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(54) **METHOD FOR ENCODING AND DECODING MOVING PICTURE SIGNALS**

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(73) Assignee: **Panasonic Corporation**, Osaka (JP)

(21) Appl. No.: **11/108,885**

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Issued: **Aug. 10, 1999**
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Filed: **Jan. 31, 1996**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G06K 9/36 (2006.01)

(52) **U.S. Cl.** **382/233**; 382/232; 375/E7.222; 375/E7.279

(58) **Field of Classification Search** 382/232–233, 382/236, 248, 250; 348/394.1–396.1, 400.1–403.1, 348/407.1, 409.1, 412.1–416.1, 420.1–421.1, 348/430.1–431.1

See application file for complete search history.

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(57) **ABSTRACT**

A method for encoding and decoding digital moving picture signals which can decode subframes appropriately in relation to time if a part of a bit stream is missing or an error occurs in the bit stream, and can suppress degradation of a reproduced picture if decoding of a subframe including a picture in motion in relation to time becomes unfeasible. In the method for encoding and decoding digital moving picture signals of this invention, information for one frame is encoded correspondingly to a spatial hierarchy of a frame, subframes and blocks. A subframe time position number and a subframe space number are attached to an identifier of each of the subframe, thereby resuming appropriate decoding of the subframes immediately after a trouble if an error occurs. The subframe identifiers are placed at a certain interval in the bit stream so as to give a smaller size to a subframe including a block which is in motion and difficult to be encoded, thereby suppressing degradation of a reproduced picture if decoding of the subframe becomes unfeasible.

9 Claims, 7 Drawing Sheets

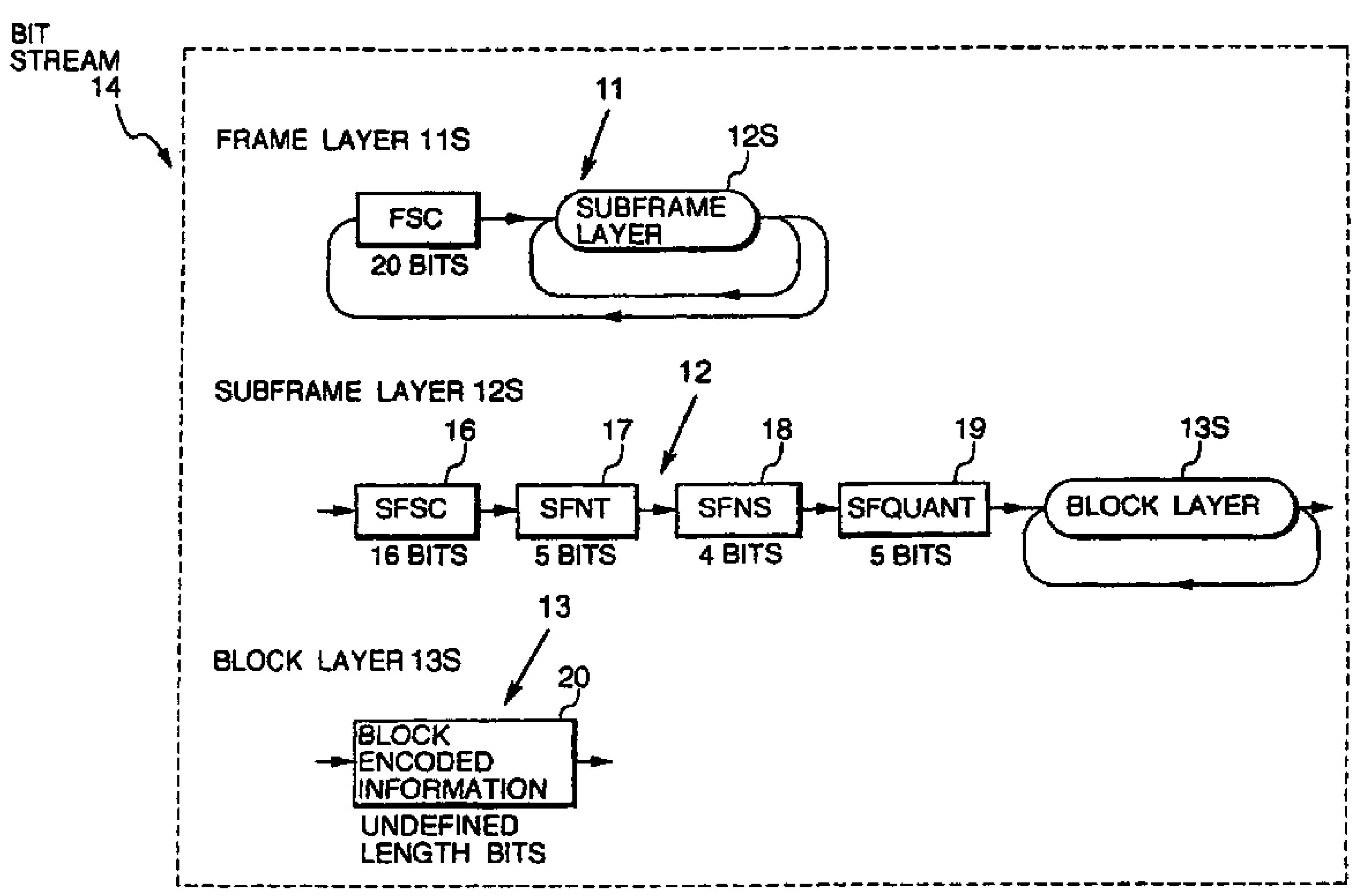

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FIG. 1
PRIOR ART

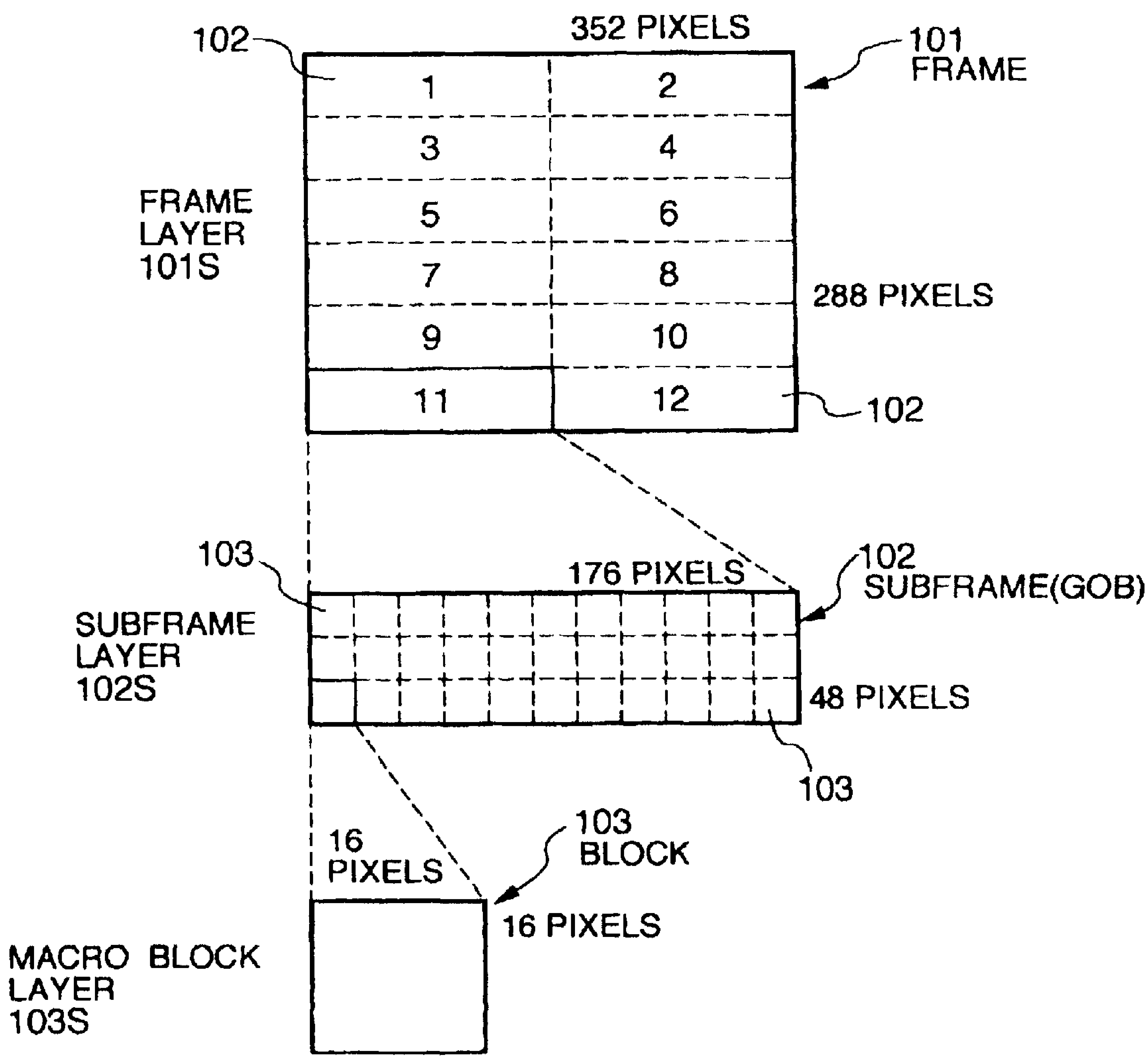


FIG. 2
PRIOR ART

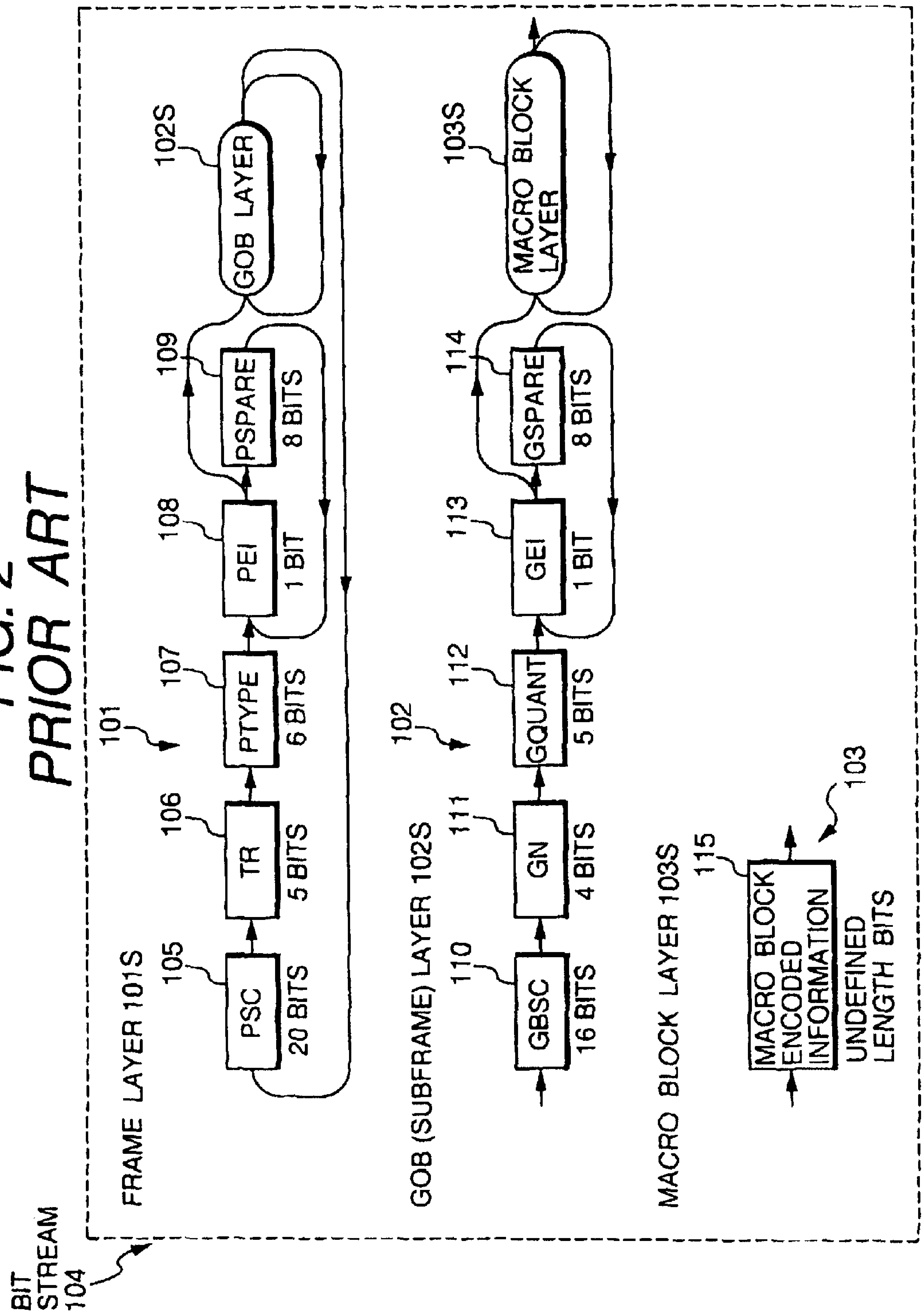


FIG. 3
PRIOR ART

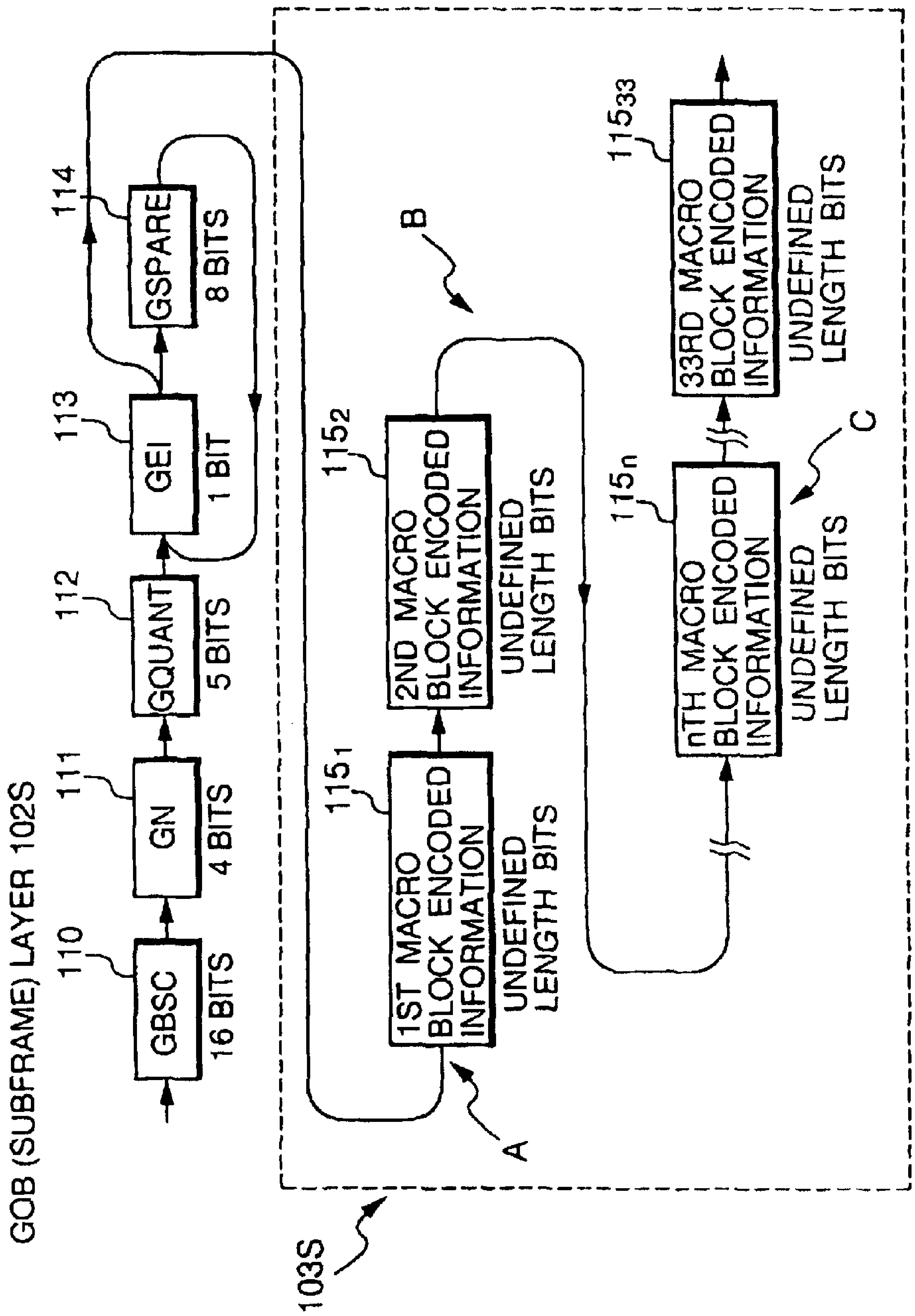


FIG. 4 AMENDED PRIOR ART

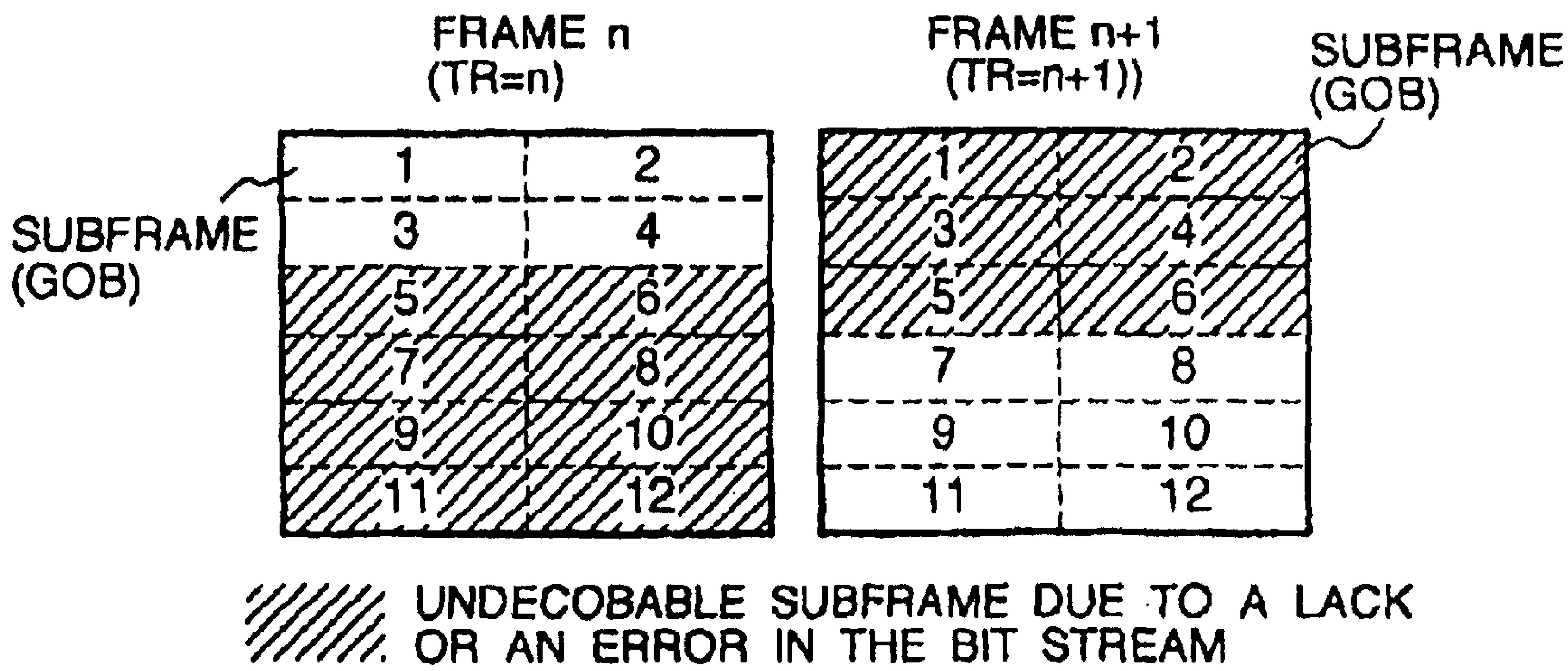


FIG. 5 PRIOR ART

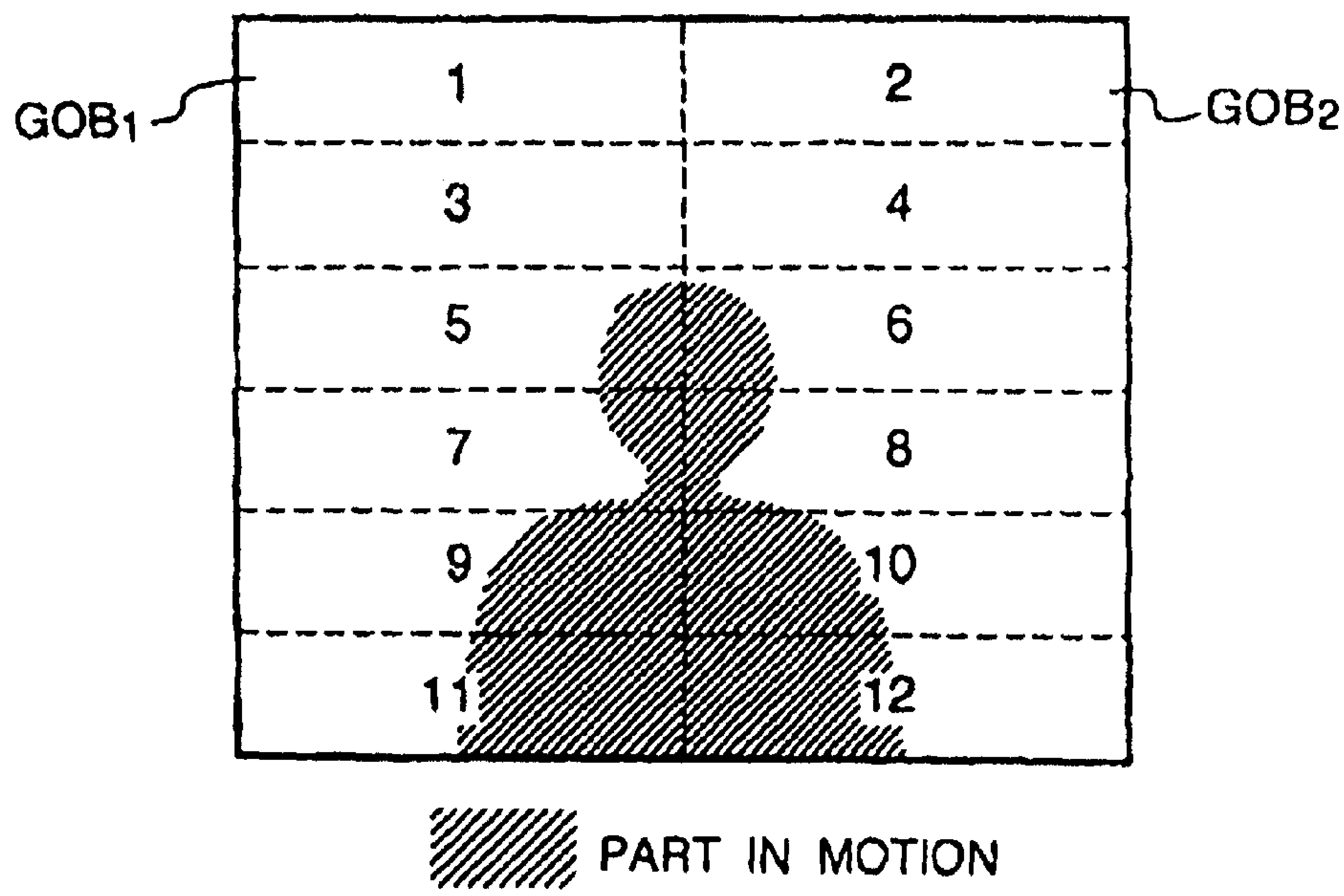


FIG. 6 AMENDED

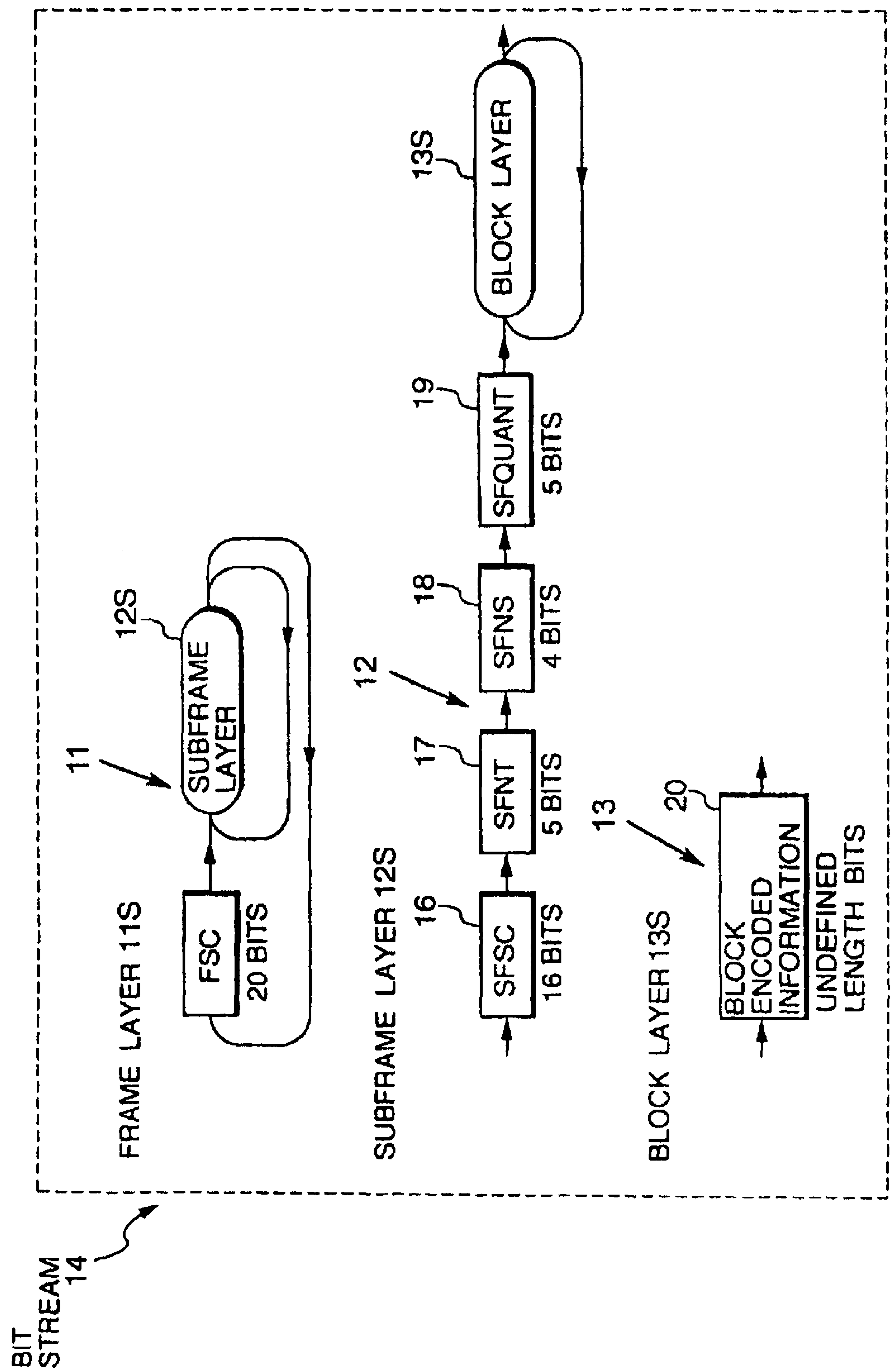


FIG. 7
AMENDED

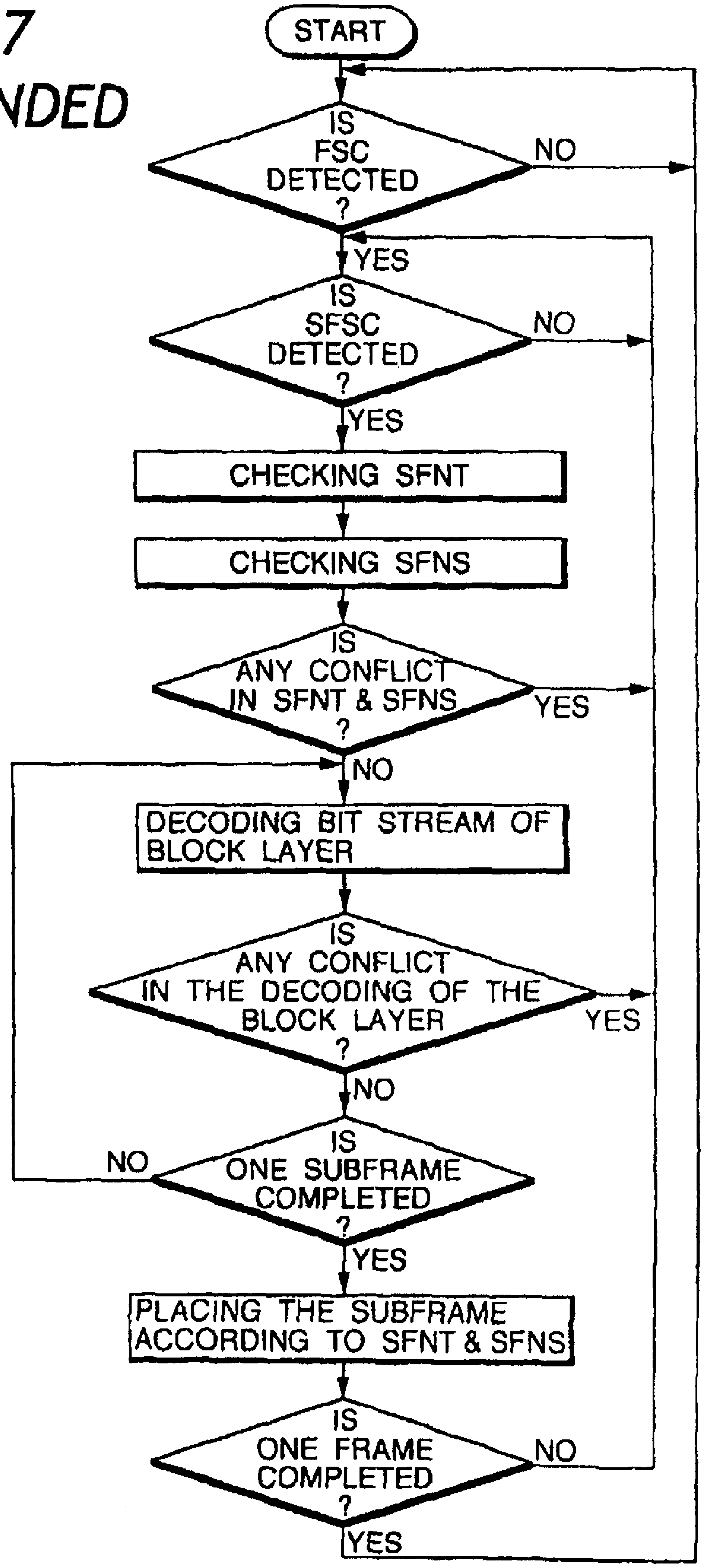


FIG. 8

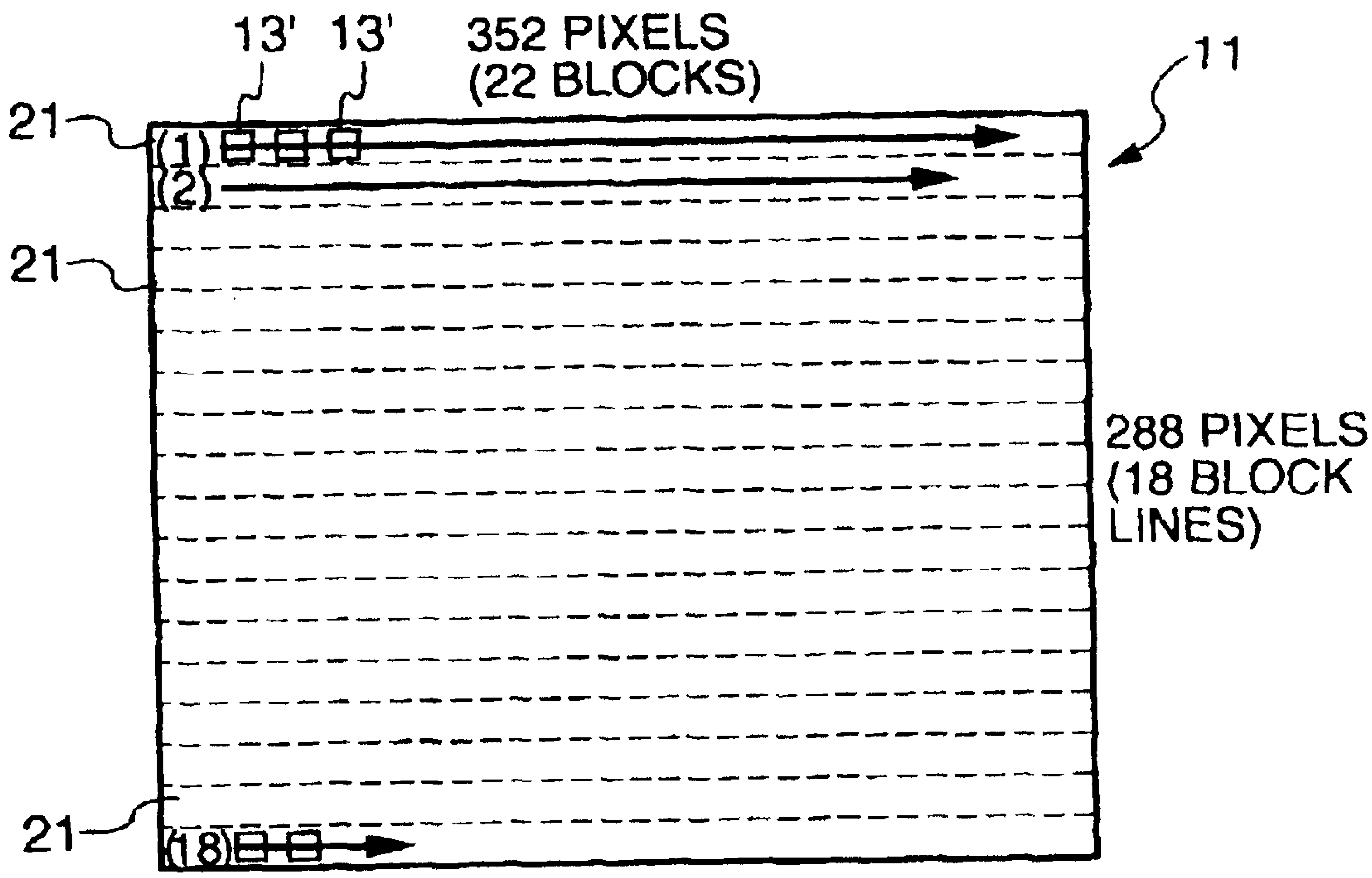
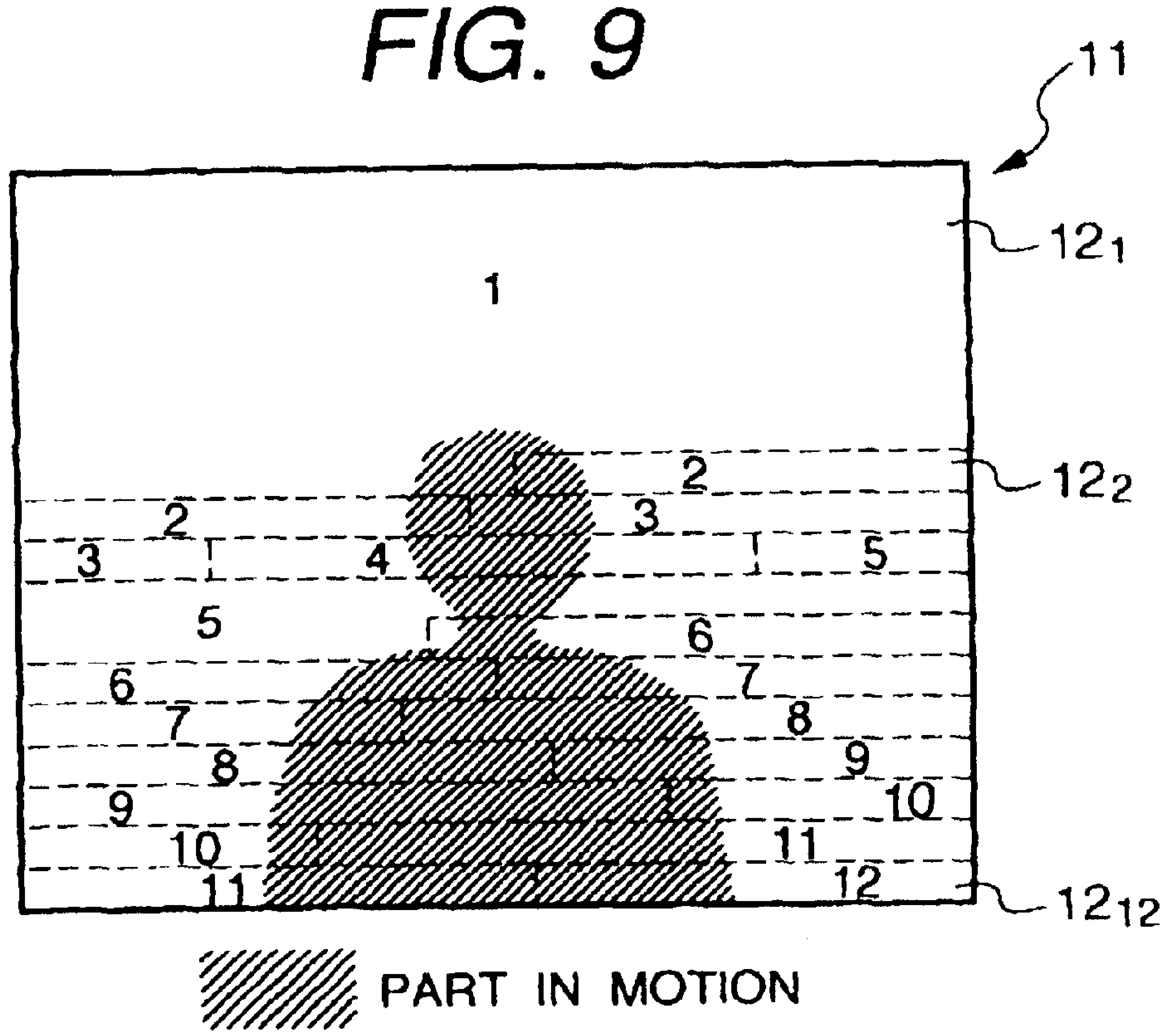

13'
13'
352 PIXELS
(22 BLOCKS)
11
21
(1)
(2)
21
288 PIXELS
(18 BLOCK
LINES)
21
(18)

FIG. 9


11
12_1
1
2
12_2
2
3
3
4
5
5
6
6
7
7
8
8
9
9
10
10
11
11
12
12_{12}
PART IN MOTION

METHOD FOR ENCODING AND DECODING MOVING PICTURE SIGNALS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This application is a continuation of Reissue application Ser. No. 09/925,423, filed on Aug. 10, 2001, now U.S. Pat. No. RE38,726, which is a Reissue application of application Ser. No. 08/594,565, filed Jan. 31, 1996, and which issued as U.S. Pat. No. 5,937,095.

Notice: more than one reissue application has been filed for the reissue of U.S. Pat. No. 5,937,095. The reissue applications are the present reissue application Ser. No. 11/108,885 filed on Apr. 19, 2005, and related reissue application Ser. Nos. 10/662,949 filed on Sep. 16, 2003, 11/108,884 filed on Apr. 19, 2005 and 11/108,883 filed on Apr. 19, 2005, and the original reissue application Ser. No. 09/925,423, filed Aug. 10, 2001, now U.S. Pat. No. Re 38,726. The present reissue application and the related reissue applications are all continuation applications of application Ser. No. 09/925,423.

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a method for encoding and decoding digital moving picture signals for use in TV phones, TV conferences and the like.

(2) Description of the Prior Art

In a general method for encoding digital moving picture signals, a frame of inputted moving picture is divided into plural blocks each composed of N×M pixels, and processes of motion detection, prediction, orthogonal transform, quantization, variable length coding, etc. are conducted on each block.

In a general method for decoding digital motion picture signals, blocks each composed of N×M pixels are regenerated in a reverse **[**procdyre**]** *procedure*, that is, processes of variable length decoding, reverse quantization, reverse orthogonal transform, motion compensation, etc.

The above general encoding method and decoding method for encoding and decoding digital moving picture signals enable removal of redundancy contained in moving picture signals, and efficient communication and storage of a moving picture with less information.

In the general encoding method and decoding method for encoding and decoding digital moving picture signals, the processes are conducted on each pixel block, as stated above. It is general that a set of pixel blocks forms a subframe and a set of subframes forms a frame, which are units processed in the general encoding and decoding method.

Hereinafter, encoding and decoding of each block, subframe and frame will be described by way of an example of a general encoding and decoding method for encoding and decoding digital moving picture signals with reference to ITU-T Recommendation H.261 (hereinafter, referred simply H.261) made on March, 1993.

H.261 defines an encoding method and a decoding method for encoding and decoding luminance signals and color difference signals, separately, of digital moving picture signals. However, description will be made of only the luminance signals, for the sake of convenience. Basically, the encoding method and decoding method for encoding and decoding the luminance signals are not different from those for the color difference signals.

As shown in FIG. **1**, one frame **101** of digital moving picture signals is composed of 352×288 pixels according to H.261. The frame **101** is divided into twelve subframes **102** called GOBs (Group of Blocks) each composed of 176×48 pixels (hereinafter, the subframe in the description of the prior art will be referred a GOB). Further, the GOB **102** (subframe) is divided into thirty three blocks **103** called macro blocks each composed of 16×16 pixels.

The encoding method according to H.261 defines that encoded information for one frame is corresponded to a spatial hierarchical structure such as the frame **101**, GOBs **102** and macro blocks **103** described above, as shown in FIG. **2**.

In FIG. **2**, a part enclosed in a rectangle shows encoded information, and the number of coding bits is shown under each of the rectangles. In FIG. **2**, arrows show linkages of the encoded information. A series of encoded moving picture signal sequences as this is called a bit stream **104**.

In the bit stream **104** according to H.261 shown in FIG. block **103** is called a macro block layer **103**S, a part including all encoded information for one GOB **102** is called a GOB layer **102**S, and a part including all encoded information for one frame **101** is called a frame layer **101**S.

Meanings of the encoded information in each of the layers shown in FIG. **2** are given below:

Frame Layer **101**S

PSC (20 bits): a frame identifier **105**; a unique code by which an encoding method can be always identified, expressed as "0000 0000 0000 0000 0001";

TR (5 bits); a frame number **106**; indicating a time position in which this frame **101** should be displayed;

PTYPE (6 bits): frame type information **107**; various information about the frame **101**;

PE**1** (1 bit): extension data insertion information **108**; a flag representing presence of following PSPARE **109**;

PSPARE (8 bits): extension data; GOB layer **102**S (subframe)

GBSC (16 bits): a GOB identifier **110**; a unique code by which a decoding method can be always identified, expressed as "0000 0000 0000 0000";

GN (4 bits): a GOB number **111**; indicating a spatial position of this GOB **102** within the frame **101**;

GQUANT (5 bits): quantization characteristic information **112**; indicating a quantization characteristic when a macro block **103** in the GOB **102** is encoded;

GE**1** (1 bit): extension data insertion information **113**; a flag representing presence of following GSPARE **114**;

GSPARE (8 bits): extension data **114**.

Incidentally, the encoded information **115** of the macro block layer which is the lowest hierarchy in FIG. **2** is generated in the encoding method of motion detection, prediction, orthogonal transform, quantization, variable length coding, etc., as described before, whose coding bit number is not fixed. The number of coding bits of the macro block layer **103**S, in general, increases if a spatial level of pixels included in the macro block **103** changes largely or a time level of pixels included in the macro block **103** having the same spatial positions changes largely. Such macro block **103** is, hereinafter, referred a macro block **103** which is difficult to be encoded.

To the contrary, if a level of pixels included in the macro block **103** is steady in relation to space and time, the number of coding bits of the macro block layer **103**S remarkably decreases, or sometimes becomes zero. Such macro block **103** is hereinafter referred a macro block **103** which is easy to be encoded.

In the decoding method according to H.261, the PSC **105** which is an identifier of the frame layer **101**S is first found out from the bit stream **104**. Incidentally, in a state where a decodable code has been successfully found out it is said that synchronization is established. When the PSC **105** is found out from the bit stream and synchronization of the frame layer **101**S is established, it can be identified that the bit stream **104** until the next PSC **105** appears is encoded information for one frame. Further, a time position in which the frame **101** composed of 352×288 pixels obtained by decoding the bit stream **104** for that one frame can be obtained by examining the frame number **106** following the PSC **105**.

After the establishment of the frame layer, a GBSC **110** that is an identifier of the GOB layer **102**S is found out from the following bit stream **104** in the encoding method according to H.261. When synchronization of the GBSC layer is established, it can be identified that the bit stream **104** until the next GBSC **110** appears is encoded information for one GOB **102**. Further, a spatial position of the GOB **102** composed of 176×48 pixels obtained by decoding the bit stream **104** for that one GOB **102** in a frame **101**, in which the GOB **102** should be placed, can be obtained by examining a GN **111** which is a GOB number following the GBSC **110**.

In the decoding method according to H.261, a bit stream **104** of a following macro block layer **103**S is decoded after the establishment of the GOB layer **102**s. The decoding method of the macro block layer **103**S is a procedure to regenerate a macro block **103** composed of 16×16 pixels in processes of variable length decoding, reverse quantization, reverse orthogonal transform, motion compensation, etc., as described before. It should be here noted that the macro block layer **103**S has no unique code by which a decoding method can be always identified dissimilarly to the PSC **105** or BGSC **110**, and encoded information of each macro block is composed of undefined length bits of a variable length code.

As shown in FIG. **3**, in the GOB (subframe) layer **102**S, the encoded information from the first macro block **115**, to the thirty third macro block **115**$_{33}$ is expressed as a series of variable length codes without a unique code. If decoding of the macro block encoded information is initiated from a point indicated by A in FIG. **3**, and successively conducted in the order of the first, the second, . . . the nth, . . . the thirty third macro blocks, it is possible to regenerate all the macro blocks **103** in the GOB layer **102**S. However, if the decoding of the macro block encoded information is initiated from a point indicated by B or C in FIG. **3**, it is impossible to identify a point from which encoded information **115** of one macro block starts, which leads to a failure of establishing synchronization. In which case, the decoding and regenerating all macro blocks **103** become unfeasible until the next GBSC **110** appears. In other words, the GBSC **110** also represents a starting point of decoding the macro block layer **103**S.

Finally, in the decoding method according to H.261, the GOB **102** which is a set of regenerated macro blocks **103** is placed in a spatial position within a frame **101** directed by GN **111**, and the frame **100** which is a set of the regenerated GOBs **102** is placed in a time position directed by TR **106**.

As above, it is possible to decode one frame **101** of digital moving picture correctly in relation to space and time according to H.261.

However, the above general method for encoding and decoding digital moving picture signals has a drawback that if a part of a bit stream **104** **[**lacks**]** *is lacking* or an error occurs therein, it might be impossible to accurately decode all subframes (GOBs) **102** in relation to time until synchronization of the next frame layer **101**S is established.

The reason of the above is that codes which can be identified at all times in the bit stream **104** are only the PSC **105** which is a frame identifier and the GBSC **110** which is a subframe identifier in the general decoding method. If a part of the bit stream **104** lacks or an error occurs therein, it is impossible to recover synchronization of the decoding until the next GBSC **110** appears so that the decoding becomes unfeasible. Even if the next GBSC **110** appears, the bit stream **104** of that subframe layer **102**S cannot be correctly decoded in relation to time. This will be understood from FIG. **4**.

FIG. **4** shows an example where the fifth GOB **102**$_5$ in the nth frame **101**n through the sixth GOB **102**$_6$ in the (n+1)th frame **[101**$_{n-1}$**]** *101*$_{n+1}$ cannot be decoded in relation to time due to **[**lacks**]** *lacking portions* or errors of the bit stream **104** occurring in burst. In this example, not only the PSC **105** corresponding to the (n+1)th frame in relation to time but also the following TR **106** are missed or in error. It is therefore possible to correctly decode the GOB **102**$_7$ in relation to space by establishing synchronization from the GBSC **110** corresponding to the seventh GOB **102**$_7$ in the (n+1)th frame **101**$_{n+1}$ in relation to time and decoding the following GN **111**, but impossible to specify whether this GOB **102**$_7$ positions in the nth frame or in the (n+1)th frame in relation to time.

In terms of decoding of the eighth GOB **102**$_8$ through the twelfth GOB **102**$_{12}$ in the (n+1)th frame in relation to time, it is impossible to specify whether these GOBs **102** position in the nth frame or in the (n+1)th frame in relation to time.

In consequence, if a part of the bit stream **104** is **[**missed**]** *missing* or an error occurs therein, it becomes impossible to correctly decode all GOBs **102** in relation to time until synchronization of the next frame layer **101**$_5$ is established.

Further, the general method for encoding and decoding digital moving picture signals has another drawback that if the GOB **102** including a picture in motion in relation to time cannot be decoded, a picture quality of the reproduced picture is largely degraded.

This problem will be described in more detail with reference to FIG. **5**. FIG. **5** shows one frame including decoded signals of a moving picture, where a figure is moving in the center of the frame. In FIG. **5**, a part moving in relation to time is indicated by slanting lines, and the remaining part is a background which is still in relation to time. A scene like this is general in TV conferences, TV telephones or the like.

Referring to FIG. **5**, considering that any one of the first GOB **102**$_1$ through the fourth GOB **102**$_4$ cannot be decoded. The first through fourth GOBs **102**$_1$ through **102**$_4$ include a picture still in relation to time. If the second GOB **102**$_2$ cannot be decoded, for example, a skillful operation is conducted to substitute the second GOB **102**$_2$ of the present frame **101** with the second GOB **102**$_2$ of the preceding frame **101**$_{-1}$ in the decoding. With this operation, degradation of a picture quality in the second GOB **102**$_2$ of the present frame **101** may be hardly detected.

However, it is a problem if decoding of the fifth through twelfth GOBs **102**$_5$ through **102**$_{12}$ shown in FIG. **5** cannot be decoded. The fifth through twelfth **[**GOSs**]** *GOBs* **102**$_5$ through **102**$_{12}$ include a picture moving in relation to time. This means, for example, that a picture in the ninth GOB **102**$_9$ of the preceding frame **101**$_{-1}$ is largely different from the ninth GOB **102**$_9$ of the present frame **101** in relation to time. If the decoding of the ninth GOB **102**$_9$ is unfeasible, degradation of the picture quality of the ninth GOB **102**$_9$ of the present frame **101** is obviously detected even if the skillful operation mentioned above is conducted in the decoding.

Accordingly, if decoding of GOB **102** including a picture moving in relation to time becomes unfeasible, a quality of a reproduced picture is largely degraded.

SUMMARY OF THE INVENTION

In the light of the above problems, an object of the present invention is to provide a method for encoding and decoding digital moving picture signals, which can appropriately decode subframes (GOBs) following a subframe in trouble in relation to time if a part of a bit stream is missing or an error occurs in the bit stream.

Another object of the present invention is to provide a method for encoding and decoding digital moving picture signals, which can suppress degradation of a reproduced picture to a small extent if decoding of a subframe (GOB) including a picture in motion in relation to time becomes unfeasible.

To accomplish the first object, the present invention is featured in that in the method for encoding and decoding digital moving picture signals of this invention, time position information representing an order of displaying a [subframe to an identifier] *subframe is attached to an identifier* of the subframe by which the subframe is identified.

According to the method for encoding and decoding digital moving picture signals of this invention, time position information representing an order of displaying a subframe is attached to an identifier used to identify the subframe and the identifier of the subframe is encoded. It is therefore possible to decode subframes following a subframe in trouble appropriately in relation to time if a part [of bit stream] *of a bit stream* is missing or an error occurs in the bit stream by using the time position information representing an order of displaying each of the subframes attached to an identifier used to identify the subframe.

To accomplish the second object, the present invention is featured in that in the method for encoding and decoding digital moving picture signals of this invention, the number of blocks included in a subframe is varied according to a sum of quantities of generated information of the blocks included in the subframe so that each of all the subframes included in the frame has an equal sum of quantities of the generated information of the blocks included in the subframe.

According to the method for encoding and decoding digital moving picture signals of this invention, the number of blocks included in a subframe is varied according to a sum of quantities of generated information of the blocks included in the subframe so that each of all the subframes included in the frame has an equal sum of quantities of the generated information of the blocks included in the subframe. In consequence, a spatial size of each subframe is not fixed. A subframe including a block having a large number of coding bits is in a smaller size, whereas a subframe including a block having a small number of coding bits is in a larger size. It is therefore possible to suppress degradation of a reproduced picture even if decoding of a subframe becomes unfeasible since a subframe including a block which includes a motion in relation to time and is difficult to be encoded is in a smaller size in relation to space.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows units to be encoded in a general encoding method for encoding moving picture signals;

FIG. **2** shows a bit stream generated in the general encoding method for encoding moving picture signals;

FIG. **3** shows a GOB layer in the bit stream in FIG. **2** generated in the general encoding method for encoding moving picture signals;

FIG. **4** illustrates an effect of a lack or an error of a part of a bit stream occurring in the general encoding and decoding method for encoding and decoding moving picture signals;

FIG. **5** illustrates an effect of a lack or an error of a part of a bit stream occurring in the general encoding and decoding method for encoding and decoding moving picture signals;

FIG. **6** shows a bit stream generated in a method for encoding digital moving picture signals according to first and second embodiments of this invention;

FIG. **7** is a flowchart illustrating the method for decoding digital moving picture signals according to the first embodiment of this invention;

FIG. **8** illustrates the method for encoding digital moving picture signals according to the second embodiment of this invention; and

FIG. **9** shows a structure of subframes according to the second embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, description will be made of embodiments according to the present invention referring to the drawings.

A method for encoding and decoding digital moving picture signals according to a first embodiment will be now described, which may correctly decode a subframe as a unit in relation to time even if a part of a bit stream is missing or an error occurs therein.

In the encoding method according to this embodiment, one frame of digital motion picture signals is composed of, for example, 352×288 pixels. The frame is divided into twelve subframes each composed of, for example, 176×48 pixels. Further, the subframe is divided into thirty three blocks **13** each composed of, for example, 16×16 pixels.

The encoding method according to this embodiment corresponds encoded information for one frame to a spatial hierarchical structure made up of a frame **11**, subframes **12** and blocks **13** to generate a bit stream **14** as shown, for example, in FIG. **6**.

Meanings of encoded information of each layer shown in FIG. **6** are given below: Frame layer **11S**

FSC (20 bits): a frame identifier **15**; a unique code by which a decoding method can be always identified, expressed as “0000 0000 0000 0001 0000”;

Subframe Layer **12S**

SFSC (16 bits): a subframe identifier **16**; a unique code by which a decoding method can be always identified, expressed as “0000 0000 0000 0001”;

SFNT (5 bits): a subframe time number **17**; indicating a time position in which this subframe **12** should be displayed;

SFNS (4 bits): a subframe space number **18**; indicating a spatial position in which the subframe **12** should be displayed;

SFQUANT (5 bits): quantization characteristic information **19**; representing a quantization characteristic when a block **13** in the subframe **12** is encoded.

Incidentally, encoded information **20** in the block layer **13S** which is the lowest hierarchy in FIG. **6** is generated in an encoding method of motion detection, prediction, orthogonal transform, quantization, variable length coding, etc., whose coding bit number are not fixed.

Now referring to FIG. **7**, a decoding method according to this embodiment will be now described. First, an FSC **15** which is an identifier of a frame layer **11S** is found out from a bit stream **14** to establish synchronization of the frame layer **11S**.

After the establishment of synchronization of the frame layer **11S**, an SFSC **16** which is an identifier of a subframe layer **12S** is found out from the following bit stream **14** to establish synchronization of the subframe layer **12**S. Then a subframe time number SFNT **17** and a subframe space number SFNS **18** following the SFSC **16** are examined. Next, a bit stream **14** of a block layer **13**S is decoded. A method for decoding this block layer **13**S is a procedure to regenerate the block in processes of, for example, variable length decoding, reverse quantization, reverse orthogonal transform, motion compensation, etc. Finally, the subframe **12** which is a set of the regenerated blocks **13** is placed in time and space positions instructed by the SFNT **17** and the SFNS **18**. If synchronization of the decoding is lost due to a lack of a part of the bit stream **14** or an error therein, a seek for the SFSC **16** which is an identifier of the subframe layer **12**S is started. A lack **[**or an error of**]** *of a portion of, or an error in,* the bit stream **14** can be detected from, for example, that a decoded value exceeds a range specified in advance or an unexpected code word appears when the bit stream **14** is decoded. When the SFSC **16** is detected and synchronization of the subframe layer **12**S is established, the SFNT **17** and the SFNS **18** are examined as stated above, the block layer **13**S is decoded and regenerated, and the subframe **12** which is a set of the regenerated blocks **13** is placed in time and space positions instructed by the SFNT **17** and the SFNS **18**.

According to the first embodiment of this invention, if a part of the bit stream **14 [**lacks**]** *is lacking* or an error occurs in the bit stream **14**, synchronization of the decoding is lost and the decoding becomes unfeasible, but correct decoding becomes possible immediately after a subframe **12** in trouble.

As having been described the above first embodiment by way of an example, it is alternatively possible that the frame **11**, the subframe **12** and the block are in different sizes and shapes. A bit length of each encoded information may be different from that of the above encoded information, or the frame layer **19** may be omitted, in addition.

According to a second embodiment of this invention, description will be now made of a method for encoding digital moving picture signals which can suppress degradation of a reproduced picture to a small extent if a subframe including a picture moving in relation to time cannot be decoded. Incidentally, it is possible here to employ a decoding method similar to that of the first embodiment.

In the encoding method of this embodiment, one frame **11** of digital moving picture signals is composed of, for example, 352×288 pixels. The frame **11** is divided into blocks each composed of 16×16 pixels. In other words, one frame **11** is composed of 22 blocks×18 block lines **21**. The block line **21** corresponds to the subframe **12** mentioned above.

In the encoding method of this embodiment, each block **13'** is encoded from the uppermost block line **21**, as shown in FIG. **8**, to generate encoded information. The encoded information of each block **13'** is generated in an encoding method of, for example, motion detection, prediction, orthogonal transform, quantization, variable length coding, etc., the number of coding bits of which is not fixed. More specifically, the number of coding bits of a block **13'** which is difficult to be encoded is large, whereas the number of coding bits of a block **13'** which is easy to be encoded is small. In the encoding method of this embodiment, a set of blocks **13** or **13'** composes a subframe **12** (or a block line **21**) which is a unit of encoding, but the number of blocks **13** or **13'** included in one subframe **12** or **12'** is not fixed.

A manner of generating a bit stream **14** in the encoding method of this embodiment and a structure of a subframe layer **12**S will be now described with reference to FIG. **6**. When one frame is encoded, an identifier of a frame layer is encoded, and an FSC **15** is placed in a bit stream **14**. Next, the identifier of the subframe layer **12**S, a time number and a space number of that subframe, and a quantization characteristic of that subframe are encoded together, and code words of an SFSC **16**, an SFNT **17**, an SFNS **18** and an SFQUANT **19** are placed in the bit stream **14**. At the same time, block coding bit number integrated value B-add is set to zero. Following that, a block **13** is encoded and encoded information of the block **13** composed of variable codes is placed in the bit stream **14**. Concurrently, the coding bit number B of this block **13** is added to B-add. Namely, an equation, B-add=B-add+B, is computed. Similarly, blocks **13** are encoded successively, encoded information **20** of each block **13** is placed in the bit stream **14**, and a calculation of B-add=B-add+B is repeated each time. If the B-add exceeds a subframe interval SFd when encoding of a certain block **12** is completed, an identifier of the subframe, a time number and a space number of that subframe and a quantization characteristic of that subframe are encoded, and code words of an SFSC **16**, an SFNT **17**, an SFNS and an SFQUANT **19** are placed in the bit stream **14**. At the same time, a block coding bit integrated value B-add is set to zero. In other words, a new subframe layer **12**S is started to be formed from that point.

The subframe interval SFd is set to, for example, 540 bits. Therefore, if one frame is encoded with, for example, 6400 bits in the encoding method of this embodiment, 12 subframes **12** exist in one frame since 6400/540=11.85.

In the encoding method according to this embodiment, the number of blocks **13** included in a subframe **12** is varied according to a quantity of generated information of the blocks included in one subframe, thereby varying a spatial size of the subframe **12**, as stated above. More specifically, a subframe **12** including a block which is difficult to be encoded becomes small, whereas a subframe **12** including a block **13** which is easy to be encoded becomes large. FIG. **9** shows an example of a structure of subframes formed in the encoding method of this embodiment.

According to the second embodiment of this invention, a subframe **12** including a block **13** which contains a motion in relation to time, and is thus difficult to be coded is made smaller in relation to space. If such subframe **12** cannot be decoded, it is possible to suppress degradation of a quality of a reproduced picture to a small extent. In a region within a frame in which no motion in relation to time exists and degradation of the picture quality is hardly detected even if the decoding is unfeasible, a size of one subframe is large in relation to space, which allows a less volume of side information such as the subframe identifier SFSC **16**, subframe number SFNT **16** and subframe number SFNT **17**. This can prevent an encoding efficiency from being lowered.

As having been described the second embodiment by way of an example, it is alternatively possible that the frame **11**, subframe **12** and the block **13** are in different sizes and shapes. It is also possible to employ values of a quantity of codes of one frame and a subframe interval SFD different from those employed in the above example.

As obvious from the above embodiments, this invention enables correct decoding of each subframe **12** as a unit in relation to time even if a part of the bit stream **14** is missing or an error occurs therein.

Further, according to this invention, it is possible to suppress degradation of a quality of the reproduced picture to a small extent if a subframe **13** including a block which is in motion in relation to time cannot be decoded.

Still further, in a region within a frame in which no motion in relation to time exists and degradation of a quality of the reproduced picture quality is hardly detected even if the decoding is unfeasible, side information of the region is allowed to be in a small volume so that it is possible to prevent an encoding efficiency from being lowered.

What is claimed is:

[1. A method for encoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded;

setting an identifier to said subframe to identify said subframe; and

specifying a frame to which said subframe belongs by adding to said identifier time position information representing an order of displaying said subframe;

encoding said time position information along with said subframe, and

multiplexing said encoded time position information and a bit stream of said encoded subframe to transmit said encoded time position information and said bit stream.**]**

2. A method for encoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded; and

varying **[**the**]** *a* number of said blocks included in said subframe according to a quantity of information generated by encoding each block to vary a spatial size of each of said subframes included in each frame.

3. A method for encoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded;

setting an identifier to said subframe to identify said subframe;

specifying a frame to which said subframe belongs by adding **[**to said identifier**]** time position information *to said identifier, the time position information* representing an order of displaying said subframe;

encoding said time position information along with said subframe; and

multiplexing said encoded time position information and a bit stream of said encoded subframe to transmit said encoded time position information and said bit stream; **[**and**]**

[varying the**]** *wherein a* number of said blocks included in said subframe *is varied* according to a quantity of information generated by encoding each block to vary a spatial size of each of said subframes included in each frame.

4. The method for encoding digital motion picture signals of a frame according to claim **2**, wherein each of said subframes included in said frame has an equal sum of quantities of generated information of said blocks included in said subframe.

5. The method for encoding digital motion picture signals of a frame according to claim **3**, wherein each of said subframes included in said frame has an equal sum of quantities of generated information of said blocks included in said subframe.

[6. A method for encoding and decoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded;

setting an identifier to said subframe to identify said subframe;

specifying a frame to which said subframe belongs by adding to said identifier time position information representing an order of displaying said subframe;

encoding said time position information along with said subframe;

multiplexing said encoded time position information and a bit stream of said encoded subframe to transmit said encoded time position information and said bit stream; and

decoding each of said subframes appropriately in relation to time by decoding and using said time position information to form said frame of said digital moving picture signals.**]**

7. A method for encoding and decoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded;

varying the number of said blocks included in said subframe according to a quantity of information generated by encoding each block to vary a spatial size of each of said subframes included in each frame; and

decoding each of said subframes to form said frame of said digital moving picture signal.

8. A method for encoding and decoding digital motion picture signals of a frame, comprising the steps of:

dividing said frame into plural blocks each including N×M pixels;

forming a subframe composed of a set of said blocks, said subframe being a unit to be encoded,

setting an identifier to said subframe to identify said subframe;

specifying a frame to which said subframe belongs by adding **[**to said identifier**]** time position information *to said identifier, the time position information* representing an order of displaying said subframe;

encoding said time position information along with said subframe;

multiplexing said encoded time position information and a bit stream of said encoded subframe to transmit said encoded time position information and said bit stream; *and*

[varying the number of said blocks included in said subframe according to a quantity of information generated by encoding each block to vary a spatial size of each of said subframes included in each frame; and**]**

decoding said subframe appropriately in relation to time by decoding and using said time position information to form said frame of said digital moving picture signal*,*

wherein a number of said blocks included in said subframe is varied according to a quantity of information generated by encoding each block to vary a spatial size of each said subframe included in each frame.

9. The method for encoding and decoding digital motion picture signals of a frame according to claim **7**, wherein each of said subframes included in said frame has an equal sum of quantities of generated information of said blocks included in said subframe.

10. The method for encoding and decoding digital motion picture signals of a frame according to claim **8**, wherein each of said subframes included in said frame has an equal sum of quantities of generated information of said blocks included in said subframe.

[**11**. The method for encoding digital motion picture signals of a frame according to claim **1**, wherein said step of adding time position information comprises adding the time information to each subframe of said frame.]

[**12**. The method for encoding digital motion picture signals of a frame according to claim **11**, further comprising the step of maintaining substantially constant a quantity of information generated for each subframe within said frame thereby to vary spatial dimensions represented by each said subframe.]

[**13**. The method for encoding digital motion picture signals of a frame according to claim **1**, further comprising the step of maintaining substantially constant a quantity of information generated for each subframe within said frame thereby to vary spatial dimensions represented by each said subframe.]

[**14**. The method for encoding and decoding digital motion picture signals of a frame according to claim **6**, wherein said step of adding time position information comprises adding the time information to each subframe of said frame.]

[**15**. The method for encoding digital motion picture signals of a frame according to claim **14**, further comprising the step of maintaining substantially constant a quantity of information generated for each subframe within said frame thereby to vary spatial dimensions represented by each said subframe.]

[**16**. The method for encoding digital motion picture signals of a frame according to claim **6**, further comprising the step of maintaining substantially constant a quantity of information generated for each subframe within said frame thereby to vary spatial dimensions represented by each said subframe.]

17. A method for decoding an encoded bitstream, said method comprising:

(*a*) *receiving said encoded bitstream containing an identifier, an encoded subframe obtained by encoding a subframe composed of at least one of said blocks, and an encoded time position information representing an order of displaying said subframe, wherein said identifier is set to said encoded subframe to identify said subframe, said encoded time position information is added to said identifier by specifying a frame to which said subframe belongs, a number of blocks included in said subframe being varied according to a quantity of information generated by encoding each block in order to vary a spatial size of each of said subframes included in each frame;*

(*b*) *detecting said identifier to extract said encoded time position information from said encoded bitstream;*

(*c*) *decoding said extracted encoded time position information to obtain decoded time position information; and*

(*d*) *decoding said encoded subframe to form said frame according to said decoded time position information.*

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