks Made in an Amendment		10	16

Warnings:

Information:

Total Files Size (in bytes):	85637
-------------------------------------	-------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/440,274		Filing Date 06/13/2019		☐ To be Mailed	
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO									
APPLICATION AS FILED - PART I									
		(Column 1)	(Column 2)						
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A	N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A					
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*	x \$100 =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$460 =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL					
APPLICATION AS AMENDED - PART II									
		(Column 1)		(Column 2)	(Column 3)				
AMENDMENT	02/11/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	x \$100 =		0	
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 6	= 0	x \$460 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		0	
		(Column 1)		(Column 2)	(Column 3)				
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/CHARLENE HERBERT/			
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".									
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/440,274		Filing Date 06/13/2019		☐ To be Mailed	
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO									
APPLICATION AS FILED - PART I									
		(Column 1)	(Column 2)						
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)		
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A		N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A				
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *		x \$100 =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *		x \$460 =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.					TOTAL				
APPLICATION AS AMENDED - PART II									
		(Column 1)		(Column 2)	(Column 3)				
AMENDMENT	02/11/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x \$100 =		0	
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x \$460 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		0	
		(Column 1)		(Column 2)	(Column 3)				
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/CHARLENE HERBERT/			
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".									
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

146825 7590 04/06/2020
Sage Patent Group/Telefonaktiebolaget LM Ericsson
PO BOX 30789
RALEIGH, NC 27622-0789

EXAMINER	
RAHMAN, MOHAMMAD J	
ART UNIT	PAPER NUMBER

2487

DATE MAILED: 04/06/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6	8403

TITLE OF INVENTION: REFERENCE PICTURE SIGNALING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	07/06/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

146825 7590 04/06/2020
Sage Patent Group/Telefonaktiebolaget LM Ericsson
PO BOX 30789
RALEIGH, NC 27622-0789

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6	8403

TITLE OF INVENTION: REFERENCE PICTURE SIGNALING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	07/06/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
RAHMAN, MOHAMMAD J	2487	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6	8403
146825	7590	04/06/2020	EXAMINER	
Sage Patent Group/Telefonaktiebolaget LM Ericsson PO BOX 30789 RALEIGH, NC 27622-0789			RAHMAN, MOHAMMAD J	
			ART UNIT	PAPER NUMBER
			2487	
DATE MAILED: 04/06/2020				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/440,274	Applicant(s) Samuelsson et al.	
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 02/11/2020.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-19. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892) 2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____. 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
--	--

/Mohammad J Rahman/
Primary Examiner, Art Unit 2487

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

2. This office Action is in response to the correspondence on 02/11/2020. Claims 1-19 are pending.

Allowable Subject Matter

3. The following is a statement of reasons for the indication of allowable subject matter:

The Applicants' replies make evident the reasons for allowance, satisfying the "record as a whole" proviso of the rule 37 CFR 1.104(e). The substance of applicants' remarks, filed on 02/11/2020, are persuasive, as such the reasons for allowance are in all probability evident from the record and no statement is deemed necessary (see MPEP 1302. 14).

A further search was conducted which failed to yield any prior art. Therefore, the prior art fails to teach or render obvious these limitations taken within the others in the claim.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MOHAMMAD J. RAHMAN whose telephone number is (571)270-7190. The examiner can normally be reached on Monday-Thursday 8:30am-7:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Czekaj can be reached on 571 272-7327. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MOHAMMAD J RAHMAN/
Primary Examiner, Art Unit 2487

<i>Notice of References Cited</i>	Application/Control No. 16/440,274		Applicant(s)/Patent Under Reexamination Samuelsson et al.	
	Examiner MOHAMMAD J RAHMAN		Art Unit 2487	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20010055318-A1	12-2001	Obata, Koji	H04N7/52	370/474
*	B	US-6374037-B1	04-2002	Okada; Tomoyuki	G11B20/10527	386/240
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

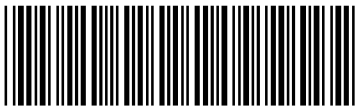
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Search report IP.com
	V	Search report Google
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/440,274	Applicant(s)/Patent Under Reexamination Samuelsson et al.
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487

CPC - Searched*		
Symbol	Date	Examiner
H04N19/\$, Limited text search	12/08/2019	JR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

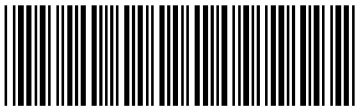
US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor search	12/08/2019	JR
Assignee search	12/08/2019	JR
EAST search, History included	12/09/2019	JR
Updated search	03/29/2020	JR
IP.com search	03/29/2020	JR

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	EAST search, History included	03/29/2020	JR

/Mohammad J Rahman/ Primary Examiner, Art Unit 2487	
--	--

Issue Classification 	Application/Control No. 16/440,274	Applicant(s)/Patent Under Reexamination Samuelsson et al.
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487

CPC						
Symbol					Type	Version
H04N	/	19	/	573	F	2014-11-01
H04N	/	19	/	70	I	2014-11-01
H04N	/	19	/	89	I	2014-11-01
H04N	/	19	/	31	I	2014-11-01
H04N	/	19	/	433	I	2014-11-01
H04N	/	19	/	58	I	2014-11-01
H04L	/	47	/	50	A	2013-01-01
H04L	/	65	/	4069	A	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/				

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 19	
/Mohammad J Rahman/ Primary Examiner, Art Unit 2487 (Primary Examiner) _____ (Date) _____		29 March 2020 O.G. Print Claim(s) 1	O.G. Print Figure 3

Issue Classification 	Application/Control No. 16/440,274	Applicant(s)/Patent Under Reexamination Samuelsson et al.	
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487	

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H04N	/	19	/ 573
H04N	/	19	/ 433
H04N	/	19	/ 89
H04N	/	19	/ 58
H04N	/	19	/ 70
H04N	/	19	/ 31
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	19	
/Mohammad J Rahman/ Primary Examiner, Art Unit 2487	29 March 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

Issue Classification 	Application/Control No. 16/440,274	Applicant(s)/Patent Under Reexamination Samuelsson et al.
	Examiner MOHAMMAD J RAHMAN	Art Unit 2487

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	19	19										
2	2	11	11												
3	3	12	12												
4	4	13	13												
5	5	14	14												
6	6	15	15												
7	7	16	16												
8	8	17	17												
9	9	18	18												

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 19	
/Mohammad J Rahman/ Primary Examiner, Art Unit 2487 (Primary Examiner) _____ (Date) _____		29 March 2020 O.G. Print Claim(s) 1	O.G. Print Figure 3

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L22	37	(buffer and reference and (picture list) and (missing non\$1existing)).clm.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:57
L23	7	((buffer adj description) and reference and (picture list) and (missing non\$1existing)).clm.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:58

3/29/2020 10:58:35 PM
C:\Users\mrahman7\Documents\EAST\Workspaces\16440274_Final.wsp

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	16/440274.app.	US-PGPUB; USPAT	OR	OFF	2020/03/29 22:33
L2	234	(Samuelsson-Jonatan\$ Sj\$1berg-Rickard\$).in.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:33
L3	32378	(ericsson).as.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:33
L4	68397	(H04N19/\$).cpc.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:33
L5	37	(buffer and reference and (picture list) and (missing non\$1existing)).clm.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:33
L6	9	L5 and L2	US-PGPUB; USPAT	OR	ON	2020/03/29 22:34
L7	4	L5 and L3	US-PGPUB; USPAT	OR	ON	2020/03/29 22:34
L8	22	L5 and L4	US-PGPUB; USPAT	OR	ON	2020/03/29 22:34
L9	4	("10368088" "10063882" "9807418" "9706223").pn.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:34
L10	7	(US-20070195882-\$ or US-20070160305-\$ or US-20080175326-\$).did. or (US-8638847-\$ or US-9609341-\$ or US-10051264-\$ or US-6252873-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/03/29 22:34
L11	11	L9 L10	US-PGPUB; USPAT	OR	OFF	2020/03/29 22:34
L12	4	L11 and (buffer adj description)	US-PGPUB; USPAT	OR	OFF	2020/03/29 22:40
L13	308	(buffer and reference and (picture list) and (relative delta)).clm.	US-PGPUB; USPAT	OR	ON	2020/03/29 22:40
L14	5	(@ad<"20110630") and L13 and L4 and (delta with reference)	US-PGPUB; USPAT	OR	ON	2020/03/29 22:40
L15	0	(@ad<"20110630") and L4 and (delta with reference) and (buffer adj description)	US-PGPUB; USPAT	OR	ON	2020/03/29 22:41
L16	43	(@ad<"20110630") and (delta with reference	US-	OR	ON	2020/03/29

		with picture) and (decoded with picture with buffer) and (reference with buffer) and (picture with count) and (missing non\$1existing)	PGPUB; USPAT			22:41
L17	0	(@ad<"20110630") and (delta with reference with picture) and (decoded with picture with buffer) and (reference with buffer) and (picture with count) and (missing non\$1existing) and (buffer adj description)	US-PGPUB; USPAT	OR	ON	2020/03/29 22:42
L18	0	(@ad<"20110630") and ((buffer adj description) same (reference with picture))	US-PGPUB; USPAT	OR	ON	2020/03/29 22:43
L19	9	(@ad<"20110630") and ((buffer adj description) and (reference with picture))	US-PGPUB; USPAT	OR	ON	2020/03/29 22:44
L20	0	(@ad<"20110630") and ((buffer adj description) and (reference with picture)) and delta	US-PGPUB; USPAT	OR	ON	2020/03/29 22:45

3/29/2020 10:46:29 PM
C:\Users\mrahman7\Documents\EAST\Workspaces\16440274_Final.wsp

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16440274	13-Jun-2019	Jonatan Samuelsson	9900-34860US6	8403

TITLE OF INVENTION :

REFERENCE PICTURE SIGNALING

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Regular Undiscounted	Utility under 35 USC 111(a)	2487	240160	MOHAMMAD RAHMAN
Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
\$1000	\$0	\$1000	06-Jul-2020	\$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
146825 Sage Patent Group/Telefonaktiebolaget LM Ericsson PO BOX 30789 RALEIGH NC 27622-0789 UNITED STATES 984-219-3444 instructions@sagepat.com	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status**Change in Entity Status**

Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.

Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.



Applicant asserting small entity status. See 37 CFR 1.27.

Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.



Applicant changing to regular undiscounted fee status.

Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.



Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:

☒ Issue Fee

☐ I authorize USPTO to apply my previously paid issue fee to the current fees due

☐ Publication Fee

☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____

☐ Advance Order - # of copies _____

☒ If in **addition** to the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number 60-1438.
The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed

NOTE: If no name is listed, no name will be printed
For printing on the patent front page, list to be displayed as entered

1. SAGE PATENT GROUP
2.
3.

5.Assignee Name(s) and Residence Data To Be Printed

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

Name	City	State	Country	Category
Telefonaktiebolaget LM Ericsson (publ)	Stockholm		sweden	corporation

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Kevin L. Wingate/	Date	05-27-2020
Name	Kevin L. Wingate	Registration Number	38662

Electronic Patent Application Fee Transmittal

Application Number:	16440274			
Filing Date:	13-Jun-2019			
Title of Invention:	REFERENCE PICTURE SIGNALING			
First Named Inventor/Applicant Name:	Jonatan Samuelsson			
Filer:	Kevin Wingate/Josh Cooke			
Attorney Docket Number:	9900-34860US6			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt

EFS ID:	39555432
Application Number:	16440274
International Application Number:	
Confirmation Number:	8403
Title of Invention:	REFERENCE PICTURE SIGNALING
First Named Inventor/Applicant Name:	Jonatan Samuelsson
Customer Number:	146825
Filer:	Kevin Wingate/Josh Cooke
Filer Authorized By:	Kevin Wingate
Attorney Docket Number:	9900-34860US6
Receipt Date:	27-MAY-2020
Filing Date:	13-JUN-2019
Time Stamp:	19:23:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	E20205QJ23106005
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Web85b.pdf	45970	no	2
			0c34b2392d9ee0cfd48676c9fc785d8a1bf9ed2		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32078	no	2
			17f42153e8ef141a2f99a02ecd924a498b49f892		
Warnings:					
Information:					
Total Files Size (in bytes):			78048		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	07/07/2020	10708618	9900-34860US6	8403

146825 7590 06/17/2020

Sage Patent Group/Telefonaktiebolaget LM Ericsson
PO BOX 30789
RALEIGH, NC 27622-0789

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Jonatan Samuelsson, Stockholm, SWEDEN;
Telefonaktiebolaget LM Ericsson (publ), Stockholm, SWEDEN;
Rickard Sjöberg, Stockholm, SWEDEN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 2

PATENT NO. : 10,708,618 B2

APPLICATION NO. : 16/440,274

ISSUE DATE : July 7, 2020

INVENTOR(S) : Samuelsson, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 1, Line 7, delete “2018,” and insert - - 2018, now Pat. No. 10,368,088, - -, therefor.

In Column 9, Line 10, delete “command The” and insert - - command. The - -, therefor.

In Column 16, Line 56, delete “S31 of FIG. 1,” and insert - - S31 of FIG. 9, - -, therefor.

In Column 17, Line 46, delete “picture identifiers (IDS)” and insert - - picture identifiers (IDs) - -, therefor.

In Column 24, Line 6, delete “description” and insert - - described - -, therefor.

In Column 24, Line 36, delete “picture, i e” and insert - - picture, i.e. - -, therefor.

In Column 30, In Table, Line 26, delete “pic_parameter_set_rbsp() {” and insert the same at Line 24 Left to Descriptor as a Heading of the table.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

6300 Legacy, MS EVR 1-C-11
Plano, TX 75024
972-583-8656

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 2 of 2

PATENT NO. : 10,708,618 B2

APPLICATION NO. : 16/440,274

ISSUE DATE : July 7, 2020

INVENTOR(S) : Samuelsson, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 31, Line 31, delete “number_of explicitly_signaled_pictures-1.” and insert - - number_of_explicitly_signaled_pictures-1. - -, therefor.

In Column 32, Line 42, in Claim 4, delete “a used” and insert - - used - -, therefor.

In Column 33, Line 7, in Claim 6, delete “a used” and insert - - used - -, therefor.

In Column 34, Line 12, in Claim 11, delete “a used” and insert - - used - -, therefor.

In Column 34, Line 50, in Claim 13, delete “a used” and insert - - used - -, therefor.

In Column 35, Line 36, in Claim 16, delete “a used” and insert - - used - -, therefor.

In Column 36, Line 42, in Claim 19, delete “a used” and insert - - used - -, therefor.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

6300 Legacy, MS EVR 1-C-11
Plano, TX 75024
972-583-8656

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		16440274		
Filing Date:		13-Jun-2019		
Title of Invention:		REFERENCE PICTURE SIGNALING		
First Named Inventor/Applicant Name:		Jonatan Samuelsson		
Filer:		Brian Michael Kearns/Elena Katz		
Attorney Docket Number:		9900-34860US6		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	1811	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				150

Electronic Acknowledgement Receipt

EFS ID:	40370698
Application Number:	16440274
International Application Number:	
Confirmation Number:	8403
Title of Invention:	REFERENCE PICTURE SIGNALING
First Named Inventor/Applicant Name:	Jonatan Samuelsson
Customer Number:	146825
Filer:	Brian Michael Kearns/Elena Katz
Filer Authorized By:	Brian Michael Kearns
Attorney Docket Number:	9900-34860US6
Receipt Date:	25-AUG-2020
Filing Date:	13-JUN-2019
Time Stamp:	03:48:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 150
RAM confirmation Number	E202080448509490
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	P34860- US6_2020-08-25_CoC_Request _Letter.pdf	181971	no	4
			799c0181daac676fb1d4805adc6851d18a637d51		
Warnings:					
Information:					
2	Request for Certificate of Correction	P34860- US6_2020-08-25_CoC_PTO-105 0.pdf	145531	no	3
			5259b0c115abc2a997754cdc6b4f4e38d49d6804		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30319	no	2
			8fd32212d679a646b768bfbf6e379e0df328e923		
Warnings:					
Information:					
Total Files Size (in bytes):			357821		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: U.S. Patent No. 10,708,618

USPTO CONFIRMATION CODE: 8403

APPLICATION NO.: 16/440,274

FILED: June 13, 2019

EXAMINER: Mohammad J Rahman

GROUP ART UNIT: 2487

FOR: REFERENCE PICTURE SIGNALING

37 CFR 1.322 & 37 CFR 1.323 REQUEST FOR CERTIFICATE OF CORRECTION
FOR USPTO AND/OR APPLICANT MISTAKE

HONORABLE COMMISSIONER OF PATENTS & TRADEMARKS

SIR:

The following is a request for a certificate of correction in Serial Number 16/440,274, now Patent Number 10,708,618.

A certificate of correction under 35 USC 254 is respectfully requested in the above-identified patent.

The errors were the fault of both the applicant and USPTO and, accordingly, please charge **\$150.00** to our Deposit Account No. 50-1379. In the event that a further fee is required, please charge the amount to the same Deposit Account.

The exact locations where the errors appear in the patent and patent application are as follows:

In Column 1, Line 7, delete “2018,” and insert - - 2018, now Pat. No. 10,368,088, - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 1, PARAGRAPH [0001], LINE 2)

In Column 9, Line 10, delete “command The” and insert - - command. The - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 12, PARAGRAPH [0071], LINE 2)

In Column 16, Line 56, delete “S31 of FIG. 1,” and insert - - S31 of FIG. 9, - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 23, PARAGRAPH [0128], LINE 5)

In Column 17, Line 46, delete “picture identifiers (IDS)” and insert - - picture identifiers (IDs) - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 24, PARAGRAPH [0134], LINE 2)

In Column 24, Line 6, delete “description” and insert - - described - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 34, PARAGRAPH [0177], LINE 1)

In Column 24, Line 36, delete “picture, i e” and insert - - picture, i.e. - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 34, PARAGRAPH [0180], LINE 5)

In Column 30, In Table, Line 26, delete “pic_parameter_set_rbsp() {” and insert the same at Line 24 Left to Descriptor as a Heading of the table.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 44, TABLE, LINE 1)

In Column 31, Line 31, delete “number_of_explicitly_signaled_pictures-1.” and insert - - number_of_explicitly_signaled_pictures-1. - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JUNE 13, 2019, PAGE 46, LINE 2)

In Column 32, Line 42, in Claim 4, delete “a used” and insert - - used - -, therefor.

(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 3 OF 16, CLAIM 4, LINE 9)

In Column 33, Line 7, in Claim 6, delete “a used” and insert - - used - -, therefor.

(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 4 OF 16, CLAIM 6, LINE 9)

In Column 34, Line 12, in Claim 11, delete “a used” and insert - - used - -,
therefor.
(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 6
OF 15, CLAIM 11, LINE 9)

In Column 34, Line 50, in Claim 13, delete “a used” and insert - - used - -,
therefor.
(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 6
OF 15, CLAIM 13, LINE 9)

In Column 35, Line 36, in Claim 16, delete “a used” and insert - - used - -,
therefor.
(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 8
OF 15, CLAIM 16, LINE 9)

In Column 36, Line 42, in Claim 19, delete “a used” and insert - - used - -,
therefor.
(AMENDMENTS TO THE CLAIMS DATED FEBRUARY 11, 2020, PAGE 9
OF 15, CLAIM 19, LINE 9)

The requested corrections are attached on Form PTO 1050.

Respectfully Submitted

, 2020

DATE

/Ronald J. Ward, Reg#54870/

Ronald J. Ward
Registration No. 54,870
Attorney of Record



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/440,274	06/13/2019	Jonatan Samuelsson	9900-34860US6	8403
146825	7590	09/23/2020		
Sage Patent Group/Telefonaktiebolaget LM Ericsson PO BOX 30789 RALEIGH, NC 27622-0789			EXAMINER RAHMAN, MOHAMMAD J	
			ART UNIT	PAPER NUMBER
			2487	
			NOTIFICATION DATE	DELIVERY MODE
			09/23/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

instructions@sagepat.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Patent No.: 10708618
Issue Date: 07/07/2020
Appl. No.: 16/440,274
Filed: 06/13/2019

PART (A) RESPONSE FOR CERTIFICATES OF CORRECTION

This is a decision on the Certificate of Correction request filed 25 August 2020.

The request for issuance of Certificate of Correction for the above-identified correction(s) under the provisions of 37 CFR 1.322 and/or 1.323 is hereby:

(Check one)

☒ Approved ☐ Approved in Part ☐ Denied

Comments: _____

PART (B) PETITION UNDER 37 CFR 1.324 OR 37 CFR 1.48

☐ This is a decision on the petition filed _____ to correct inventorship under 37 CFR 1.324.

☐ This is a decision on the request under 37 CFR 1.48, petition filed _____. In view of the fact that the patent has already issued, the request under 37 CFR 1.48 has been treated as a petition to correct inventorship under 37 CFR 1.324.

The petition is hereby: ☐ Granted ☐ Dismissed

Comment: _____

The patented filed is being forwarded to Certificate of Corrections Branch for issuance of a certificate naming only the actual inventor or inventors.

/Dave Czekaj/
Supervisory Patent Examiner
Technology Center 2400
Phone: (571)272-7327

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov CoC Central Phone Number: (703) 756-1814

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,708,618 B2
APPLICATION NO. : 16/440274
DATED : July 7, 2020
INVENTOR(S) : Samuelsson et al.

Page 1 of 2

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

In Column 1, Line 7, delete “2018,” and insert -- 2018, now Pat. No. 10,368,088, --, therefor.

In Column 9, Line 10, delete “command The” and insert -- command. The --, therefor.

In Column 16, Line 56, delete “S31 of FIG. 1,” and insert -- S31 of FIG. 9, --, therefor.

In Column 17, Line 46, delete “picture identifiers (IDS)” and insert -- picture identifiers (IDs) --, therefor.

In Column 24, Line 6, delete “description” and insert -- described --, therefor.

In Column 24, Line 36, delete “picture, i e” and insert -- picture, i.e. --, therefor.

In Column 30, In Table, Line 26, delete “pic_parameter_set_rbsp() {” and insert the same at Line 24 Left to Descriptor as a Heading of the table.

In Column 31, Line 31, delete “number_of_explicitly_signaled_pictures-1.” and insert -- number_of_explicitly_signaled_pictures-1. --, therefor.

In the Claims

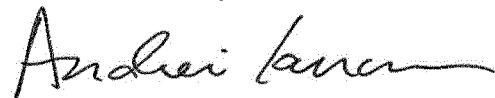
In Column 32, Line 42, in Claim 4, delete “a used” and insert -- used --, therefor.

In Column 33, Line 7, in Claim 6, delete “a used” and insert -- used --, therefor.

In Column 34, Line 12, in Claim 11, delete “a used” and insert -- used --, therefor.

In Column 34, Line 50, in Claim 13, delete “a used” and insert -- used --, therefor.

Signed and Sealed this
Thirteenth Day of October, 2020



Andrei Iancu
Director of the United States Patent and Trademark Office

CERTIFICATE OF CORRECTION (continued)
U.S. Pat. No. 10,708,618 B2

Page 2 of 2

In Column 35, Line 36, in Claim 16, delete “a used” and insert -- used --, therefor.

In Column 36, Line 42, in Claim 19, delete “a used” and insert -- used --, therefor.

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court **Eastern District of North Carolina** on the following

☐ Trademarks or ☐ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

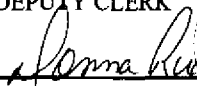
DOCKET NO. 5:23-CV-714-M-BM	DATE FILED 12/12/2023	U.S. DISTRICT COURT Eastern District of North Carolina
PLAINTIFF Telefonaktiebolaget LM Ericsson		DEFENDANT Lenovo (United States), Inc. et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,641,841	5/2/2017	Telefonaktiebolaget LM Ericsson
2 10,142,659	11/27/2018	Telefonaktiebolaget LM Ericsson
3 10,708,618	7/7/2020	Telefonaktiebolaget LM Ericsson
4 10,708,613	7/7/2020	Velos Media, LLC
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK Peter A. Moore, Jr.,	(BY) DEPUTY CLERK 	DATE 12/14/2023
-------------------------------	--	--------------------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court **Eastern District of North Carolina** on the following

☐ Trademarks or ☐ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

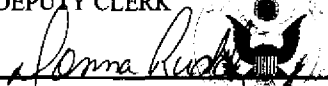
DOCKET NO. 5:23-CV-714-M-BM	DATE FILED 12/12/2023	U.S. DISTRICT COURT Eastern District of North Carolina
PLAINTIFF Telefonaktiebolaget LM Ericsson		DEFENDANT Lenovo (United States), Inc. et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,641,841	5/2/2017	Telefonaktiebolaget LM Ericsson
2 10,142,659	11/27/2018	Telefonaktiebolaget LM Ericsson
3 10,708,618	7/7/2020	Telefonaktiebolaget LM Ericsson
4 10,708,613	7/7/2020	Velos Media, LLC
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK Peter A. Moore, Jr.,	(BY) DEPUTY CLERK 	DATE 12/14/2023
-------------------------------	---	--------------------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy