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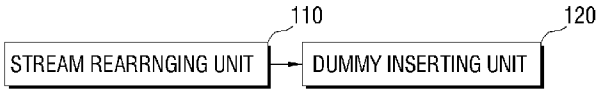
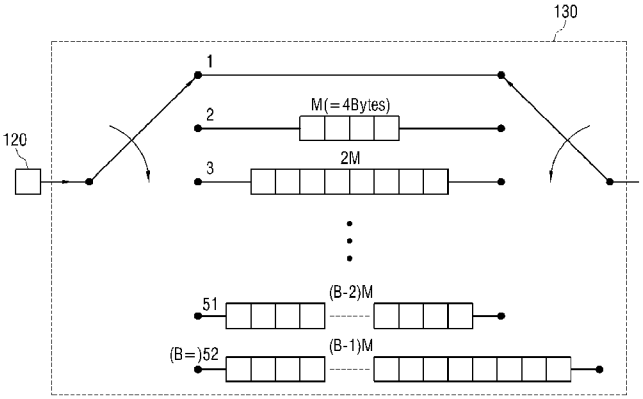
[Continued on next page]

(54) Title: DEVICE FOR PROCESSING STREAMS AND METHOD THEREOF

[Fig. 1]



[Fig. 2]



(57) Abstract: A device for processing streams is disclosed. The device includes a stream arranging unit which stacks and rearranges streams, and a dummy inserting unit which inserts a dummy into the rearranged streams. The device may further include a convolutional interleaver which interleaves the stream with a dummy or an RS encoder and a CRC encoder. This enhances the stability of digital broadcasting services.

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Description

DEVICE FOR PROCESSING STREAMS AND METHOD THEREOF

Technical Field

[1] The present invention relates to a device for processing streams and a method thereof, and more particularly, to a device for processing streams to interleave the streams with a dummy, and a method thereof.

Background Art

[2] With the development of electronic and communication technologies, digital technologies have been introduced into the field of broadcasting systems, and diverse standards for digital broadcasting have been published. Specifically, these standards include the Advanced Television Systems Committee (ATSC) Vestigial Sideband (VSB) standard that is used as a digital terrestrial broadcasting standard in North America, and the Digital Video Broadcasting-Terrestrial (DVB-T) standard that is used as a digital terrestrial broadcasting standard in Europe.

[3] The ATSC VSB transmission method used in North America is based on the National Television System Committee (NTSC) frequency band, and is advantageous in that a transmitter and receiver can be implemented easily and economically. Such an ATSC VSB transmission method uses a single carrier amplitude modulation vestigial side band (VSB), and is able to transmit high quality video, audio, and auxiliary data at a single 6MHz bandwidth.

[4] Diverse standards for digital broadcasting have been proposed so as to provide improved digital broadcasting services.

[5] Accordingly, there is a need for technologies for more effectively and stably processing streams.

Disclosure of Invention

Technical Problem

[6] The present invention is proposed in order to solve the above problem. An object of the present invention is to provide a device for processing streams capable of processing streams efficiently and stably, a method thereof, and a digital broadcasting receiver receiving the processed streams.

Technical Solution

[7] In order to accomplish the above object, according to one embodiment of the present invention, there is provided a device for processing streams, the device comprising a stream rearranging unit which stacks and rearranges streams; and a dummy inserting unit which inserts a dummy into the rearranged streams.

[8] The interleaver may be a convolutional interleaver.

[9] The stream rearranging unit may vertically stack the streams according to the number of streams preset for each unit and rearrange the streams by perpendicularly rotating the stacked streams for each unit.

[10] The stream rearranging unit may divide the respective streams for each unit into blocks having a preset size and perform perpendicular rotation on the respective streams in each block.

[11] The dummy inserting unit may insert dummy corresponding to the size of the memory in the interleaver into the streams rotated in each block.

[12] The device for processing streams may further comprise a dummy removing unit which removes the dummy from the streams output from the interleaver; and a burst generating unit which collects the streams from which the dummy has been removed in bursts.

[13] According to another embodiment of the present invention, the stream rearranging unit may rearrange the streams so as to be horizontally arranged according to a preset first size unit, and vertically stacking the streams.

[14] The device for processing streams may further comprise an RS encoder which adds an RS parity vertically to an end portion of the stream; and a CRC encoder which adds a CRC value horizontally to an end portion of the stream to which the RS parity is added.

[15] The dummy inserting unit may divide the stacked streams into transmission bursts having a preset second size unit, and add a dummy matching the size of the transmission burst into a stream, in which a transmission burst is not performed.

[16] The streams input into the stream rearranging unit may be divided into packet to which the parity is added.

[17] According to one embodiment of the present invention, there is provided a method of processing streams, the method comprising stacking and rearranging streams, and inserting a dummy into the rearranged streams.

[18] The interleaving the streams may comprise using a convolutional interleaver.

[19] The stacking and rearranging the streams may comprise vertically stacking the streams according to the number of streams preset for each unit, and rearranging the streams by perpendicularly rotating the stacked streams for each unit.

[20] The rearranging the streams by perpendicularly rotating the stacked streams for each unit may comprise dividing the respective streams for each unit into blocks having a preset size and performing perpendicular rotation on the respective streams in each block.

[21] The inserting the dummy may comprise inserting a dummy corresponding to the size of the memory of the convolutional interleaver into the streams rotated in each block.

[22] The method of processing streams may further comprise removing the dummy from the interleaved streams, and collectingthe streams from which the dummy has been removed in bursts.

[23] According to another embodiment of the present invention, the rearranging the streams may comprise horizontally arranging the streams according to a preset first size unit and vertically stacking the streams.

[24] The method of processing streams may further comprise performing RS encoding, the RS encoding adding an RS parity vertically to an end portion of the stream; and performing CRC encoding, the CRC encoding adding a CRC value horizontally to an end portion of the stream to which the RS parity is added.

[25] The inserting the dummy may comprise dividing the stacked streams into transmission bursts having a preset second size unit, and adding a dummy matching the size of the transmission burst into the streams, in which one transmission burst is not performed.

[26] The rearranging the streams may comprise rearranging the streams divided into packets to which the parity is added.

[27] According to one embodiment of the present invention, there is provided a digital broadcasting receiver comprising a tuner which receives streams; a demodulator which demodulates the received streams; an equalizer which equalizes the demodulated streams; and a deinterleaver which deinterleaves the equalized streams, wherein the streams are stacked and rearranged in a preset unit on the side of a digital broadcasting transmitter, and are processed by inserting a dummy thereinto.

[28] The streams may be convolutionally interleaved on the side of the digital broadcasting transmitter andthe dummy may be removed therefrom.

[29] The digital broadcasting receiver may further comprise a dummy removing unit which removes the dummy inserted into the streams, wherein the streams are block-interleaved on the side of the digital broadcasting transmitter and the dummy is inserted thereinto.

Advantageous Effects

[30] With a device for processing streams, a method thereof, and a digital broadcasting receiver according to the diverse forms of embodiments of the present invention, streams can be transmitted/received efficiently and stably.

[31] [Brief Description of the Drawings]

[32] FIG. 1 is a block diagram showing a configuration of a device of processing streams according to one embodiment of the present invention;

[33] FIG. 2 is a schematic block diagram showing the device of processing streams of FIG. 1 to which a convolutional interleaver is added;

[34] FIGS. 3 to 6 are schematic block diagrams explaining stream processing operation of a device of processing streams using a convolutional interleaver;

[35] FIG. 7 is a block diagram showing one example of a detailed configuration of the device of processing streams of FIG. 1;

[36] FIG. 8 is a schematic block diagram showing one example of a configuration of streams from which the dummy has been removed;

[37] FIG. 9 is a block diagram showing a configuration of a device of processing streams according to another embodiment of the present invention;

[38] FIGS. 10 and 11 are schematic block diagrams explaining the stream processing operation of a device of processing streams of FIG. 9;

[39] FIG. 12 is a flowchart explaining a method of processing streams according to one embodiment of the present invention; and

[40] FIGS. 13 and 14 are block diagrams showing a configuration of a digital broadcasting receiver according to diverse embodiments of the present invention.

Best Mode for Carrying Out the Invention

[41] Hereinafter, preferred embodiments of the present invention will be described with reference to the accompanying drawings.

[42] FIG. 1 is a block diagram showing a configuration of a device of processing streams according to one embodiment of the present invention. Referring to FIG. 1, the device of processing streams includes a stream rearranging unit 110 and a dummy inserting unit 120.

[43] The stream rearranging unit 110 stacks and rearranges input streams. Rearrangement methods may vary according to the embodiment.

[44] The inserting unit 120 inserts a dummy into the streams rearranged by the stream rearranging unit 110. The dummy means data inserted so that the rearranged streams can be distinguished by a preset processing unit or transmission unit. The dummy may use optional data with no meaning, for example, a preset bit value such as 0 bits, or a preset byte value. The dummy may also use meaningful data. For example, when there are diverse forms of data to be transmitted supplementarily, for example, data such as supplementary reference signals or supplementary channel information, the corresponding data may be used as a dummy.

[45] The stream rearranging unit 110 may stack the streams in preset units. For example, the stream rearranging unit 110 may horizontally arrange the stream in packet or segment and then arrange the stream in the next packet or segment on the following line of the stream to vertically stack the streams.

[46] An interleaver may be added to a rear end of the dummy inserting unit 120 of FIG. 1.

[47] FIG. 2 is a schematic block diagram showing the device of processing streams of

FIG. 1 to which an interleaver is added.

[48] As shown in FIG. 2, an interleaver 130 implemented as a convolutional interleaver may be provided on a rear end of the dummy inserting unit 120. More specifically, the interleaver 130 may be implemented as a convolutional byte interleaver that processes the streams in bytes. The convolutional interleaver of FIG. 2 may be implemented to have different branch number and memory size according to the sort of transceiver used.

[49] When the interleaver 130 is implemented as a convolutional byte interleaver, the interleaver 130 includes a plurality of shift registers having different lengths. In other words, shift registers having sizes M, 2M, ... (B-2)M, (B-1)M are arranged in sequence. The interleaver 130 selects the respective shift registers in sequence to make the interleaving intervals different.

[50] Referring to FIG. 2, the streams input to the interleaver 130 are divided into bytes and stored in the plurality of shift registers in sequence, and are then output again in sequence. Interleaving in bytes is performed in this manner.

[51] For example, when the input streams are divided into a plurality of fields, each of which comprises 312 data segments or packets, the interleaver 130 may be implemented to operate using blocks of 52 data segments or packets.

[52] FIGS. 3 to 6 are schematic block diagrams explaining a stream processing operation of a device of processing streams when a convolutional interleaver is used as the interleaver 130.

[53] Referring to FIG. 3, a stream rearranging unit 110 stacks streams sequentially in blocks of preset numbers of packets. For example, the stream rearranging unit 110 may stack the streams in blocks of six packets. Each packet may have a form including 188 bytes of data and a 20-byte parity. The stream rearranging unit 110 may rotate perpendicularly and rearrange the respective vertically stacked stream units.

[54] In this case, as shown in FIG. 3, the stream rearranging unit 110 may divide the plurality of stacked packets into a plurality of blocks again. In this case, six packets may be divided into four blocks. When a single packet consists of a total of 208 bytes as shown in FIG. 3, the stream arranging unit 110 may divide each stack of 6 packets into blocks of 52 bytes. As shown in FIG. 3, the plurality of packets may thus be divided into N blocks. For convenience of explanation, the blocks divided by the stream rearranging unit 110 are represented as 1, 2, 3, 4, ... N-3, N-2, N-1 and N.

[55] FIG. 4 shows a state of rotated blocks, after streams have been divided into blocks by a stream rearranging unit 110. The stream rearranging unit 110 may rotate each of N blocks by 90 degrees in a clockwise direction. Six packets a, b, c, d, e and f are thereby arranged vertically as shown in FIG. 4. The stream rearranging unit 110 may output the rotated blocks sequentially as shown in FIG. 4.

[56] FIG. 4 shows that N blocks rotated by the stream rearranging unit 110 are output sequentially from a first block to a Nth block, but the N blocks may be output randomly, not sequentially. When N blocks are output randomly by the stream rearranging unit 110, it may be expected that data are much more mixed after being interleaved by an interleaver 130.

[57] FIG. 5 is a schematic block diagram of a stream into which dummy 20 is inserted by a dummy inserting unit 120. Referring to FIG. 5, the dmmuy inserting unit 120 may insert a dummy into the data part 10. In this case, the dummy inserting unit 120 may insert a dummy of appropriate size into the data part 10 taking into consideration the memory size of an interleaver 130, that is, the interleaving size.

[58] In other words, since the interleaver 130 includes a plurality of shift memories, the dummy corresponding to the plurality of shift memories should be inserted in order that the data part 10 is stored in the shift memories to be output. As the dummy is thus input to the interleaver 130, the data part 10 is shifted normally and output.

[59] FIG. 6 is a schematic block diagram of a stream after being interleaved by an interleaver 130. Data are mixed by the interleaving operation of the interleaver 130. In this case, a dummy 20 of FIG. 5 is output after a data part 10 is output, so the dummy 20 is positioned to the left of a data part 10 in FIG.6. A dummy 20' positioned to the right of the data part 10 may become a dummy for previous data.

[60] As described above, the interleaving is performed after the streams are rearranged by the stream rearranging unit 110, and it is possible to secure sufficiently wide interleaving intervals. In other words, when a convolutional interleaver of FIG. 2 is used, an interleaving interval between the same data is only 4 bytes or 8 bytes if a memory path such as M or 2M is selected. The interleaving performance is thus deteriorated.

[61] However, as shown in FIGS. 3 to 5, if streams are rearranged and interleaved by adding a dummy in the stream rearranging unit 110, it is possible to secure sufficiently wide interleaving intervals between the same data. The interleaving performance can thereby be improved.

[62] Meanwhile, after the stream including the dummy is interleaved as shown in FIG. 6, the dummy may be removed from the stream for transmission.

[63] FIG. 7 is a block diagram showing an example of a device for processing streams including an interleaver 130 as shown in FIG. 2, further including a dummy removing unit 140 and a burst generating unit 150.

[64] Referring to FIG. 7, the interleaver 130 of the device for processing streams 100 may output the stream of FIG. 6 to the dummy removing unit 140.

[65] The dummy removing unit 140 removes a dummy from the stream, and the burst generating unit 150 collects, in a burst unit, the stream from which the dummy has been removed by the dummy removing unit 140. Assuming that one unit of the stream

input into the device for processing streams is referred to as 1 burst, the burst generating unit 150 may collect streams corresponding to 1 burst and output the streams,in a state that the dummy has been added to the streams for processing by the interleaver 130 and then removed therefrom.

[66] FIG. 8 is a schematic block diagram of streams that are collected in a burst unit, after the streams have been interleaved by an interleaver 130 and a dummy has been removed therefrom by a dummy removing unit 140.

[67] In other words, the streams of FIG. 8 may be a final state of the streams output by the device for processing streams 100. Referring to FIG. 8, the streams have lengths corresponding vertically to the branch number B of a convolutional interleaver.

[68] In this case, referring to the right-most vertical line of FIG. 8, it may be known that respective packets a, b, c, d, e, f, ... are interleaved and arranged in predetermined units. For example, "a" packet is interleaved in the manner that it is divided one by one into every six section.If the streams are rearranged and then are interleaved by adding the dummy as described above, it is possible to prevent the interleaving intervals of the initial stream from being narrow in the conventional interleaving method. Consequently, a stable stream transmission can be made, the possibility of packets being discarded and retransmitted is reduced, making it possible to provide an efficient digital broadcasting service.

[69] FIG. 9 is a schematic block diagram of a configuration of a device for processing streams according to another embodiment of the present invention. Referring to FIG. 9, the device for processing streams further comprises an RS encoder 160, a CRC encoder 170 and a burst transmitting unit 180, in addition to a stream rearranging unit 110 and a dummy inserting unit 120.

[70] The stream rearranging unit 110 rearranges the streams by arranging the streams horizontally according to a preset first size unit and stacking the streams vertically. The form of the rearranged streams is shown in FIG. 10.

[71] Referring to FIG. 10, streams 30 are arranged horizontally according to a preset first size unit x2 and subsequent streams are arranged horizontally on subsequent lines. Therefore, a plurality of streams having unit x1 are disposed within one line. x1 may be diversely set according to the embodiment. For example, x1 may be set as 187 bytes.

[72] When the streams 30 are rearranged as shown in FIG. 10, the RS encoder 160 adds an RS parity 40 to an end portion of the streams 30 in a vertical direction. In other words, the RS encoder 160 calculates the RS parity 40 vertically with respect to the st reams 30 and adds the calculated RS parity 40 into the streams 30 vertically.

[73] The CRC encoder 170 adds cyclic redundancy check (CRC) values 50 to the streams 30 to which the RS parity 40 is added in a horizontal direction. The CRC values 50

include both CRC values for the streams 30 and CRC values for the RS parity 40.

[74] Consequently, streams may have the form shown at the bottom of FIG. 10.

[75] The streams constituted as described above are transmitted using a method shown in FIG. 11.

[76] FIG. 11 is a schematic block diagram explaining a method of processing streams. Referring to FIG. 11, a burst transmitting unit 180 transmits streams supplied from a dummy inserting unit 120 in burst units 61, 62, 63, 64, 65, 66, 67, 68. Here, the size of a single burst may be set to be larger than the horizontal size of streams further including the CRC value 50 part. In this case, streams are transmitted together with a portion of a stream on a subsequent line.

[77] In other words, as shown in the right side of FIG. 11, transmission is made in bursts. In the case of the last transmission burst 68 of FIG. 11, the stream fails to completely make up for a single burst.

[78] The dummy inserting unit 120 inserts the dummy into the stream so that an empty space within the burst can be filled thereby. In other words, the dummy inserting unit 120 divides the streams into transmission bursts of a preset second size unit, wherein, with respect to a stream in which a single transmission burst is not made, the dummy inserting unit 120 adds the dummy so as to match the transmission burst size. Data transmission can thereby be performed in bursts by the burst transmitting unit 180.

[79] As shown in FIGS. 10 and 11, transmission is performed horizontally in a state that the RS parity 40 is calculated vertically and added to the streams, so block interleaving is performed. In other words, the streams rearranged with the RS parity 40 and CRC values 50 added are stored in the plurality of memories in the form shown at the bottom of FIG. 10 and are then output in bursts horizontally as shown in FIG. 11, making it possible to obtain the effect of block interleaving.

[80] As described above, the device for processing streams may be implemented using diverse methods.

[81] The devices for processing streams having the diverse configurations described above may be used for a digital broadcasting transmitter. The processed stream may also be an existing normal data stream, a supplementary data stream having enhanced robustness, or a stream including known data for improving equalization performance.

[82] In this case, the device for processing streams may further comprise diverse constituents such as a MUX unit constituting a stream, a data processing unit allowing a supplementary data stream to have enhanced robustness, a randomizer performing randomization, an RS encoder performing RS encoding, a trellis encoder, a sync multiplexer adding a field sync or a segment sync to the stream, a modulator performing modulation, a known data inserting unit inserting known data to the stream, and the like. These constituents are disposed in diverse forms, so diverse embodiments

may be constructed.

[83] FIG. 12 is a flowchart explaining a method of processing streams according to one embodiment of the present invention. Referring to FIG. 12, if streams are input, the streams are rearranged in operation S1010. The rearranged forms are changed according to the configuration of an interleaver 130. In other words, when the interleaver 130 is a convolutional interleaver, the streams are stacked and then divided into blocks of a predetermined size, so the streams may be arranged by being rotated perpendicularly.

[84] When the device for processing streams is constructed as shown in FIG. 9 and block interleaving is thus performed, the dummy may be added only to some bursts.

[85] The stacked and rearranged streams may be output to the rear ends thereof sequentially or randomly.

[86] The dummy is then added to the output streams in operation S1020.

[87] As described above, the dummy fills the internal memories of the interleaver 130 with specific values so that interleaving is normally performed by the interleaver 130 to output the streams.

[88] When the streams are rearranged and the dummy is inserted thereinto as shown in FIGS. 3 to 5, convolutional interleaving may be performed after adding the dummy. Owing to the interleaving, the respective packets within the streams are rearranged at diverse intervals. In this case, an operation to remove the dummy may be further included after interleaving the streams. After removing the dummy, an operation to collect and output the streams in burst units may also further be included. These operations have been explained in detail in the above description, so duplicated explanation thereof will be omitted.

[89] When the device for processing streams is implemented in the form of FIG. 9, a separate interleaving operation may not be present after adding the dummy. In other words, in the case of the device for processing streams of FIG. 9, the streams are stacked and rearranged, and RS encoding and CRC encoding are performed thereon. In this state, output is made horizontally to generate block interleaving. When a single burst is not completely filled with the streams, RS parity, and CRC values during the process, the corresponding burst is filled with a dummy.

[90] FIG. 13 is a block diagram showing a configuration of a digital broadcasting receiver according to an embodiment of the present invention. The digital broadcasting receiver of FIG. 13 may receive streams processed by the device for processing streams having a configuration as shown in FIGS. 1, 7 or 9 or a digital broadcasting transmitter having the same. More specifically, the digital broadcasting receiver may be implemented as a portable display device such as a cellular phone, a laptop computer, a navigation device or an electronic notebook, or a display device such as a TV or a set-top box.

[91] Referring to FIG. 13, the digital broadcasting receiver includes a tuner 210, a demodulator 220, an equalizer 230, and a deinterleaver 240.

[92] The tuner 210 selects a channel and receives a stream.

[93] The demodulator 220 demodulates the stream received by the tuner 210, and the equalizer 230 equalizes the demodulated stream.

[94] The deinterleaver 240 deinterleaves the equalized stream to reconstitute the stream to its original state.

[95] The stream received by the digital broadcasting receiver of FIG. 13 may be a stream that is convolutionally interleaved on the side of a transmitting terminal and from which a dummy is then removed. In other words, a stream in the shape as shown in FIG. 8 may be received and processed.

[96] In the case of the stream processed in the manner shown in FIGS. 10 and 11, the stream may be a stream from which a dummy has not been removed. When the stream from which the dummy has not been removed is received, the digital broadcasting receiver may further include a configuration for removing the dummy.

[97] FIG. 14 is a block diagram showing a configuration of a digital broadcasting receiver receiving a stream including a dummy according to another embodiment of the present invention. The digital broadcasting receiver of FIG. 14 includes a tuner 210, a demodulator 220, an equalizer 230, a dummy removing unit 250, and a decoder 260.

[98] The dummy removing unit 250 removes a dummy from a stream processed as shown in FIGS. 10 and 11 and thus transmitted without the dummy being removed. In other words, the digital broadcasting receiver of FIG. 14 receives and processes the stream block-interleaved on the side of the digital broadcasting transmitter and including the dummy.

[99] In this case, the dummy removing unit 250 checks the size of the data region of the stream using information included in the stream or information provided through a separate channel, so a part exceeding the size of the data region may be understood to be a dummy.

[100] The decoder 260 decodes the stream from which the dummy has been removed and restores the stream. In this case, the decoder 260 stacks the streams sequentially and then processes them perpendicularly to the direction of stacking, thereby making it possible to obtain the block interleaving effects.

[101] Although not shown in the digital broadcasting receiver in FIG. 13 or FIG. 14, the digital broadcasting receiver may further include diverse constituents, such as a trellis encoder, an RS decoder, a derandomizer, a demultiplexer, and the like.

[102] The stream received by the digital broadcasting receiver of FIG. 13 or FIG. 14 may include a normal data stream, a supplementary data stream processed to have enhanced robustness, known data, or the like.

[103] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

[104]

[105]

Claims

[1] A device for processing streams, the device comprising:
a stream rearranging unit which stacks and rearranges streams; and
a dummy inserting unit which inserts a dummy into the rearranged streams.

[2] The device of claim 1, further comprising:
an interleaver which convolutionally interleaves the streams to which the dummy is inserted.

[3] The device of claim 2, wherein the stream rearranging unit vertically stacks the streams according to the number of streams that are preset for each unit and rearranges the streams by perpendicularly rotating the stacked streams for each unit.

[4] The device of claim 3, wherein the stream rearranging unit divides the respective streams for each unit into blocks having a preset size and performs the perpendicular rotation on the respective streams in each block.

[5] The device of claim 4, wherein the dummy inserting unit inserts a dummy corresponding to the size of the memory in the interleaver into the streams rotated in each block.

[6] The device of claim 4, further comprising:
a dummy removing unit which removes the dummy from the streams output from the interleaver; and
a burst generating unit which collects the streams from which the dummy is removed in bursts.

[7] The device of claim 1, wherein the stream rearranging unit rearranges the streams by horizontally arranging the streams according to a preset first size unit and vertically stacking the streams.

[8] The device of claim 7, further comprising:
an RS encoder which adds an RS parity vertically to an end portion of the stream; and
a CRC encoder which adds a CRC value horizontally to an end portion of the stream to which the RS parity is added.

[9] The device of claim 8, wherein the dummy inserting unit divides the stacked streams into transmission bursts having a preset second size unit, and adds a dummy into the streams, in which one transmission burst is not performed, so as to match the size of the transmission burst.

[10] The device of any one of claims 1 to 6, wherein the streams input to the stream rearranging unit are divided into packet to which the parity is added.

[11] A method of processing streams, the method comprising:

stacking and rearranging streams; and

inserting a dummy into the rearranged streams.

[12] The method of claim 11, further comprising:

interleaving the streams to which the dummy is inserted using a convolutional interleaver.

[13] The method of claim 12, wherein the stacking and rearranging the streams comprises:

vertically stacking the streams according to the number of streams that are preset for each unit; and

rearranging the streams by perpendicularly rotating the stacked streams for each unit.

[14] The method of claim 13, wherein the rearranging the streams by perpendicularly rotating the stacked streams for each unit comprises dividing the respective streams for each unit into blocks having a preset size and performing the perpendicular rotation on the respective streams in each block.

[15] The method of claim 14, wherein the inserting the dummy comprises inserting a dummy corresponding to the size of memory of the convolutional interleaver into the streams rotated in each block.

[16] The method of claim 14, further comprising:

removing the dummy from the interleaved streams; and

collectingthe streams from which the dummy has been removed in bursts.

[17] The method of claim 11, wherein the rearranging the streams comprises horizontally arranging the streams according to a preset first size unit and vertically stacking and rearranging the streams.

[18] The method of claim 11, further comprising:

performing RS encoding, the RS encoding adding an RS parity vertically to an end portion of the stream; and

performing CRC encoding, the CRC encoding adding a CRC value horizontally to an end portion of the stream to which the RS parity is added.

[19] The method of claim 18, wherein the inserting the dummy comprises: dividing the stacked streams into transmission bursts having a preset second size unit, and adding a dummy into the stream, in which one transmission burst is not performed, so as to match the size of the transmission burst.

[20] The method of any one of claims 11 to 16, wherein the rearranging the streams comprises rearranging the streams divided into packets to which the parity is added.

[21] A digital broadcasting receiver, comprising:

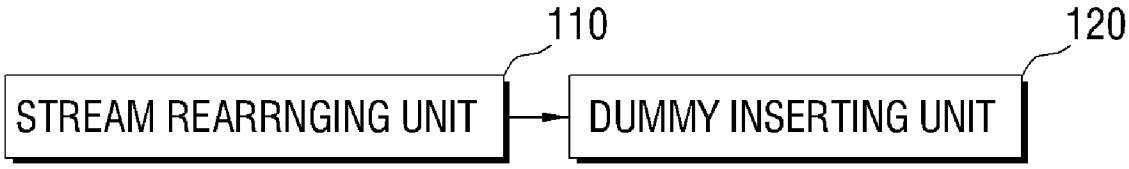
a tuner which receives streams;

a demodulator which demodulates the received streams;
an equalizer which equalizes the demodulated streams; and
a deinterleaver which deinterleaves the equalized streams,
wherein the streams are stacked and rearranged in a preset unit on the side of a digital broadcasting transmitter, and are processed by inserting a dummy thereinto.

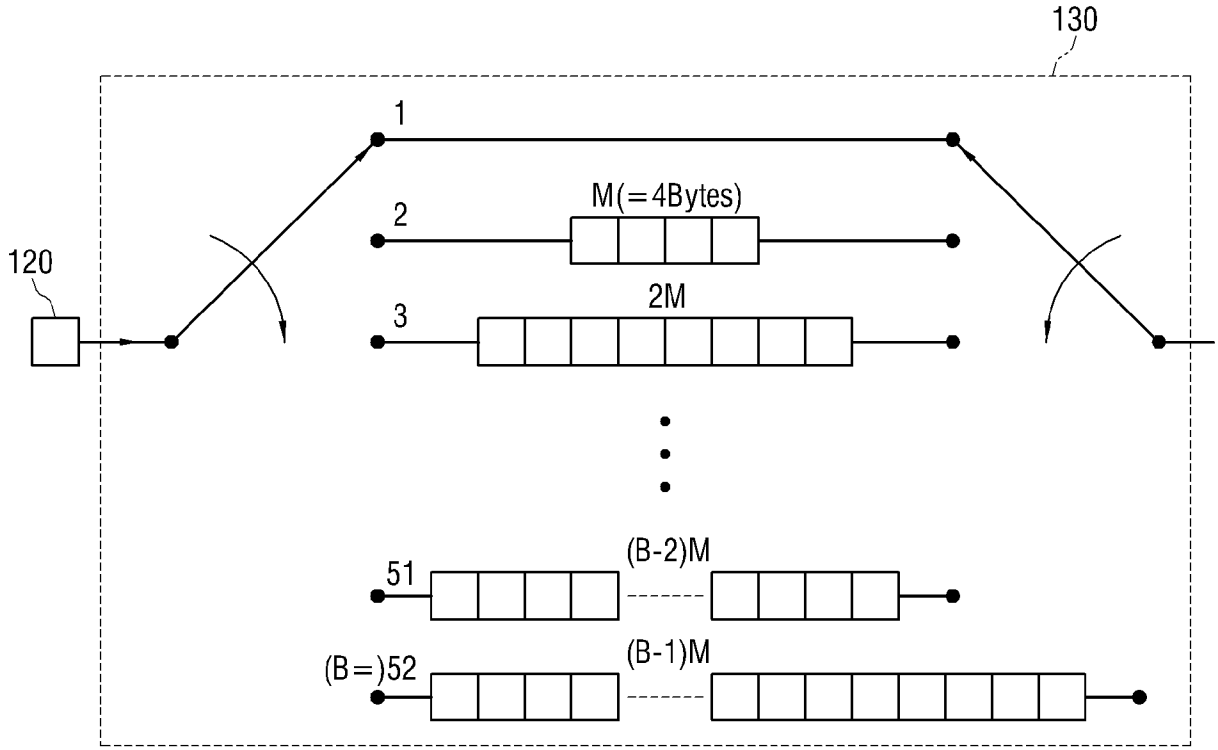
[22] The digital broadcasting receiver of claim 21, wherein the streams are convolutionally interleaved on the side of the digital broadcasting transmitter and the dummy is removed therefrom.

[23] The digital broadcasting receiver of claim 21, further comprising:
a dummy removing unit which removes the dummy inserted into the streams,
wherein the streams are block-interleaved on the side of the digital broadcasting transmitter and the dummy is inserted thereinto.

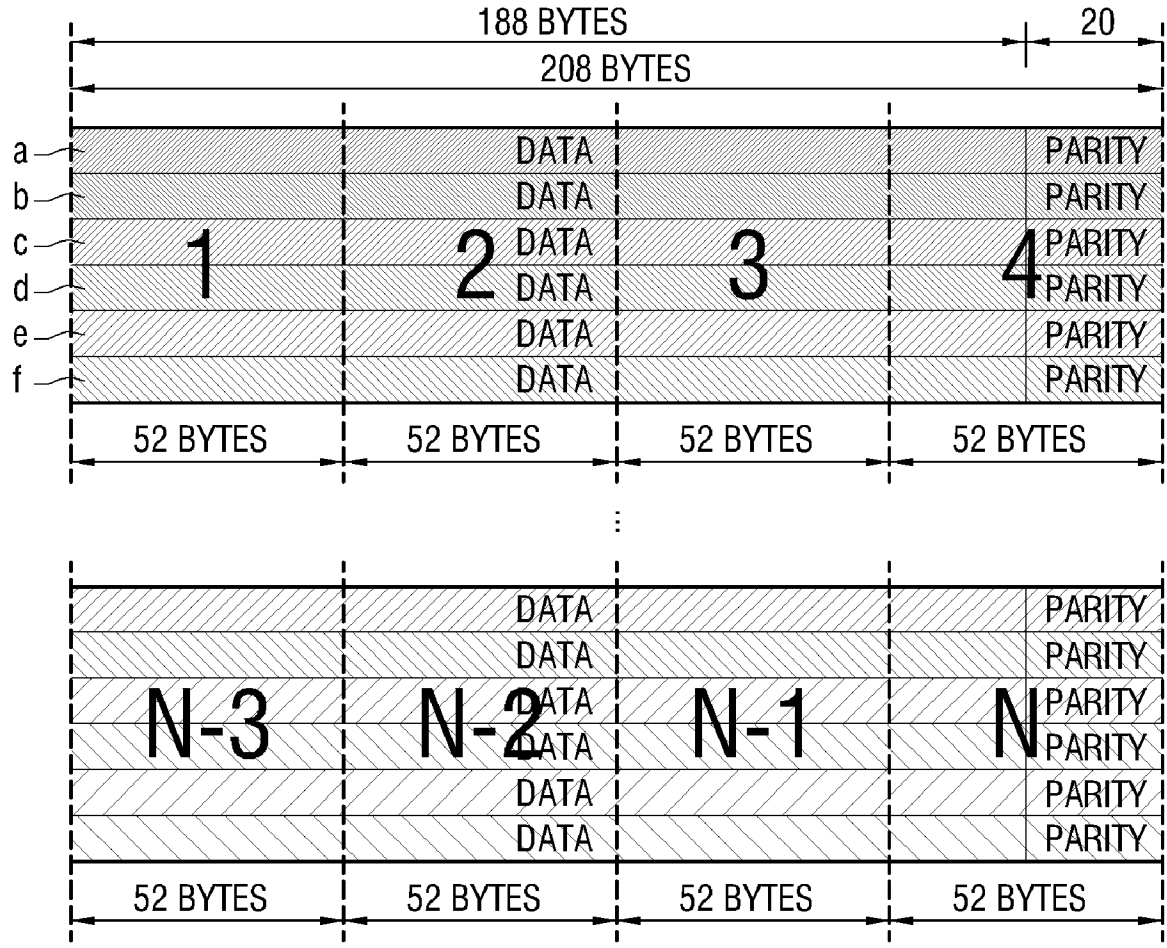
[Fig. 1]


110
120
STREAM REARRNGING UNIT
DUMMY INSERTING UNIT

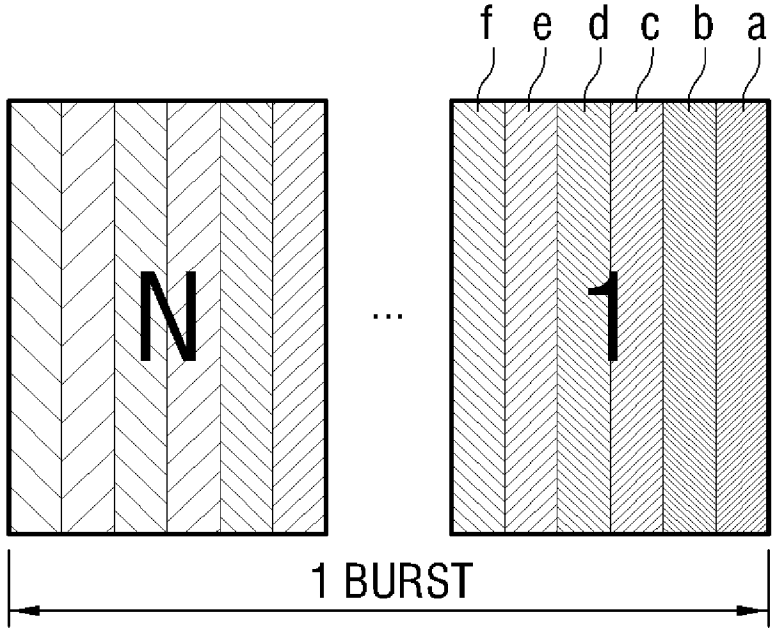
[Fig. 2]


130
120
1
2
M(=4Bytes)
3
2M
51
(B-2)M
(B=)52
(B-1)M

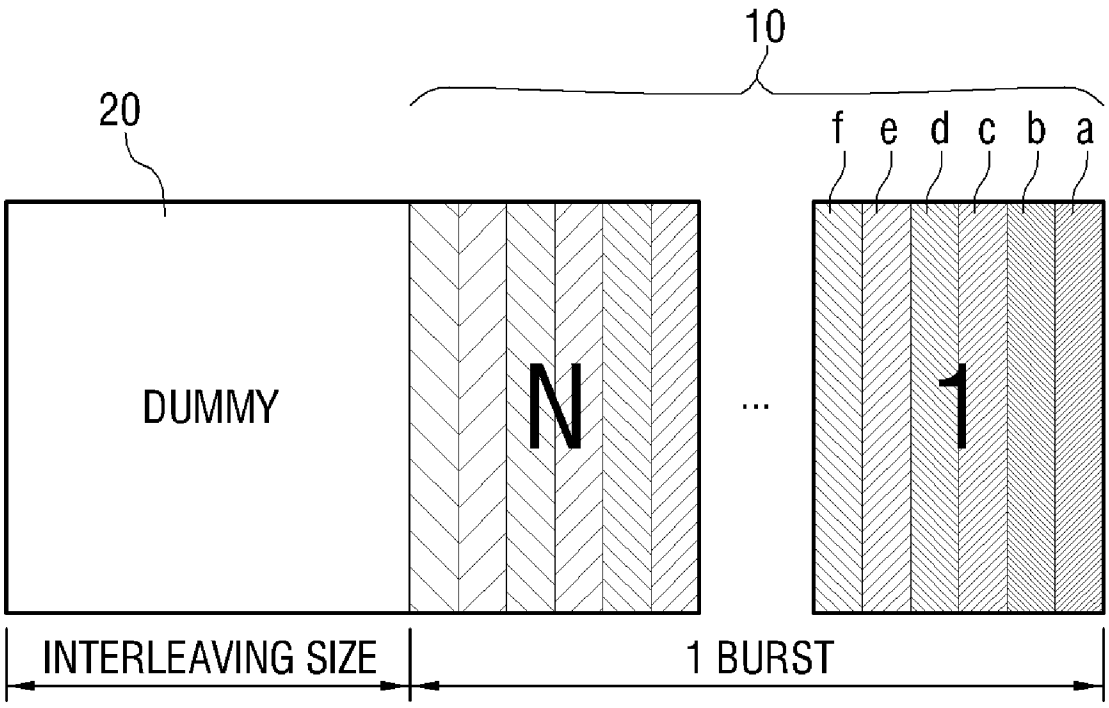
[Fig. 3]


188 BYTES
20
208 BYTES
a
b
c
d
e
f
DATA
PARITY
1
2
3
4
52 BYTES
N-3
N-2
N-1
N

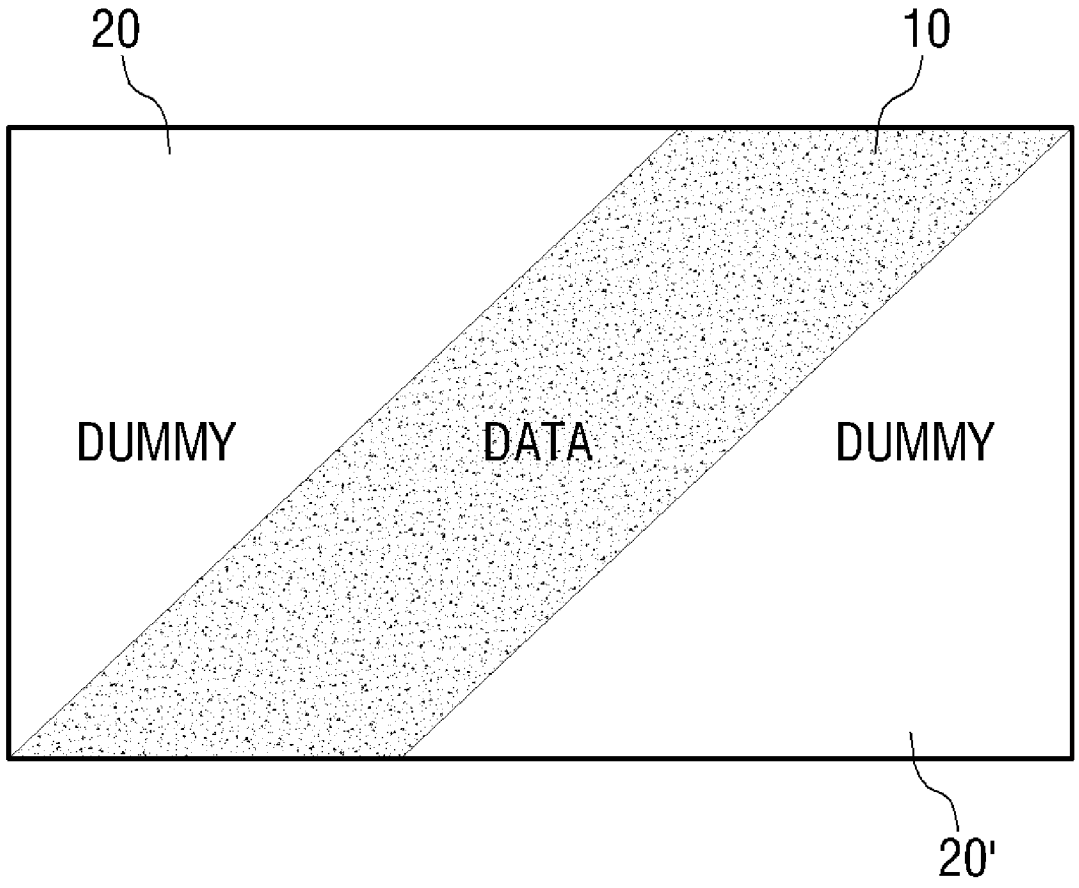
[Fig. 4]


f e d c b a
N
...
1
1 BURST

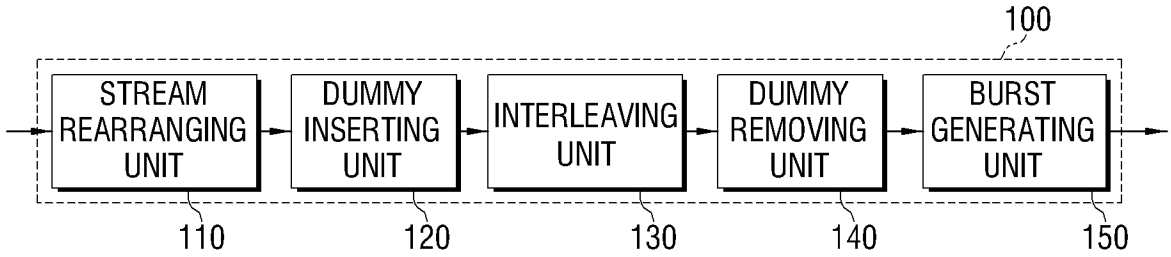
[Fig. 5]


10
20
f e d c b a
DUMMY
N
...
1
INTERLEAVING SIZE
1 BURST

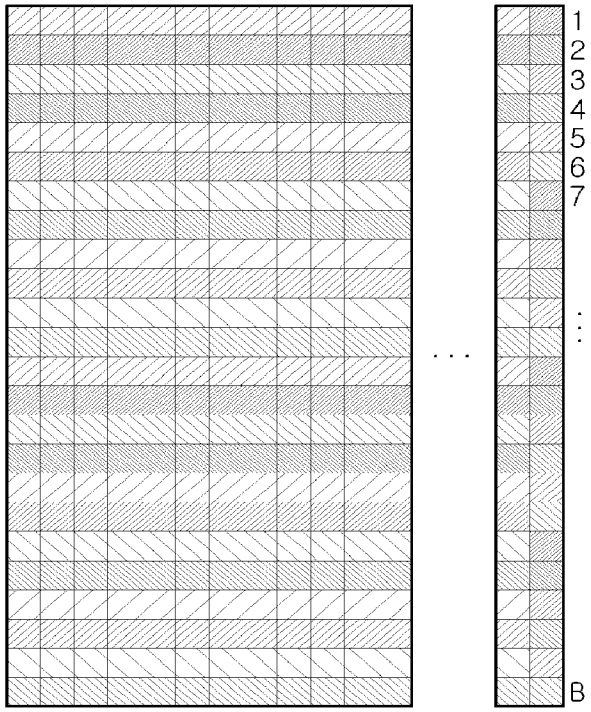
[Fig. 6]


20
10
DUMMY
DATA
DUMMY
20'

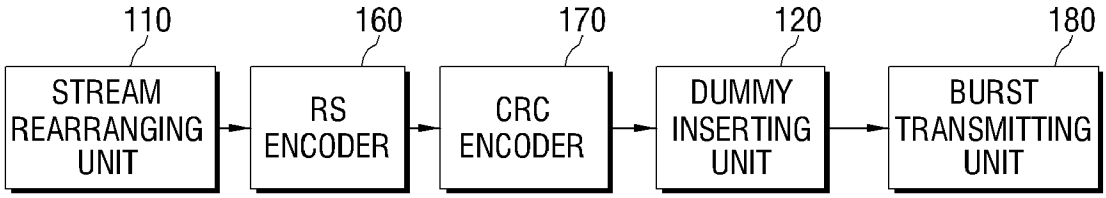
[Fig. 7]



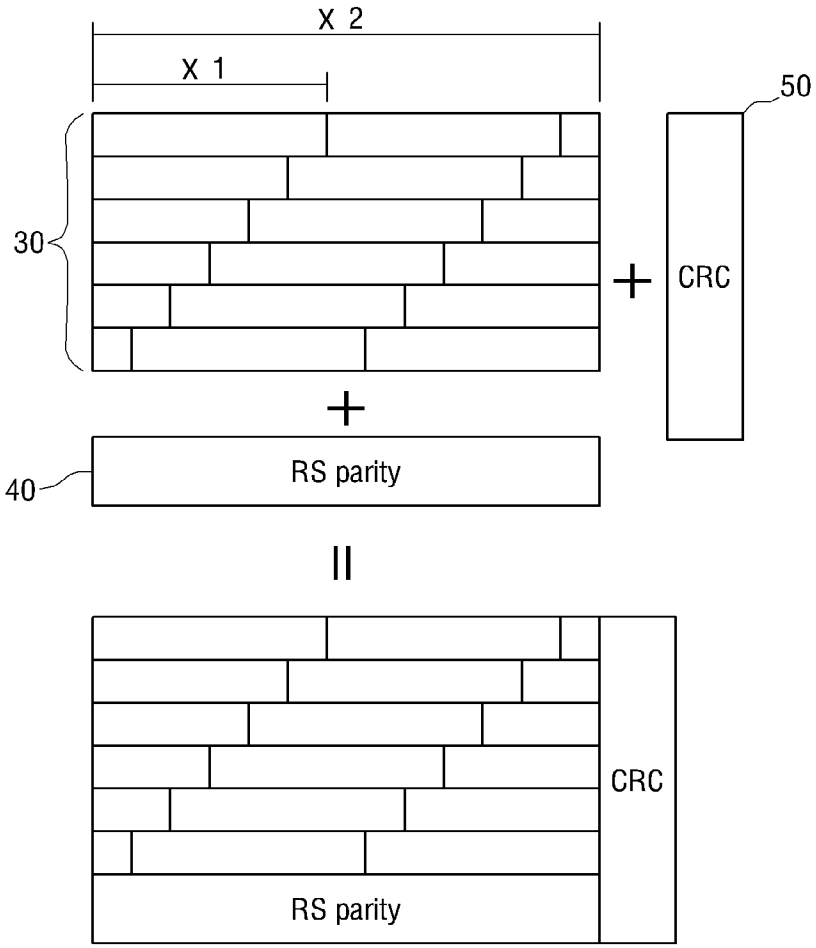
[Fig. 8]



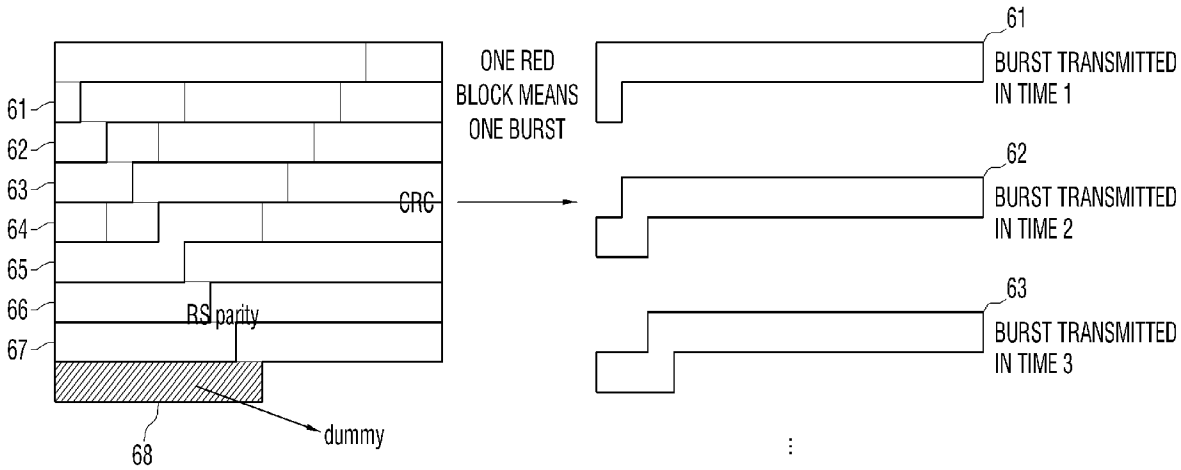
[Fig. 9]



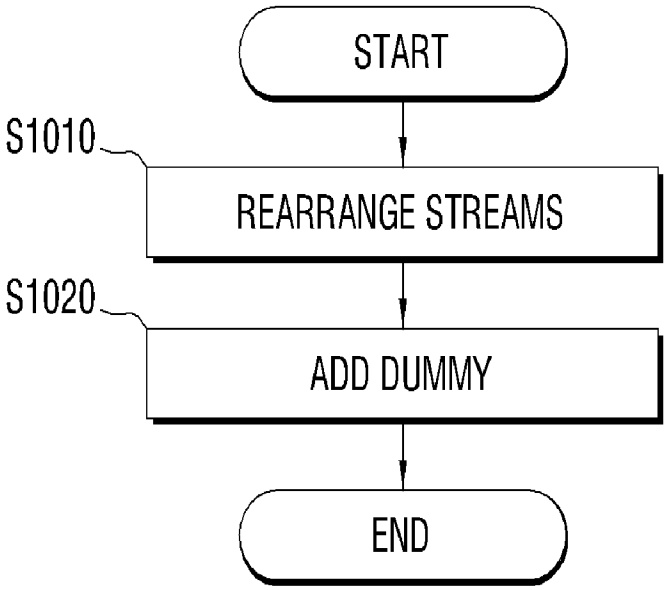
[Fig. 10]


X 2
X 1
50
30
CRC
RS parity
40
CRC
RS parity

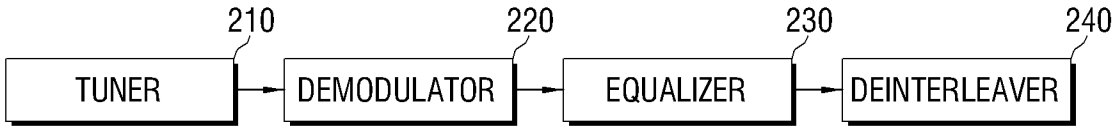
[Fig. 11]


61
62
63
64
65
66
67
68
CRC
RS parity
dummy
ONE RED BLOCK MEANS ONE BURST
61
BURST TRANSMITTED IN TIME 1
62
BURST TRANSMITTED IN TIME 2
63
BURST TRANSMITTED IN TIME 3

[Fig. 12]



[Fig. 13]



[Fig. 14]