(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 September 2012 (27.09.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/128701 A1

(51) International Patent Classification:
H04N 7/26 (2006.01) *H04N 7/50* (2006.01)

(21) International Application Number:
PCT/SE2012/050285

(22) International Filing Date:
15 March 2012 (15.03.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/454,118 18 March 2011 (18.03.2011) US

(71) Applicant *(for all designated States except US)*: **TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)** [SE/SE]; S-164 83 Stockholm (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **SJÖBERG, Rickard** [SE/SE]; Robert Almströmsgatan 9A, S-113 36 Stockholm (SE). **SAMUELSSON, Jonatan** [SE/SE]; Stadshagsplan 1, S-112 50 Stockholm (SE). **WENNERSTEN, Per** [SE/SE]; Årstavägen 67, 2tr., S-120 54 Årsta (SE).

(74) Agent: **NORIN, Klas**; Ericsson AB, Patent Unit SLM, Torshamnsgatan 21-23, S-164 80 Stockholm (SE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) Title: ENCODER, DECODER FOR SCANNING A PICTURE AND METHODS THEREOF

(57) Abstract: The present invention relates to an encoder, a decoder and methods thereof for increasing the coding efficiency. The coding efficiency is achieved by introducing Zscan blocks and scanning the Zscan blocks horizontally, row by row, in the picture e.g. by processing the coding units in a Z-scan order within each Zscan block. The Zscan block size is equal to or smaller than the maxsize of the macroblocks and the Zscan block size is larger than the current macroblock size.

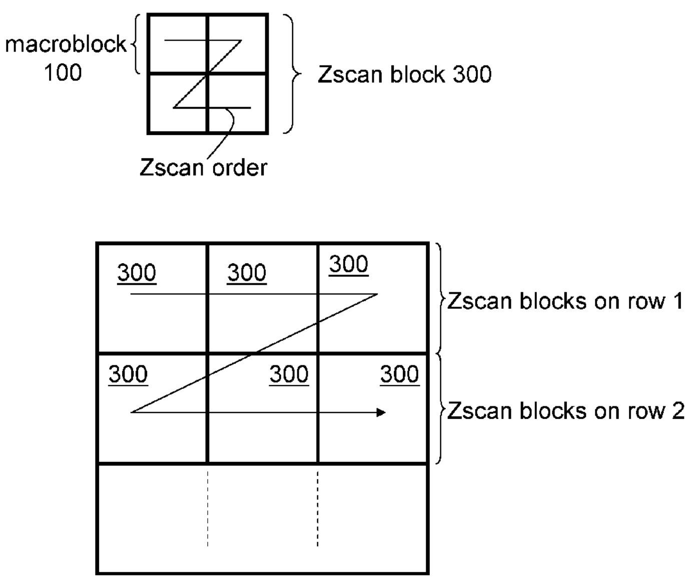

Fig. 3

WO 2012/128701 A1

Published:

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

ENCODER, DECODER FOR SCANNING A PICTURE AND METHODS THEREOF

TECHNICAL FIELD

The embodiments relate to coding of picture which may be part of a video sequence and in particular to scan order of the picture, i.e. in which order parts of the picture are being processed for encoding/decoding.

BACKGROUND

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.

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 committee draft (CD) of HEVC is defined that includes large macroblocks which are referred to as Largest Coding Units (LCUs) and a number of other new tools and is considerably more efficient than H.264/AVC.

In general, an encoder at a transmitter encodes video data packet to compress the data and sends a bit stream of the compressed data to a decoder at a receiver. Accordingly, at the receiver the decoder receives the bit stream representing pictures, i.e. video data packets of compressed data. The compressed data comprises payload and control information. The control information comprises information needed to decode the compressed data e.g. information of which reference pictures should be stored in a reference picture buffer. 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 reference picture buffer according to the control information. These stored reference pictures are used by the decoder when decoding subsequent pictures.

Each picture is divided into blocks, wherein the picture is encoded/decoded block by block. As video resolutions have increased, it has been noticed that large blocks can provide good video coding benefits. Traditional block sizes are in the order of 16x16 pixels or smaller (e.g.

macroblocks in H.264), but it has been shown that block sizes of up to 128x128 pixels can provide improved coding efficiency.

To enable large blocks while keeping the coding performance of small detailed areas in the same image, hierarchical coding is used. This is the case for HEVC.

Large blocks, referred to as Largest Coding Units (LCU) in HEVC, are scanned left to right in the same way as normal macroblocks in H.264. Each LCU may be split into four smaller coding units (CU), and the may be split again hierarchically in a quad-tree fashion. There is also a smallest size for the Coding Unit defined; these blocks are called Smallest Coding Unit (SCU).

Figure 1 shows how a picture is divided in to a number of LCU blocks and how an LCU can be split in a quad-tree fashion into smaller CUs according to prior art.

A LCU 100 may be split into smaller CUs 110. The only profile currently defined in HEVC supports an LCU size of 64x64, 32x32 and 16x16 and an SCU size of 8x8, but it is possible that future profiles will use other values. Each CU 110 has a coding type assigned, e.g. Intra, P, skip. Each CU may also be quad-tree split further in three independent quad-tree structures.

The CU 110 has its prediction type (e.g. intra prediction or inter-prediction). The CU 110 is also a root of two structures called prediction units and transform units. Each prediction unit inside the CU 110 can have its own prediction that is different from the predictions of the other PU (for example, a separate motion vector or intra prediction direction). A CU can contain one PU (which has then the same size as the CU) or can be split further into up to four PUs. Those PUs can have either square or rectangular form (in this case, the vertical and horizontal PU dimensions differ). As an example, there might be a CU of size 16x16 that is split once, creating 4 8x8 prediction unit blocks (PUs). If the coding type of the CU is Intra, the PUs may have different Intra prediction modes. If the coding type of the CU is Inter, the PUs may have different motion vectors.

Then there is a transform quad-tree that also has the CU as its root. The resulting blocks are called Transform Units (TU). As an example, there might be a CU of size 16x16 that is split into 8x8 TUs. Then, one of the 8x8 TU can be split into 4x4 TUs. Then each TU is transformed with an 8x8 or a 4x4 transform. If the root TU was not split, then a 16x16 transform would have been used. Transforms can also have a non-square (rectangular) shape.

Assuming that LCU=128x128 and SCU=16x16, it may be coded in a bitstream as:

```
Slice_header_syntax()
split_coding_unit_flag=1 // split 128x128 -> 64x64
split_coding_unit_flag=1 // split 64x64 -> 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=1 // split 64x64 -> 32x32
split_coding_unit_flag=1 // split 32x32 -> 16x16, no further split flag needed since 16x16 is smallest block size
split_coding_unit_flag=1 // split 32x32 -> 16x16, no further split flag needed
split_coding_unit_flag=1 // split 32x32 -> 16x16, no further split flag needed
split_coding_unit_flag=1 // split 32x32 -> 16x16, no further split flag needed
split_coding_unit_flag=1 // split 64x64 -> 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 32x32
split_coding_unit_flag=0 // code 64x64
```

where the slice_header_syntax() is the slice header and the split_coding_unit_flag indicates to the decoder whether the current CU should be split further or not. Note that if the current block is a SCU, then no split_coding_unit_flag is sent since it is not allowed to be split further.

Each picture is divided into one or more slices, where each slice is an independently decodable piece of an image. In other words, if one slice is lost, the other slices of that frame are still decodable.

In H.264/AVC, a slice boundary may occur between any two macroblocks.

In the HEVC Model (HM), a slice boundary may occur between any two LCUs.

The HM specification WD2: Working Draft 2 of High-Efficiency Video Coding, JCTVC-D503, available at http://wftp3.itu.int/av-arch/jctvc-site/2011_01_D_Daegu/JCTVC-D503_r1.doc on 2011-03-18, currently support slice boundaries on largest coding unit (LCU) resolution. In Common test conditions and software reference configurations, JCTVC-D600, F. Bossen, available at http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=1915 on 2011-03-18, the current common conditions specifies the LCU size to be 64x64 which is 16 times larger than traditional 16x16 macroblocks. The problem with such coarse slice boundaries is that it becomes difficult to control the size of slices in terms of bytes. For highly active and hard-to-compress areas, one single LCU may be larger than a target number of slice bytes.

One way to handle this problem is to reduce the size of the LCU to e.g. 32x32. However, this will result in decreased coding efficiency in the range from 0.4% to 8.8% for different configurations as reported in JCTVC-C259.

When a picture is divided into slices, e.g. in order to match a specific size, the loss in coding efficiency is even larger (as reported in JCTVC-E024).

SUMMARY

Thus, an object of the present invention is to increase the coding efficiency while having large macroblocks of e.g. 64x64.

In HEVC, it is currently possible to use a number of predefined configurations of the LCUs, also referred to as macroblocks. E.g. the LCU size can be 64x64, 32x32, and 16x16 pixels. A max LCU size is defined which in this case is 64x64.

Currently, the macroblocks are scanned and coded/decoded in a raster scan order according to **figure 2**. In accordance with embodiments of the present invention, the coding efficiency is achieved by introducing Zscan blocks and scanning the Zscan blocks horizontally, row by row, in the picture e.g. by processing the coding units in a Z-scan order within each Zscan block. The Zscan block size is equal to or smaller than the maxsize of the macroblocks and the Zscan block size is larger than the current macroblock size. In this way the locality of the coded data is increased as the coding units which are scanned subsequently are highly correlated as they are located adjacent to each other, which implies that the prediction is improved. Hence the coding efficiency is increased.

According to a first aspect of embodiments of the present invention a method in an encoder for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size (maxsize) which is larger than a current macroblock size. The method comprises determining the maxsize, determining the current macroblock size for the picture, and dividing the picture into Zscan blocks. The Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size. The method further comprises scanning the macroblocks, by scanning the Zscan blocks horizontally, row by row, in the picture.

According to a second aspect of embodiments of the present invention a method in a decoder for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size (maxsize) which is larger than a current macroblock size. The method comprises determining the maxsize, determining the current macroblock size for the picture, and dividing the picture into Zscan blocks. The Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size. The method further comprises scanning the macroblocks, by scanning the Zscan blocks horizontally, row by row, in the picture.

According to a third aspect of embodiments of the present invention an encoder for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size (maxsize) which is larger than a current macroblock size. The encoder comprises a determining unit configured to determine the maxsize and the current macroblock size for the picture, and a dividing unit configured to divide the picture into Zscan blocks. The Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan blocksize is larger than the current macroblock size. The encoder further comprises a scanning unit configured to scan the macroblocks, wherein the scanning unit is configured to scan the Zscan blocks horizontally, row by row, in the picture.

According to a fourth aspect of embodiments of the present invention a decoder for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size (maxsize) which is larger than a current macroblock size. The decoder comprises a determining unit configured to determine the maxsize and the current macroblock size for the picture, and a dividing unit configured to divide the picture into Zscan blocks. The Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan blocksize is larger than the current macroblock size. The decoder further comprises a scanning unit configured to scan the macroblocks, wherein the scanning unit is configured to scan the Zscan blocks horizontally, row by row, in the picture.

An advantage with embodiments of the present invention is that neither complexity nor memory requirements is increased compared to raster scan processing of macroblocks with size equal to the largest allowed LCU size, since the size of the Zscan does not exceed the largest allowed LCU size.

Further, embodiments of the present invention will have positive effects when entropy slices are used to enable waveform parallelism as described in JCTVC-D073 since it reduces the number of context resets and thereby reduces the coding efficiency loss.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates schematically how a picture is divided in to a number of LCU blocks and how an LCU can be split in a quad-tree fashion into smaller CUs according to prior art.

Fig. 2 illustrates schematically how the LCUs (macroblocks) are scanned and coded/decoded in a raster scan order according to prior art.

Fig. 3 illustrates schematically a Zscan block scanned horizontally, row by row and also that the macroblocks within the Zscan block may be scanned in a Zscan order according to embodiments of the present invention.

Figure 4 is a flowchart of the method in an encoder and a decoder according to embodiments of the present invention.

Figs. 5-7 illustrate schematically how the macroblocks are scanned within a Zscan block in a Z-scan order according to the embodiments of the present invention.

Fig. 8 illustrates schematically an encoder and a decoder according to embodiments of the present invention.

Fig. 9 illustrates schematically how the functionalities of the units of figure 8 can be implemented.

DETAILED DESCRIPTION

Throughout the following description similar reference numerals have been used to denote similar elements, units, parts, items or features, when applicable.

As stated above, the object of the present invention is to increase the coding efficiency. The coding efficiency is achieved by introducing Zscan blocks and scanning the Zscan blocks horizontally, row by row, in the picture e.g. by processing the coding units in a Z-scan order within each Zscan block which is illustrated in **figure 3**. The Zscan block size is equal to or smaller than the maxsize of the macroblocks and the Zscan block size is larger than the current macroblock size.

Thus, the embodiments of the present invention relate to scanning a picture divided into macroblocks. The macroblocks usually have the same size. However, if the number of macroblocks are not a multiple of e.g. 64, the last macroblock of the picture may be smaller than the other macroblocks. The scanning implies the order in which the macroblocks are processed in the coding/decoding process. The macroblocks are further divided into coding units and the number of coding units depends on the size of the macroblock. For each picture a maximum size of the macroblocks, maxsize, is defined. The picture may be a picture of a video sequence.

As illustrated in **figure 4** and in accordance with an embodiment, a method in an encoder 450 for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size. In a first step a maxsize is determined 401, and the current macroblock size for the picture is determined 402 in a second step. The picture is divided 403 into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size. Then, the macroblocks are scanned 404, by scanning the Zscan blocks horizontally, row by row, in the picture. In an embodiment, the macroblocks are scanned 404a within a Zscan block in a zscan order.

As further illustrated in **figure 4** and in accordance with an embodiment, a method in a decoder 460 for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size. In a first step a maxsize is determined 406, and the current macroblock size for the picture is determined 407 in a second step. The picture is divided 408 into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size. Then, the macroblocks are scanned 409, by scanning the Zscan blocks horizontally, row by row, in the picture. In an embodiment, the macroblocks are scanned 409a within a Zscan block in a zscan order.

In the embodiments of the present invention, the same scanning order is applied in the entire picture.

According to further embodiments, coding information comprising current macroblock size and Zscan block size is sent 405 from the encoder to the decoder. In this case, the current macroblock size is determined based on the received information. Also the maxsize may be sent in the coding information and thus be determined based on the received information or by a preconfiguration. According to another embodiment, the current macroblock size is sent from the encoder to the decoder and wherein the Zscan block size is implicitly sent by setting the Zscan block size to the maxsize whereby the maxsize is preconfigured. This is further explained below.

The concept of a Zscan block is introduced to explain the functionality of the embodiments. The Zscan block is a block of size larger than the current macroblock size in which macroblocks are processed in Zscan order in a quad-tree manner.

There are two reasons why the macroblock size could not instead be increased to the size of the Zscan block. Firstly, the Zscan block does not require any in-stream signaling at all for the block since the scanning order is defined from the size of the Zscan block and the size of the macroblock only. A macroblock of the same size as the Zscan block would have to signal split flags in order to create the same scanning pattern as the invention.

Secondly, a Zscan block may contain slice borders inside the block at macroblock borders which cannot be done with an equally sized macroblocks, since slice borders are only allowed at LCU borders.

According to a first embodiment, the Zscan block size is equal to the maxsize of the macroblock. In this case the Zscan block size can be implicitly signaled from the encoder to the decoder as the decoder is aware of the maxsize of the macroblock and hence the Zscan block size.

As illustrated in **figures 5-7**, the macroblocks are scanned by scanning Zscan blocks 300 horizontally, row by row.

In **figure 5**, the macroblock maxsize is 64, the current macroblock size is 32 and the Zscan block size is 64, i.e. equal to the macroblock maxsize. Accordingly, the Zscan blocks 300 are scanned horizontally, row by row by processing the macroblocks 100 in a Z-scan order within each Zscan block 300.

Figure 6 shows an example of the scanning order for the case when a Zscan block 300 contains more than 4 macroblocks 100. The maxsize of the macroblock is 128, the current macroblock size is 32 and the Zscan block size is 128. Thus, the macroblocks within a Zscan block are scanned horizontally, row by row within the Zscan block. As illustrated in **figure 6**, a number of macroblock sizes are defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size. The current macroblock size is dxd. The macroblocks within the Zscan block are scanned in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and then 2dx2d blocks are scanned horizontally, row by row within the Zscan block. "d" may be any positive integer value. It should be noted that the granularity of the rows is dependent on the block size, i.e. the Zscan block size and the macroblock size.

According to a further embodiment, the scanning order of the macroblocks 100 within the Zscan block 300 are performed in raster scan order, as illustrated in **figure 7**. In this case the maxsize of the macroblock is 128, current macroblock size 32 and Zscan block size 128.

The embodiments may be implemented in both an encoder and a decoder as illustrated by **figure 4**. That implies that the encoder and the decoder have to be aware of the scanning order such that they can implement identical scanning orders.

In the decoder, the scanning order can either be implicitly derived based on a defined maximum macroblock size and a signaled macroblock size, or it can be signaled as a separate parameter indicating a Zscan block size that is larger than the signaled macroblock size and up to the maximum macroblock size.

When the Zscan block size is equal to the maxsize of the macroblock the Zscan block size can be implicitly signaled if the Zscan block size is defined by e.g. the standard and pre-configured in the decoder. In this case, only the current macroblock size needs to be signaled from the encoder to the decoder.

Moreover, the Zscan block size can also be explicitly signaled from the encoder to the decoder together with the current macroblock size.

The macroblock size or, the zscan block size and the macroblock size may be signaled in a sequence Parameter Set, a picture Parameter Set or an adaptation Parameter Set. It should be noted that adaptation parameter set may also be referred to as slice parameter set. The parameter set contains information valid for larger parts of a video sequence.

Turning to **figure 8**, showing an encoder 450 for scanning a picture divided into macroblocks further divided into coding units, wherein the macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size. The encoder 450 comprises a determining unit 810 configured to determine the maxsize and the current macroblock size for the picture, a dividing unit 820 configured to divide the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks and the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size. The encoder further comprises a scanning unit 830 configured to scan the macroblocks, wherein the scanning unit 830 is configured to scan the Zscan blocks horizontally, row by row, in the picture. Hence, the picture 895 is encoded in the scanning order and then sent to the decoder.

According to an embodiment, the scanning unit 830 is further configured to scan the macroblocks within a Zscan block in a Z-scan order. A number of macroblock sizes may be defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size and the current macroblock size is dxd, the scanning unit 830 is configured to scan the macroblocks within the Zscan block in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and configured to then scan 2dx2d blocks horizontally, row by row within the Zscan block. Alternatively, the scanning unit 830 may be configured to scan macroblocks within a Zscan block horizontally, row by row within the Zscan block.

Furthermore, the encoder comprises a transmitting unit 840 configured to signal coding information such as macroblock size to a decoder according to one embodiment.

According to a further embodiment, the encoder comprises a transmitting unit 840 configured to signal coding information such as macroblock size and Zscan block size to a decoder.

Moreover according to a further embodiment, the transmitting unit 840 is configured to signal macroblock size or the macroblock size and the Zscan block size in a sequence parameter set, picture parameter set or in an adaptation parameter set also referred to as slice parameter set.

The encoded picture and coding information are received by the decoder. The decoder has to decode the picture in the same order as it is being encoded. Therefore, a decoder 460 for scanning a picture divided into macroblocks further divided into coding units is provided. The macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size. The decoder 460 comprises a determining unit 850 configured to determine the maxsize and the current macroblock size for the picture. The received coding information may be used for this determination. The decoder 460 also comprises a dividing unit 860 configured to divide the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan blocksize is larger than the current macroblock size. A scanning unit 870 is provided which is configured to scan the macroblocks, wherein the scanning unit 870 is configured to scan the Zscan blocks horizontally, row by row, in the picture.

According to an embodiment, the scanning unit 870 is further configured to scan the macroblocks within a Zscan block in a Z-scan order. A number of macroblock sizes may be defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size and the current macroblock size is dxd, the scanning unit 870 is configured to scan the macroblocks within the Zscan block in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and configured to then scan 2dx2d blocks horizontally, row by row within the Zscan block. Alternatively, the scanning unit 870 may be configured to scan macroblocks within a Zscan block horizontally, row by row within the Zscan block.

Furthermore, the encoder comprises a receiving unit 880 configured to signal coding information such as macroblock size from an encoder according to one embodiment.

According to a further embodiment, the encoder comprises a receiving unit 880 configured to signal coding information such as macroblock size and Zscan block size from an encoder.

Moreover according to a further embodiment, the receiving unit 880 is configured to receive macroblock size or the macroblock size and the Zscan block size in a sequence parameter set, picture parameter set or in an adapatation parameter set also referred to as slice parameter set.

With references to **figure 9**, the functionalities of the encoder 450 and the decoder 460 respectively (of **figure 8**) may be implemented by software portions which are stored in a memory 920,960. The software portions are processed by a processor 910, 950 such that the functionalities of the encoder and the decoder are performed. The encoder 450 also comprises an input/output section 930, whereby pictures to be encoded are received and the encoded pictures are transmitted. The decoder 460 comprises an input/output section 970, whereby encoded pictures are received and decoded pictures are transmitted to be displayed. It should be noted that the transmitting unit 840 of **figure 8** may be a part of the input/output section 930 of **figure 9** and that the receiving unit 880 of **figure 8** may be a part of the input/output section 970 of **figure 9**.
The encoder and the decoder, respectively may be implemented in a video camera in e.g. a mobile device such as a mobile phone, tablet etc or in a pc.

Claims

1. A method in an encoder for scanning a picture divided into macroblocks further divided into coding units, wherein the macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size, the method comprises:
-determining (401) the maxsize,
-determining (402) the current macroblock size for the picture,
-dividing (403) the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size, and
-scanning (404) the macroblocks, by scanning the Zscan blocks horizontally, row by row, in the picture.

2. The method according to claim 1, wherein the Zscan block size is equal to the maxsize.

3. The method according to any of claims 1-2, wherein the scanning step further comprises:
-scanning (404a) the macroblocks within a Zscan block in a zscan order.

4. The method according to claim 3, wherein a number of macroblock sizes are defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size, and the current macroblock size is dxd, the macroblocks within the Zscan block are scanned in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and then 2dx2d blocks are scanned horizontally, row by row within the Zscan block.

5. The method according to claim 3, wherein the macroblocks within a Zscan block are scanned horizontally, row by row within the Zscan block.

6. The method according to any of claims 1-5, comprising the further step of:
-signaling (405) macroblock size to a decoder.

7. The method according to any of claims 1-5, comprising the further step of: -signaling (405) macroblock size and Zscan block size to a decoder.

8. The method according to claim 6 or 7, wherein macroblock size or the macroblock size and the Zscan block size are signaled in a Sequence parameter set.

9. The method according to claim 6 or 7, wherein the macroblock size or the macroblock size and the Zscan block size are signaled in an adaptation parameter set.

10. A method in a decoder for scanning a picture divided into macroblocks further divided into coding units, wherein the macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size, the method comprises:
-determining (406) the maxsize,
-determining (407) the current macroblock size for the picture,
-dividing (408) the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size, and
-scanning (409) the macroblocks, by scanning the Zscan blocks horizontally, row by row, in the picture.

11. The method according to claim 10, wherein the Zscan block size is equal to the maxsize.

12. The method according to any of claims 10-11, wherein the scanning step further comprises:
-scanning (409a) the macroblocks within a Zscan block in a Z-scan order.

13. The method according to claim 12, wherein a number of macroblock sizes are defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size, and the current macroblock size is dxd, the macroblocks within the Zscan block are scanned in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and then 2dx2d blocks are scanned horizontally, row by row within the Zscan block.

14. The method according to claim 12, wherein the macroblocks within a Zscan block are scanned horizontally, row by row within the Zscan block.

15. The method according to any of claims 10-14, comprising the further step of: -receiving (405) macroblock size and wherein the Zscan block size is predefined.

16. The method according to any of claims 10-14, comprising the further step of: -receiving (405) macroblock size and Zscan block size from en encoder.

17. The method according to claim 15 or 16, wherein the macroblock size or the macroblock size and the Zscan block size are received in a Sequence parameter set.

18. The method according to claim 15 or 16, wherein the macroblock size or the macroblock size and the Zscan block size are received in an adaptation parameter set.

19. An encoder (450) for scanning a picture divided into macroblocks further divided into coding units, wherein the macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size, the encoder (450) comprises a determining unit (810) configured to determine the maxsize and the current macroblock size for the picture, a dividing unit (820) configured to divide the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size, and a scanning unit (830) configured to scan the macroblocks, wherein the scanning unit (830) is configured to scan the Zscan blocks horizontally, row by row, in the picture.

20. The encoder (450) according to claim 19, wherein the Zscan block size is equal to the maxsize.

21. The encoder (450) according to any of claims 19-20, wherein the scanning unit (830) is further configured to scan the macroblocks within a Zscan block in a Z-scan order.

22. The encoder (450) according to claim 21, wherein a number of macroblock sizes are defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size, and the current macroblock size is dxd, the scanning unit (830) is configured to scan the macroblocks within the Zscan block in a Zscan order for the

macroblocks horizontally, row by row within a 2dx2d block and configured to then scan 2dx2d blocks horizontally, row by row within the Zscan block.

23. The encoder (450) according to claim 21, wherein the scanning unit (830) is configured to scan macroblocks within a Zscan block horizontally, row by row within the Zscan block.

24. The encoder (450) according to any of claims 19-23, comprising a transmitting unit (840) configured to signal macroblock size to a decoder.

25. The encoder (450) according to any of claims 19-23, comprising a transmitting unit (840) configured to signal macroblock size and Zscan block size to a decoder.

26. The encoder (450) according to claim 24 or 25, wherein the transmitting unit (840) is configured to signal macroblock size or the macroblock size and the Zscan block size in a Sequence parameter set.

27. The encoder (450) according to claim 24 or 25, wherein the transmitting unit (840) is configured to signal macroblock size or the macroblock size and the Zscan block size in an adaptation parameter set.

28. A decoder (460) for scanning a picture divided into macroblocks further divided into coding units, wherein the macroblocks can have a predetermined maximum size, maxsize, which is larger than a current macroblock size, the decoder (460) comprises a determining unit (850) configured to determine the maxsize and the current macroblock size for the picture, a dividing unit (860) configured to divide the picture into Zscan blocks, wherein the Zscan blocks comprises an integer number of macroblocks, wherein the Zscan block size is equal to or smaller than the maxsize and the Zscan block size is larger than the current macroblock size, and a scanning unit (870) configured to scan the macroblocks, wherein the scanning unit (870) is configured to scan the Zscan blocks horizontally, row by row, in the picture.

29. The decoder (460) according to claim 28, wherein the Zscan block size is equal to the maxsize.

30. The decoder (460) according to any of claims 28-29, wherein the scanning unit (870) is further configured to scan the macroblocks within a Zscan block in a Z-scan order.

31. The decoder (460) according to claim 30, wherein a number of macroblock sizes are defined comprising 4dx4d, 2dx2d and dxd, wherein 4dx4d is the maxsize and the Zscan block size, and the current macroblock size is dxd, the scanning unit is configured to scan the macroblocks within the Zscan block in a Zscan order for the macroblocks horizontally, row by row within a 2dx2d block and configured to then scan 2dx2d blocks horizontally, row by row within the Zscan block.

32. The decoder (460) according to claim 30, wherein the scanning unit (870) is configured to scan macroblocks within a Zscan block horizontally, row by row within the Zscan block.

33. The decoder (460) according to any of claims 28-32, comprising a receiving unit (880) configured to signal macroblock size to a decoder.

34. The decoder (460) according to any of claims 28-32, comprising a receiving unit (880) configured to signal macroblock size and Zscan block size to a decoder.

35. The decoder (460) according to claim 28-32, wherein the receiving unit (880) is configured to signal macroblock size or the macroblock size and the Zscan block size in a Sequence parameter set.

36. The decoder (460) according to claim 34 or 35, wherein the receiving unit (880) is configured to signal macroblock size or the macroblock size and the Zscan block size in an adaptation parameter set.

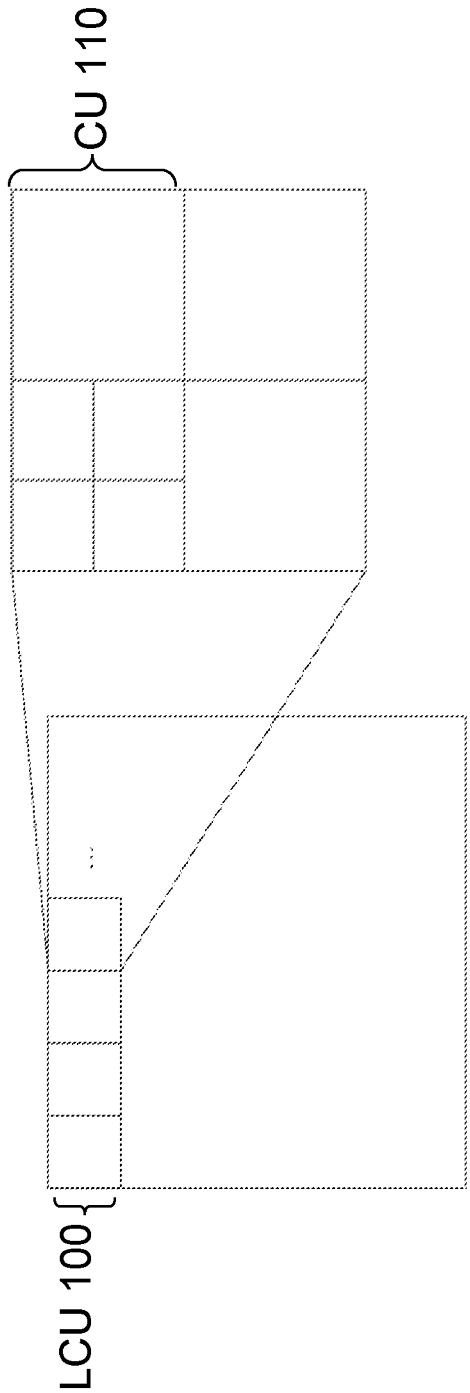

Fig. 1

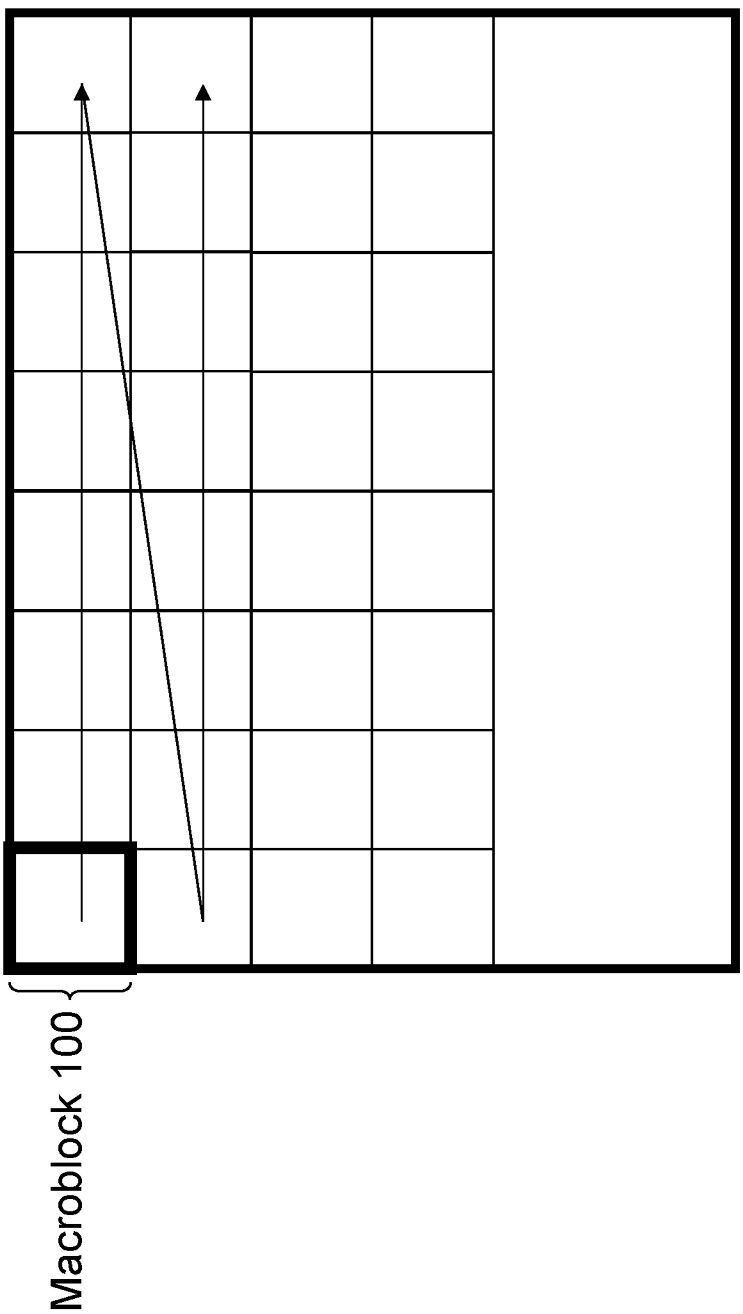

Fig. 2

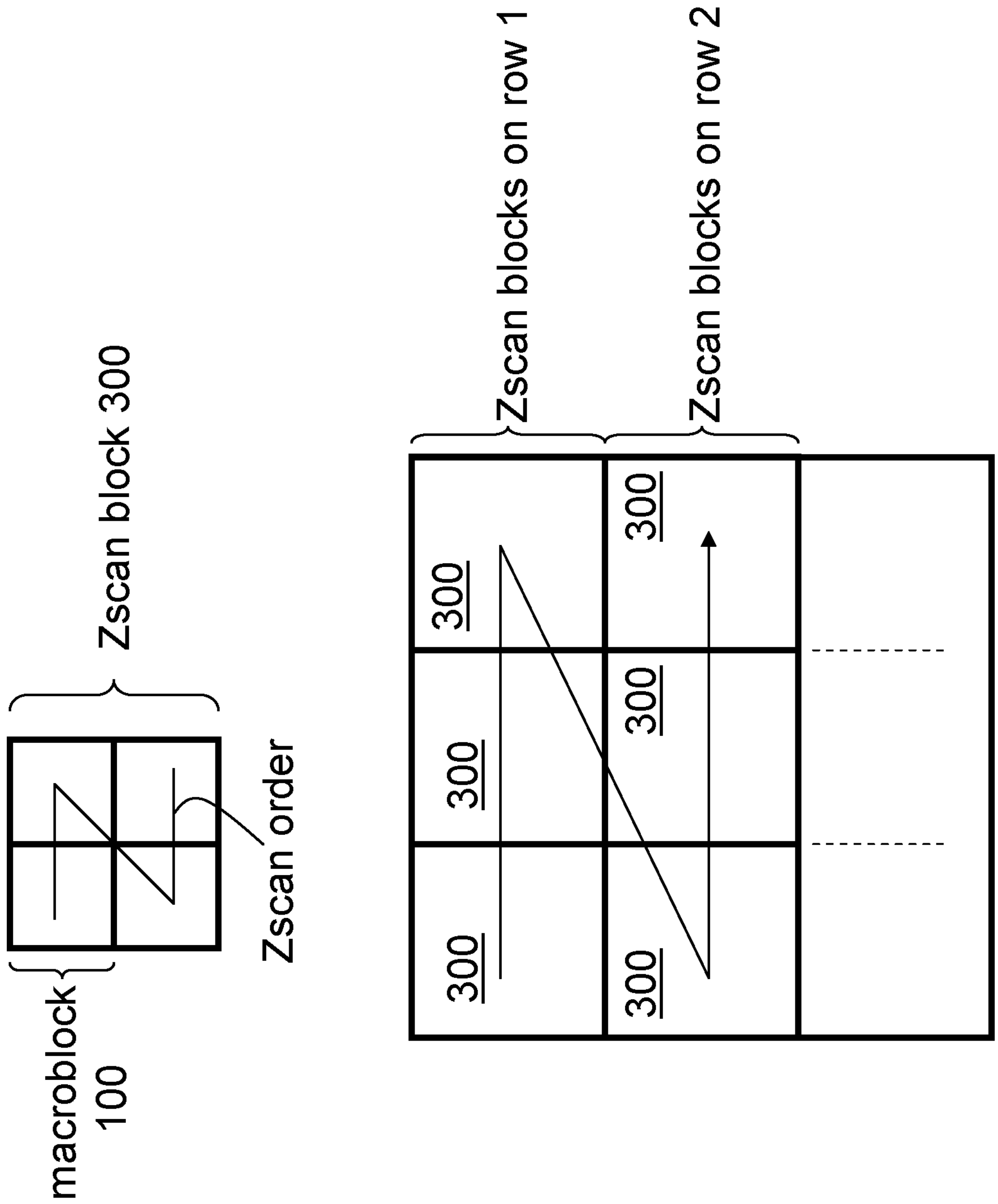
Zscan block 300
macroblock
100
Zscan order
Zscan blocks on row 1
Zscan blocks on row 2
300
300
300
300
300
300

Fig. 3

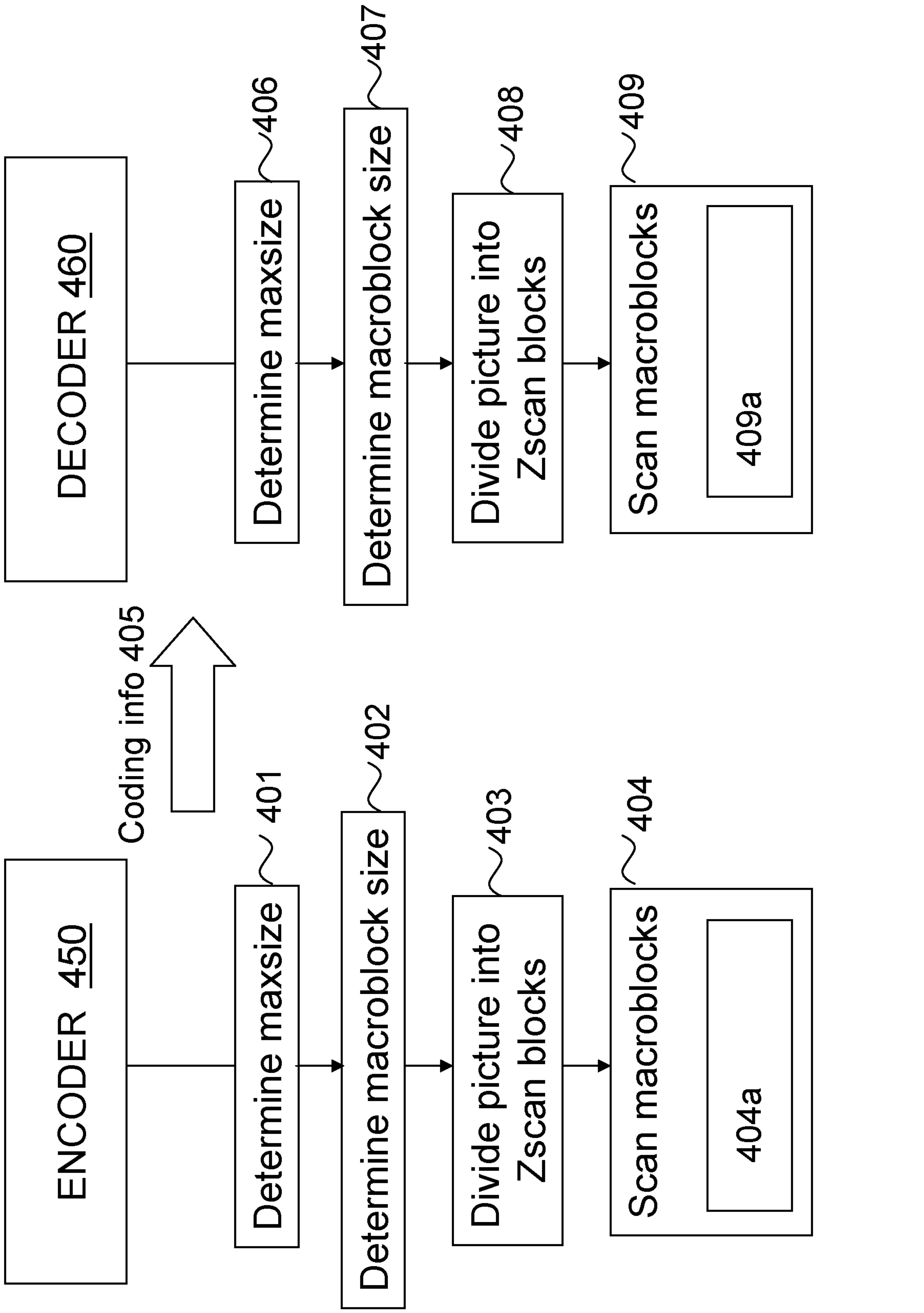
ENCODER 450
Determine maxsize
401
Determine macroblock size
402
Divide picture into Zscan blocks
403
Scan macroblocks
404
404a
Coding info 405
DECODER 460
Determine maxsize
406
Determine macroblock size
407
Divide picture into Zscan blocks
408
Scan macroblocks
409
409a

Fig. 4

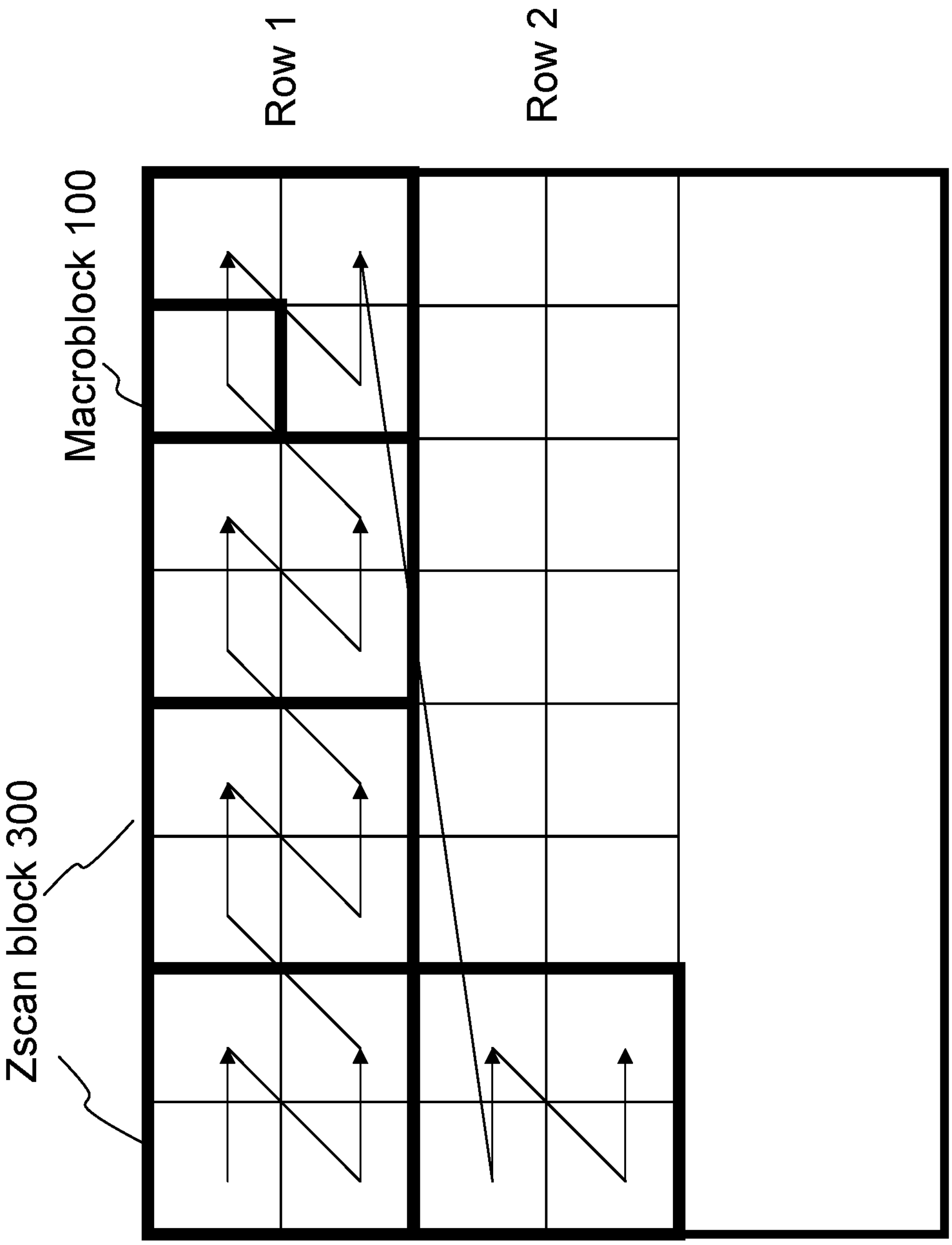

Fig. 5

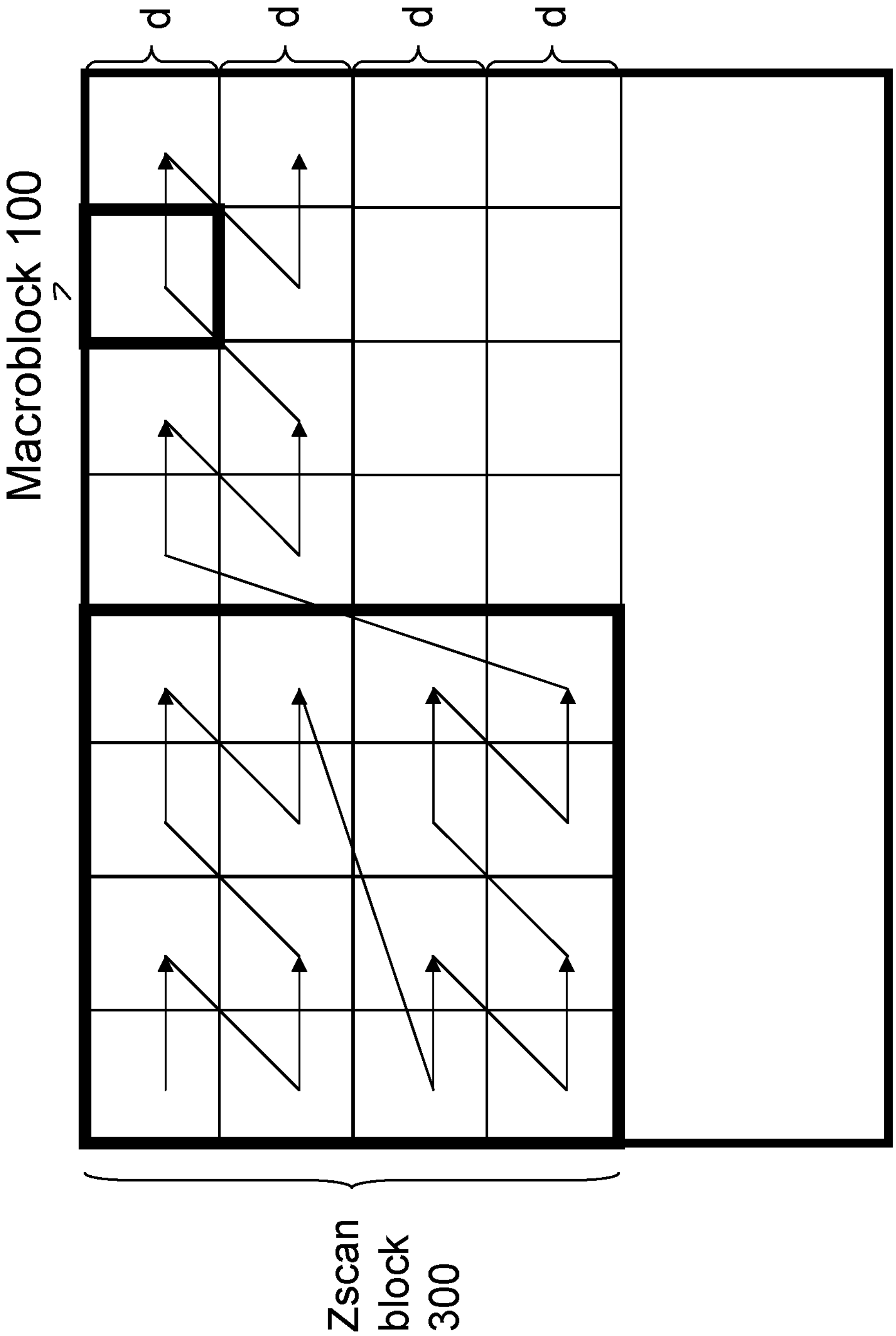

Fig. 6

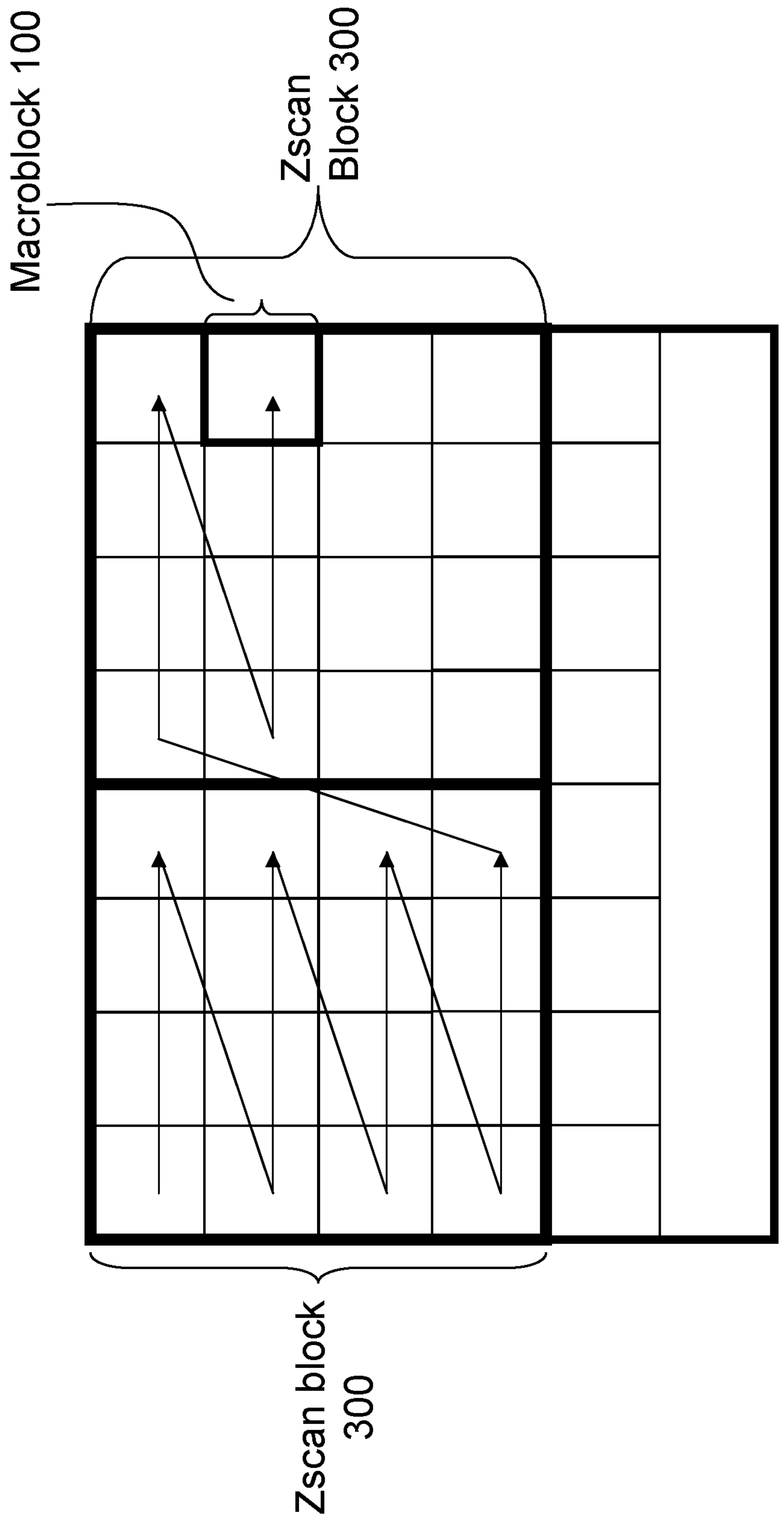

Fig. 7

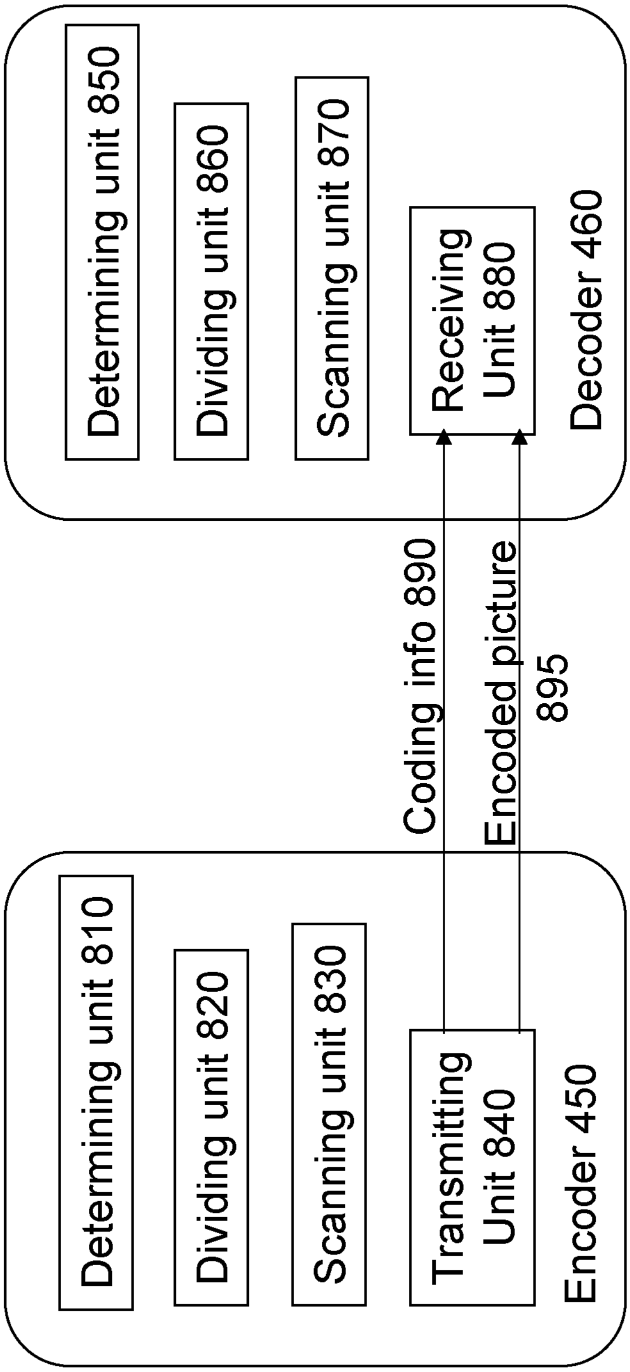
Determining unit 850
Dividing unit 860
Scanning unit 870
Receiving Unit 880
Decoder 460
Coding info 890
Encoded picture 895
Determining unit 810
Dividing unit 820
Scanning unit 830
Transmitting Unit 840
Encoder 450

Fig. 8

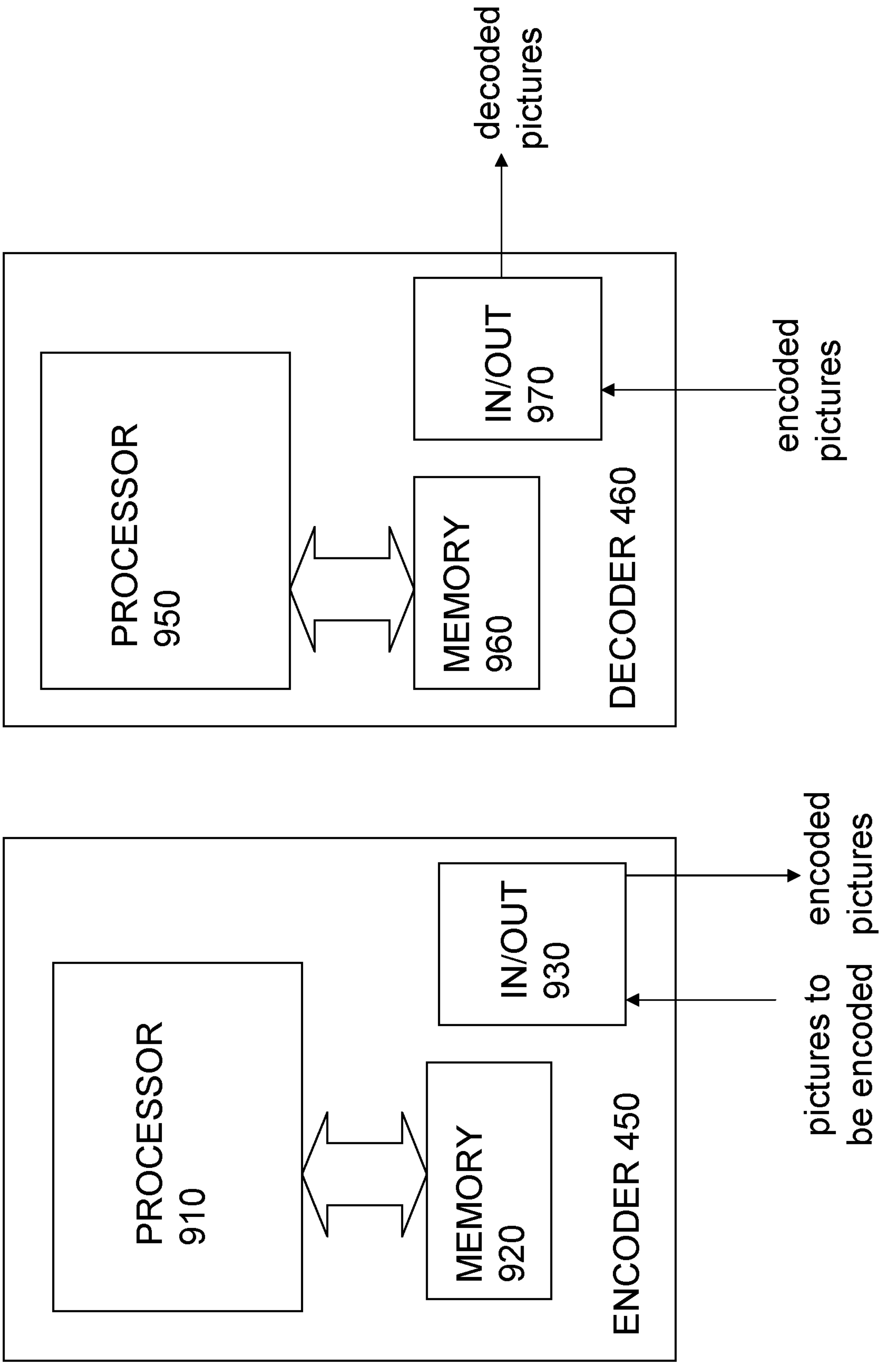
PROCESSOR
910
MEMORY
920
IN/OUT
930
ENCODER 450
pictures to be encoded
encoded pictures
PROCESSOR
950
MEMORY
960
IN/OUT
970
DECODER 460
encoded pictures
decoded pictures

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2012/050285

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/26 H04N7/50
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	UGUR (NOKIA) K ET AL: "Video coding technology proposal by Tandberg, Nokia, and Ericsson", 1. JCT-VC MEETING; 15-4-2010 - 23-4-2010; DRESDEN; (JOINTCOLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-TSG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/,, no. XP030007562, 24 April 2010 (2010-04-24), XP030007563, ISSN: 0000-0049 Sections 2.3, 3.1.1, 3.1.4, 3.2.1 -----	1-36

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2012	02/07/2012

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

Authorized officer
Morbee, Marleen

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2012/050285

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	UGUR (NOKIA) K ET AL: "Description of video coding technology proposal by Tandberg, Nokia, Ericsson", 1. JCT-VC MEETING; 15-4-2010 - 23-4-2010; DRESDEN; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/,, no. JCTVC-A119, 12 April 2010 (2010-04-12) , XP030009029, Sections 2.3 and 2.7 -----	1-36
X,P	WO 2011/046446 A1 (TANDBERG TELECOM AS [NO]; BJOENTEGAARD GISLE [NO]) 21 April 2011 (2011-04-21) the whole document -----	1-36
A	WO 2008/027192 A2 (THOMSON LICENSING [FR]; DIVORRA ESCODA OSCAR [US]; YIN PENG [US]) 6 March 2008 (2008-03-06) the whole document -----	1-36
A	JP 2004 253826 A (MATSUSHITA ELECTRIC IND CO LTD) 9 September 2004 (2004-09-09) abstract; figures 1-5, 11 -----	1-36

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2012/050285

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 2011046446	A1	21-04-2011	NO 331356	B1	12-12-2011
			US 2011110433	A1	12-05-2011
			WO 2011046446	A1	21-04-2011
WO 2008027192	A2	06-03-2008	CN 101507280	A	12-08-2009
			EP 2055108	A2	06-05-2009
			JP 2010502102	A	21-01-2010
			KR 20090057225	A	04-06-2009
			US 2009196517	A1	06-08-2009
			WO 2008027192	A2	06-03-2008
JP 2004253826	A	09-09-2004	NONE		