

# EXHIBIT G



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**Kim et al.**

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(54) **INTERLEAVING APPARATUS AND METHOD FOR SYMBOL MAPPING IN AN HSDPA MOBILE COMMUNICATION SYSTEM**

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(73) Assignee: **Samsung Electronics Co., Ltd.** (KR)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 583 days.

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(57) **ABSTRACT**

(51) **Int. Cl.**

*H03M 13/00* (2006.01)

*H03M 13/03* (2006.01)

In an apparatus for data transmission in a communication system, a turbo encoder encodes data bits to generate systematic bits and parity bits, and a rate matcher matches the systematic bits and parity bits. A first interleaver writes the rate-matched systematic bits on a row by row basis, and performs inter-column permutation. A second interleaver writes the rate-matched parity bits on a row-by-row basis, and performs inter-column permutation. A modulator alternatively collects the permuted bits on a column by column basis from the first and second interleavers, and maps collected bits from the first and second interleavers onto one modulation symbol, wherein a size of the first interleaver is equal to a size of the second interleaver.

(52) **U.S. Cl.** ..... 714/755; 714/786; 714/758; 714/790

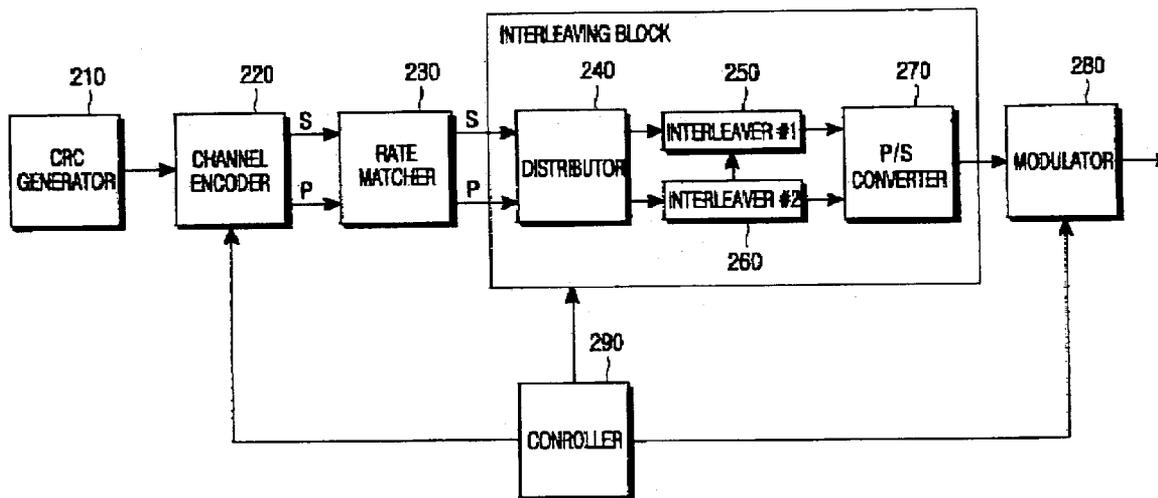
(58) **Field of Classification Search** ..... None  
See application file for complete search history.

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**16 Claims, 27 Drawing Sheets**



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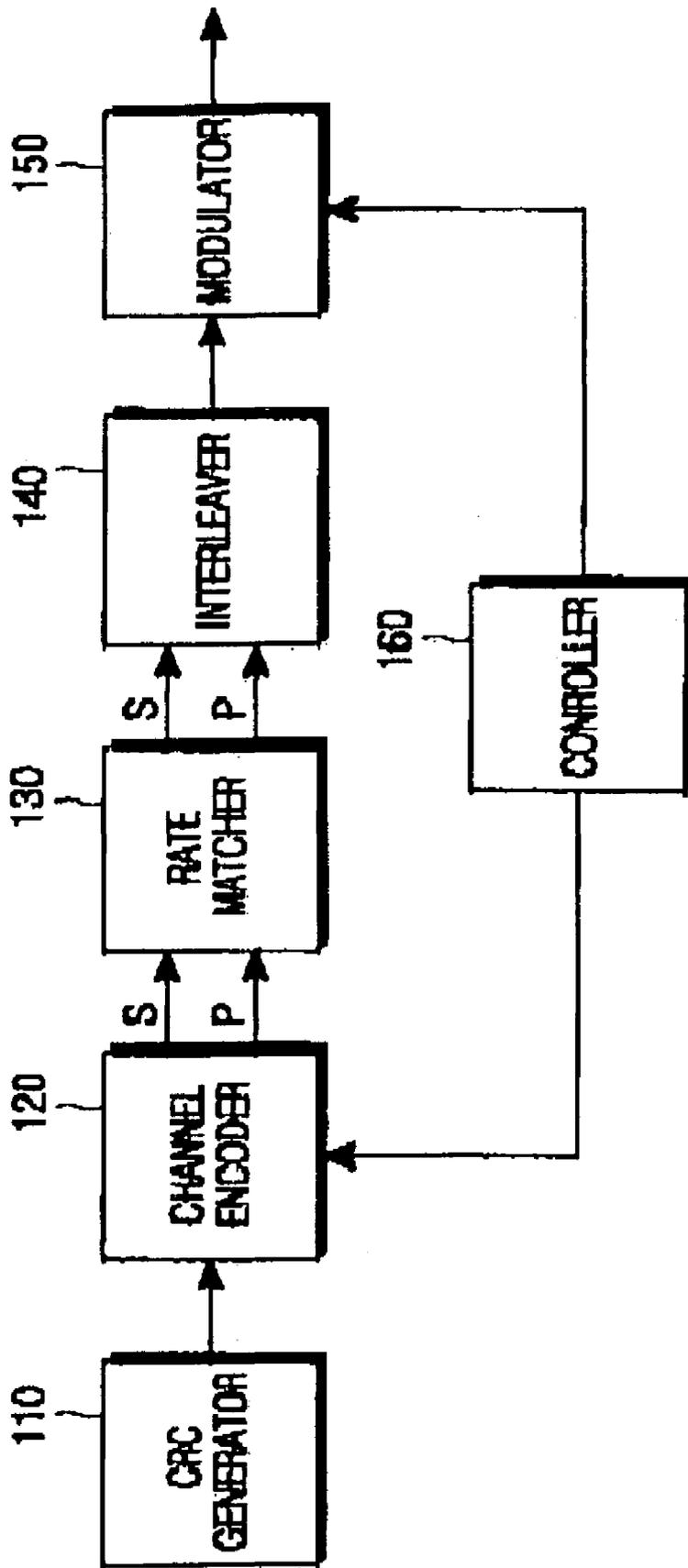


FIG. 1  
(PRIOR ART)

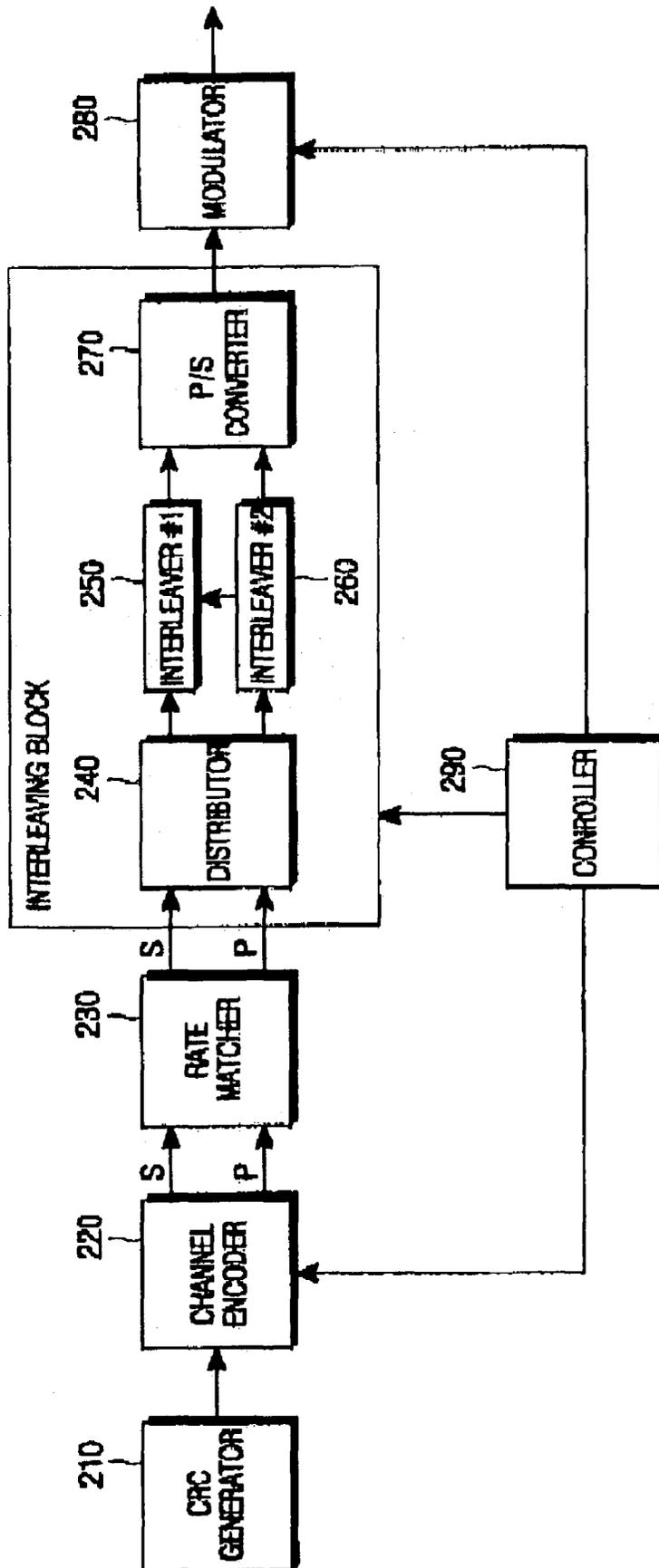


FIG. 2

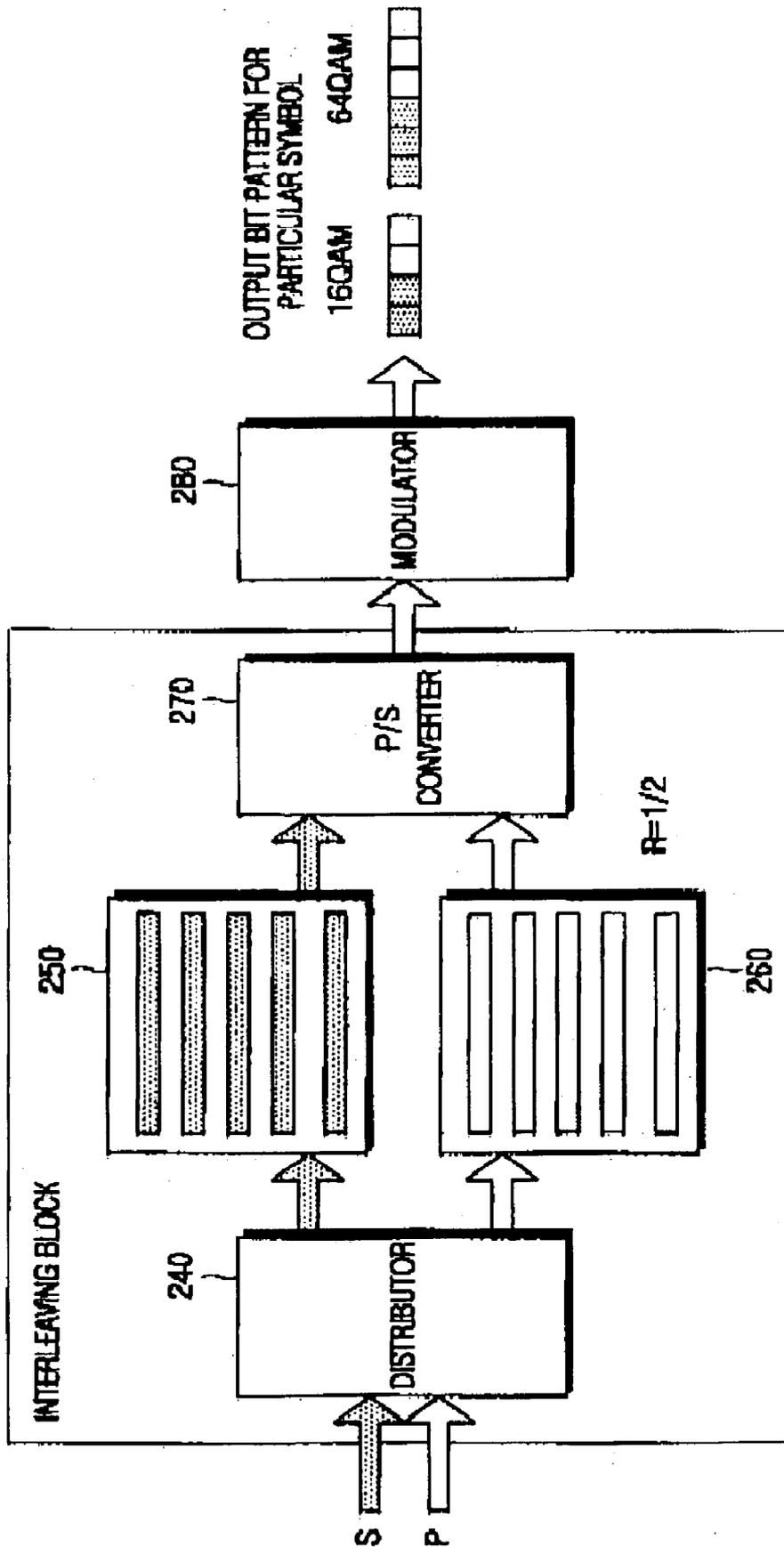


FIG. 3

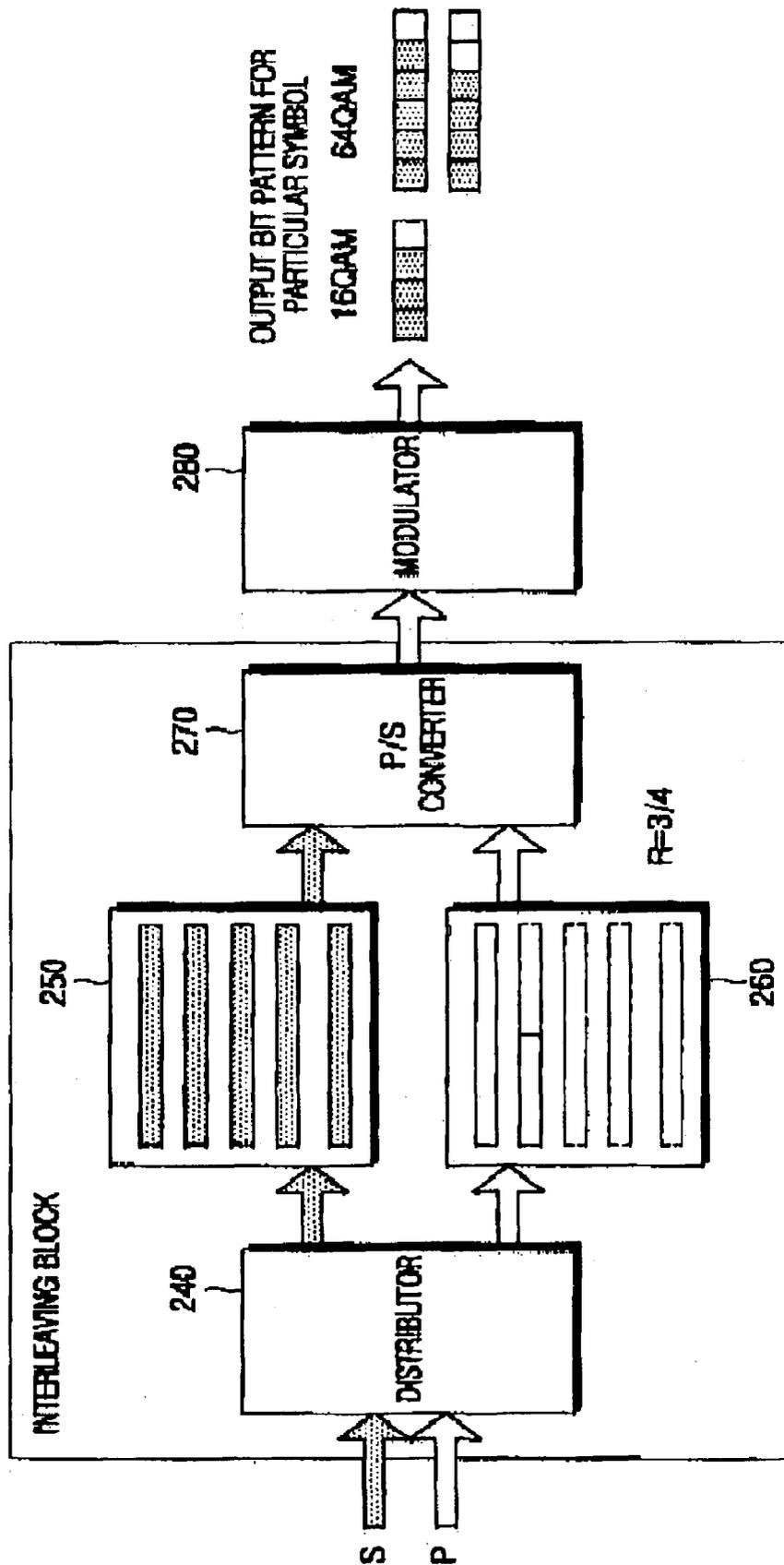


FIG. 4

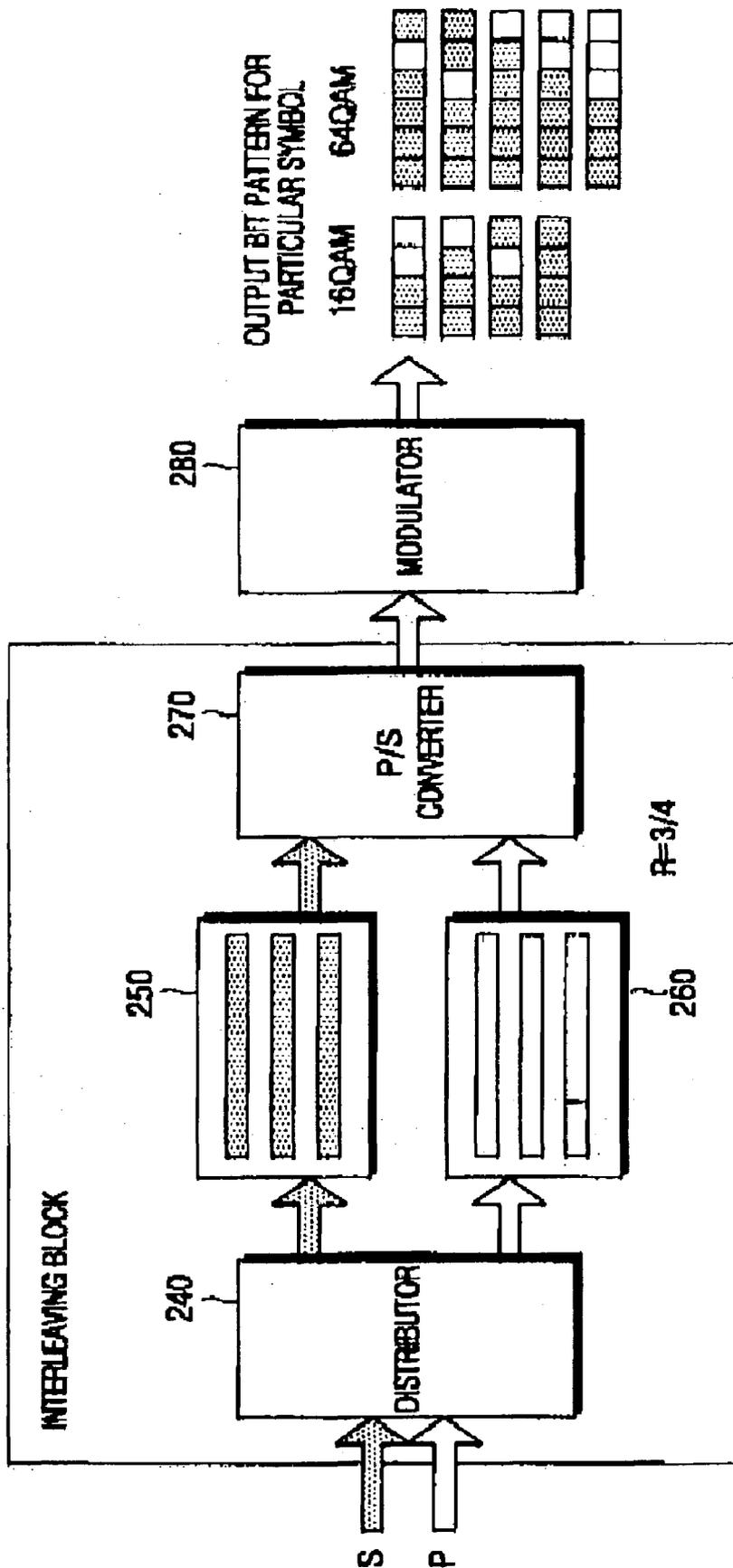


FIG.5

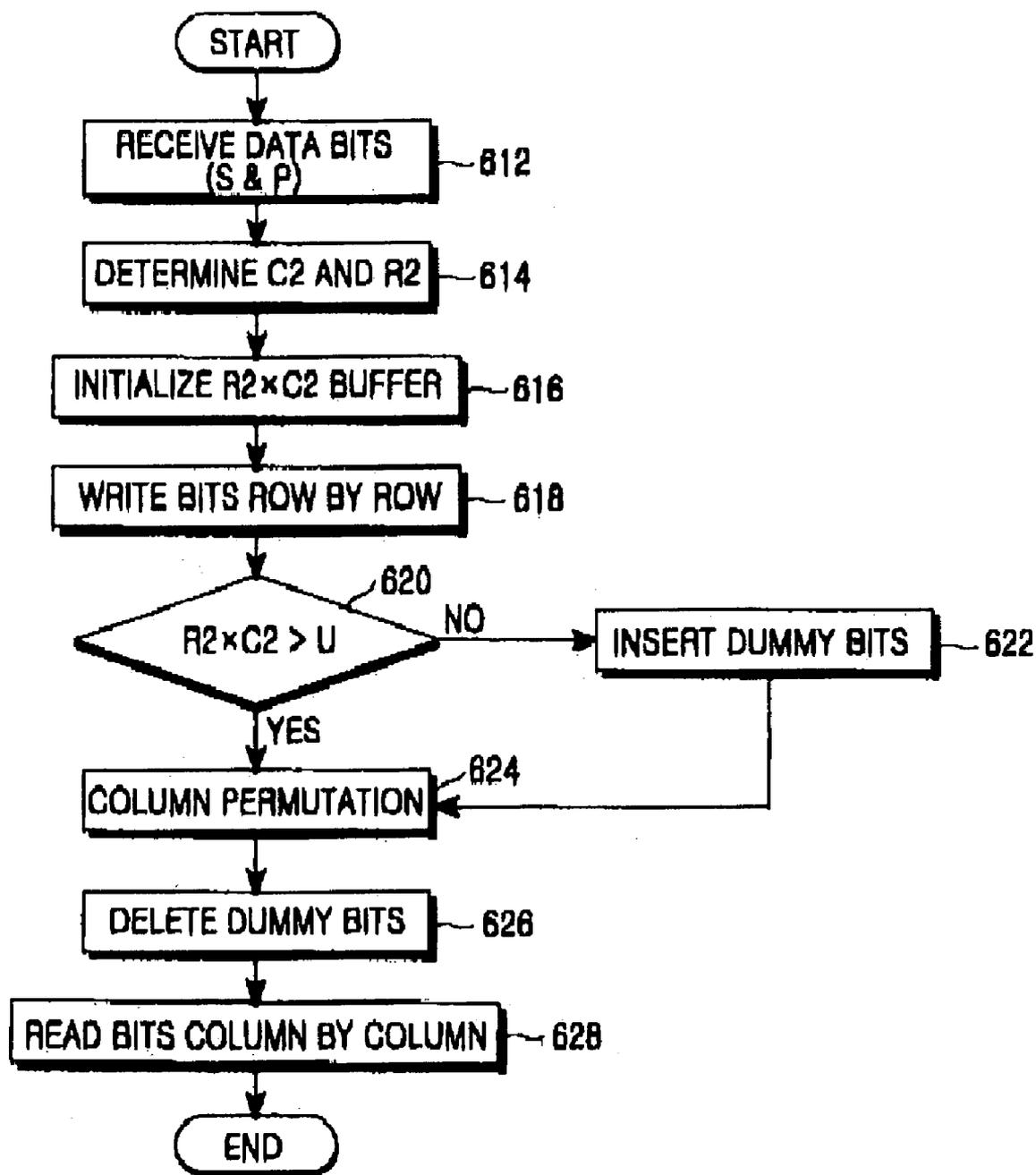


FIG.6

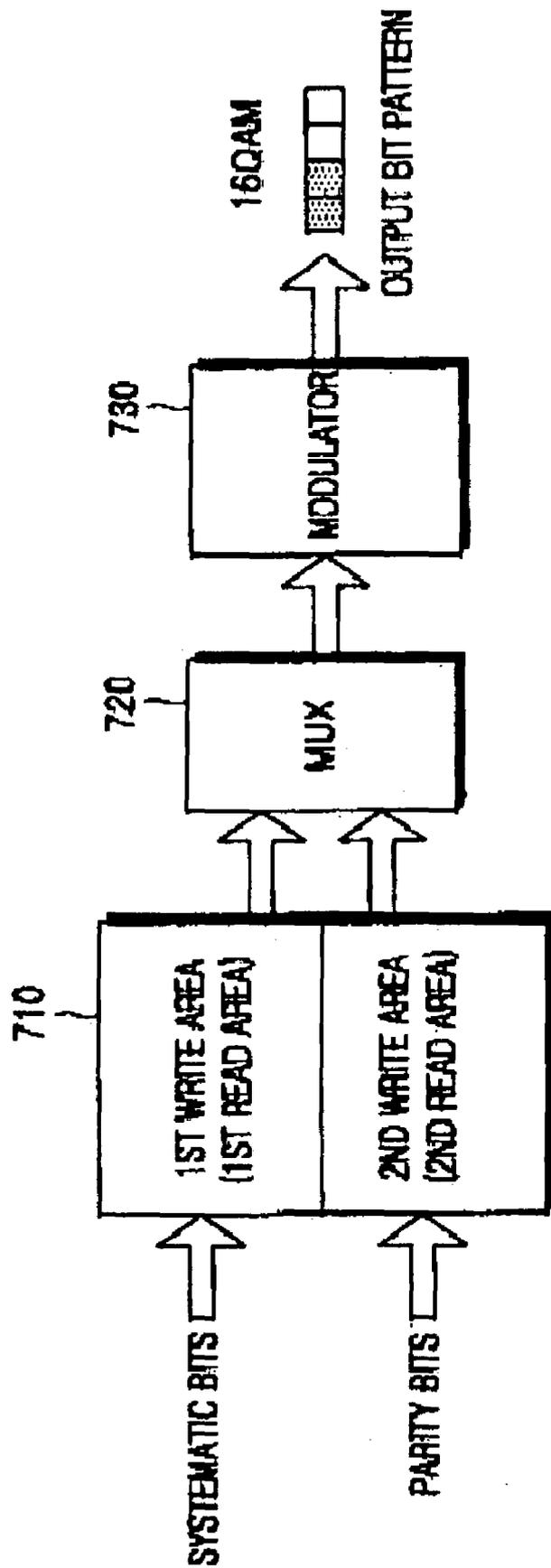


FIG.7

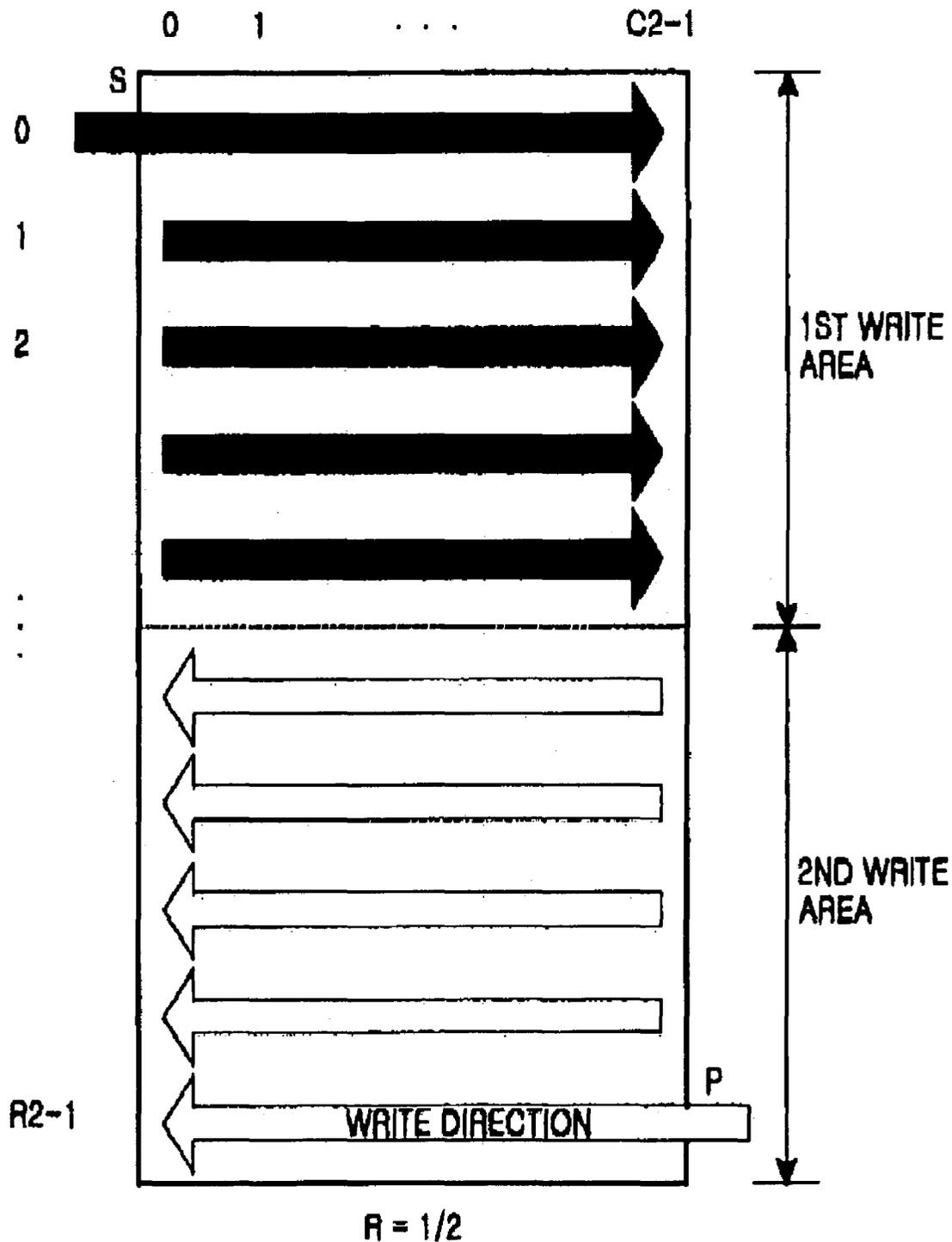


FIG.8A

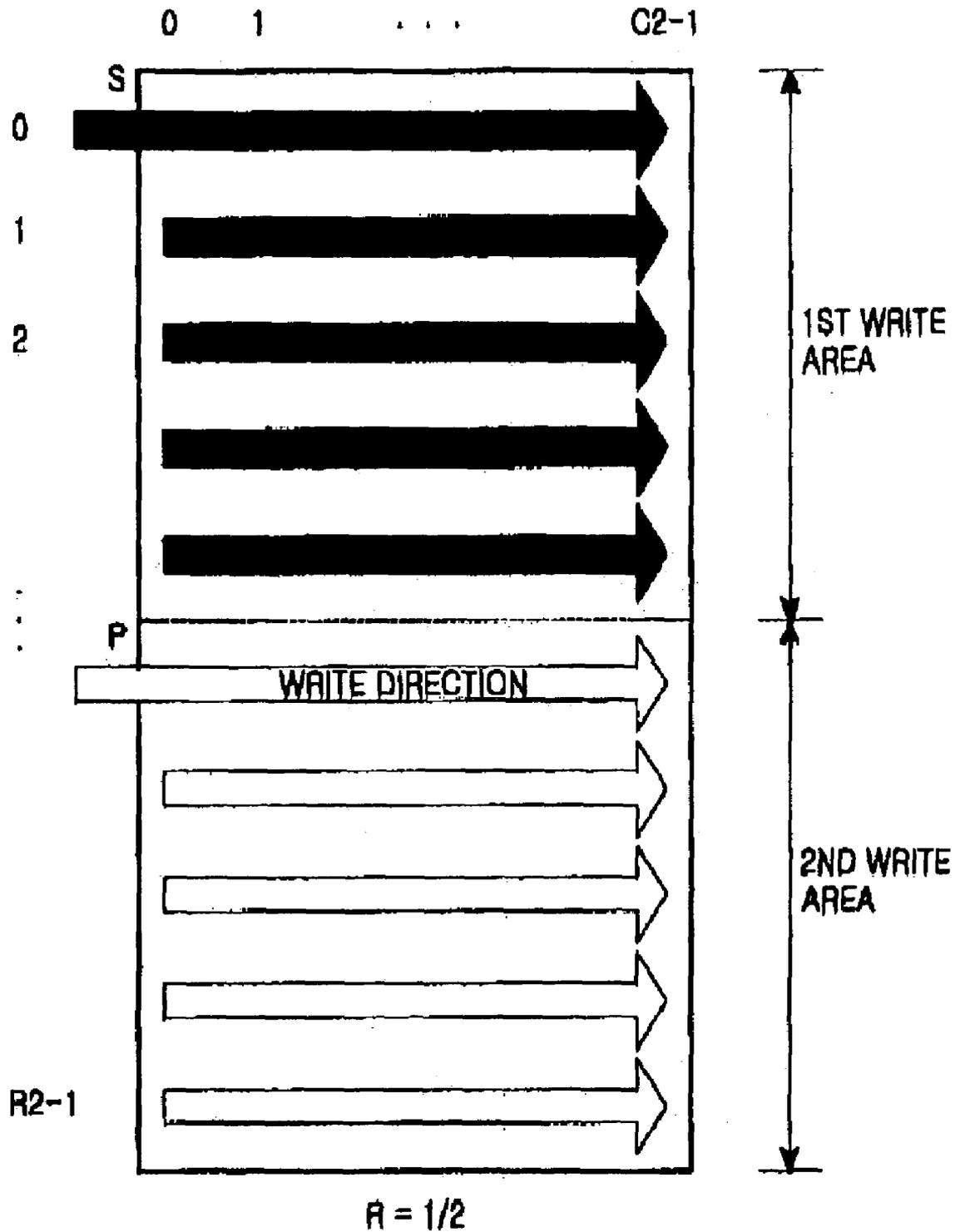


FIG. 8B



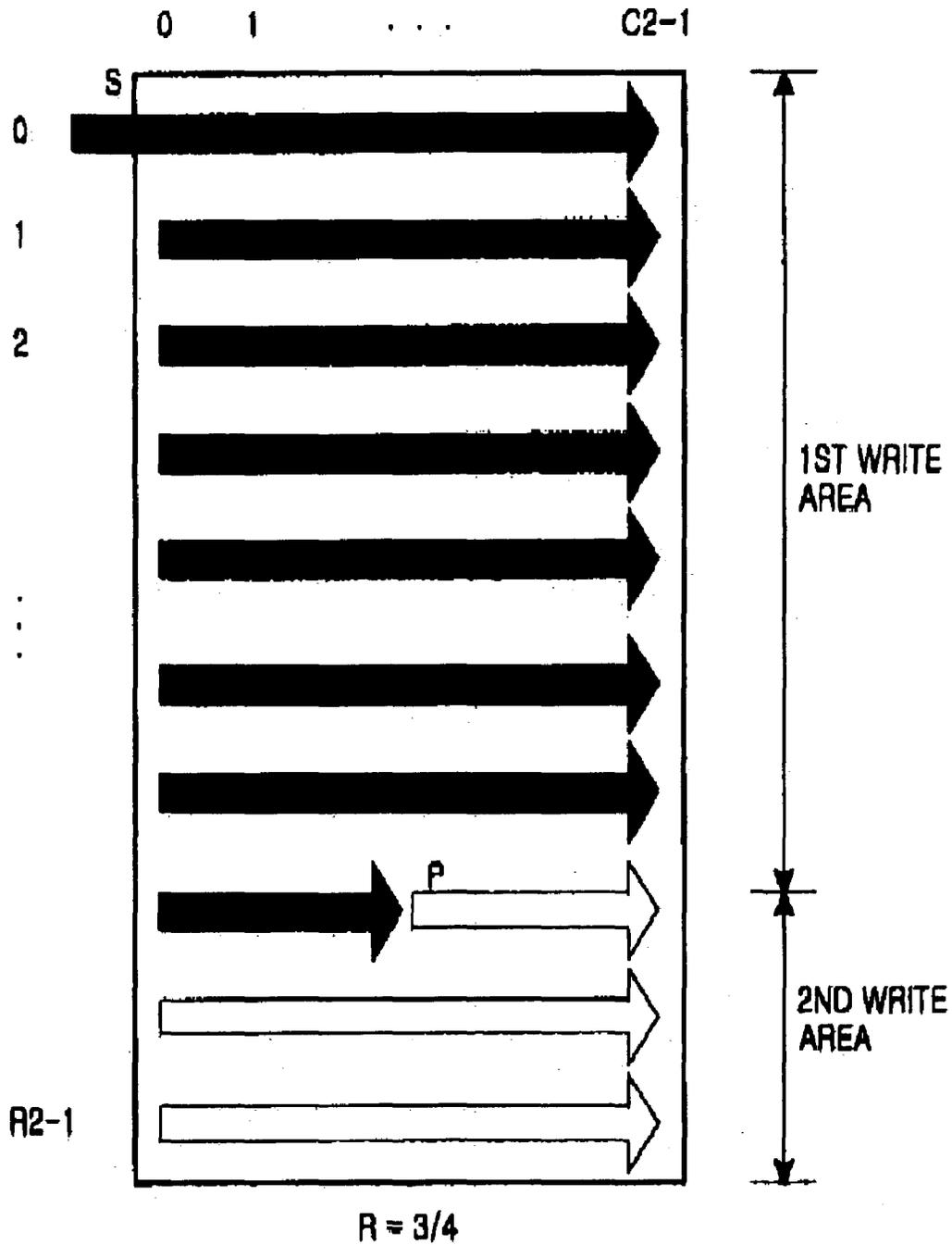


FIG.9B

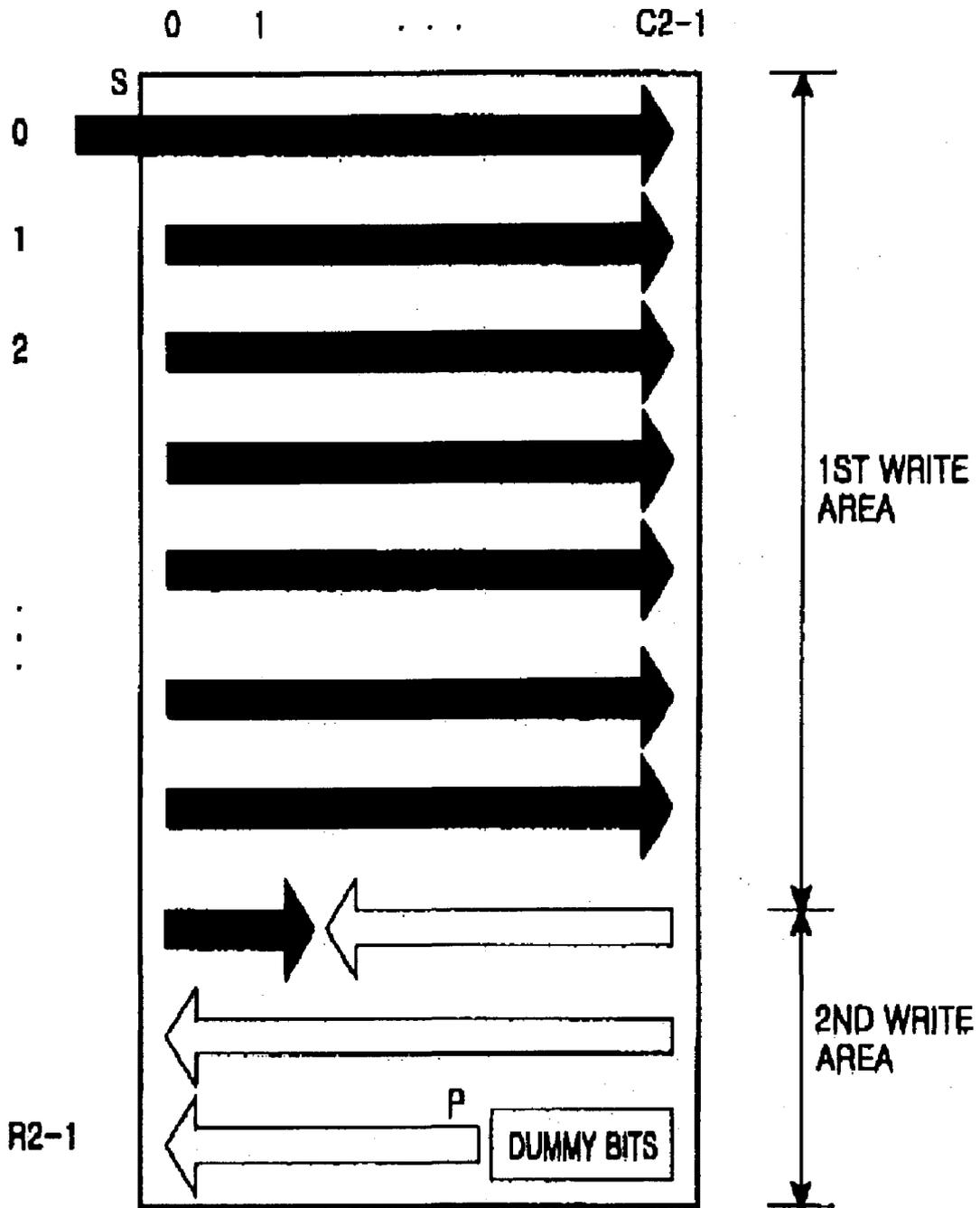


FIG. 10A



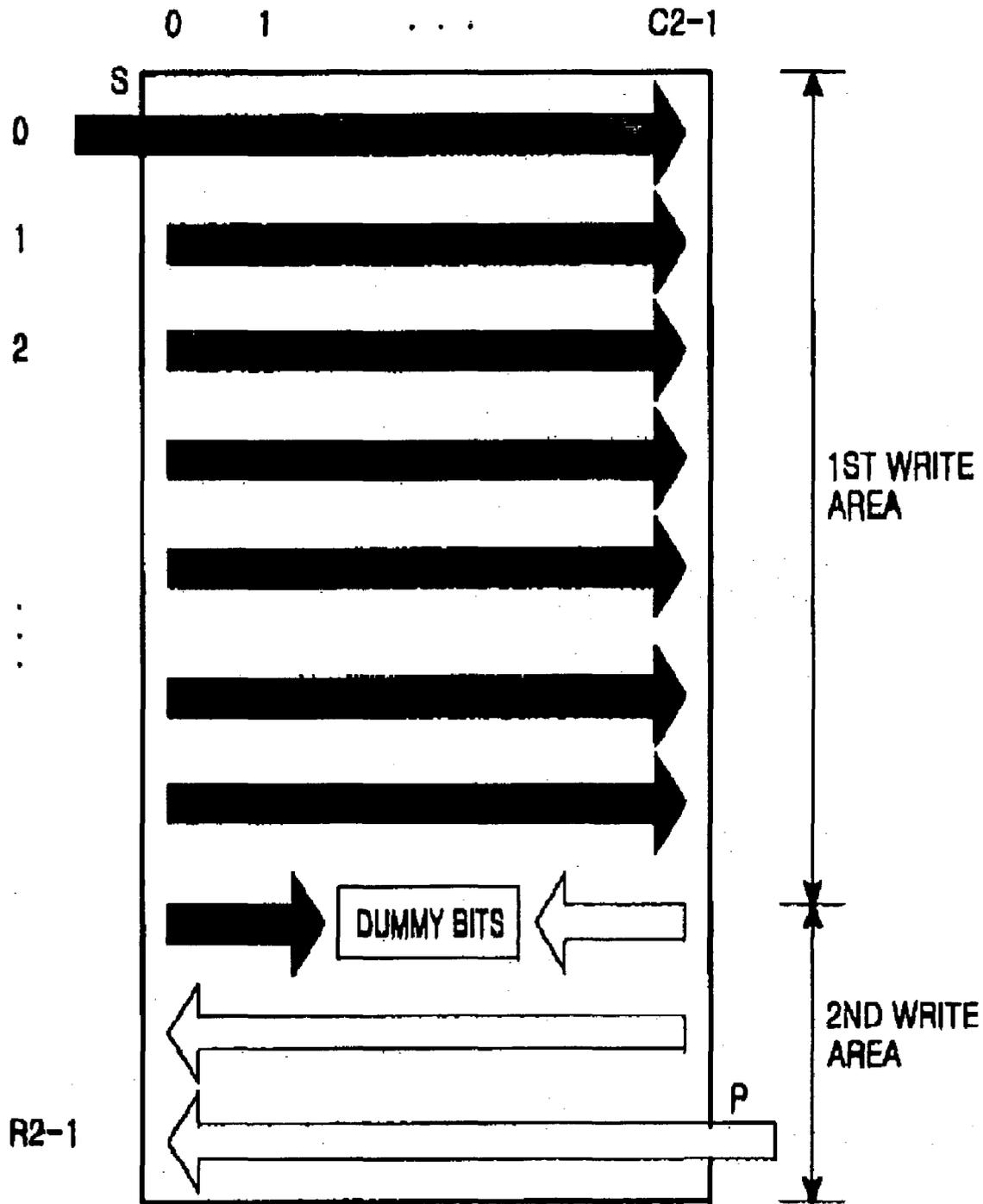


FIG. 10C

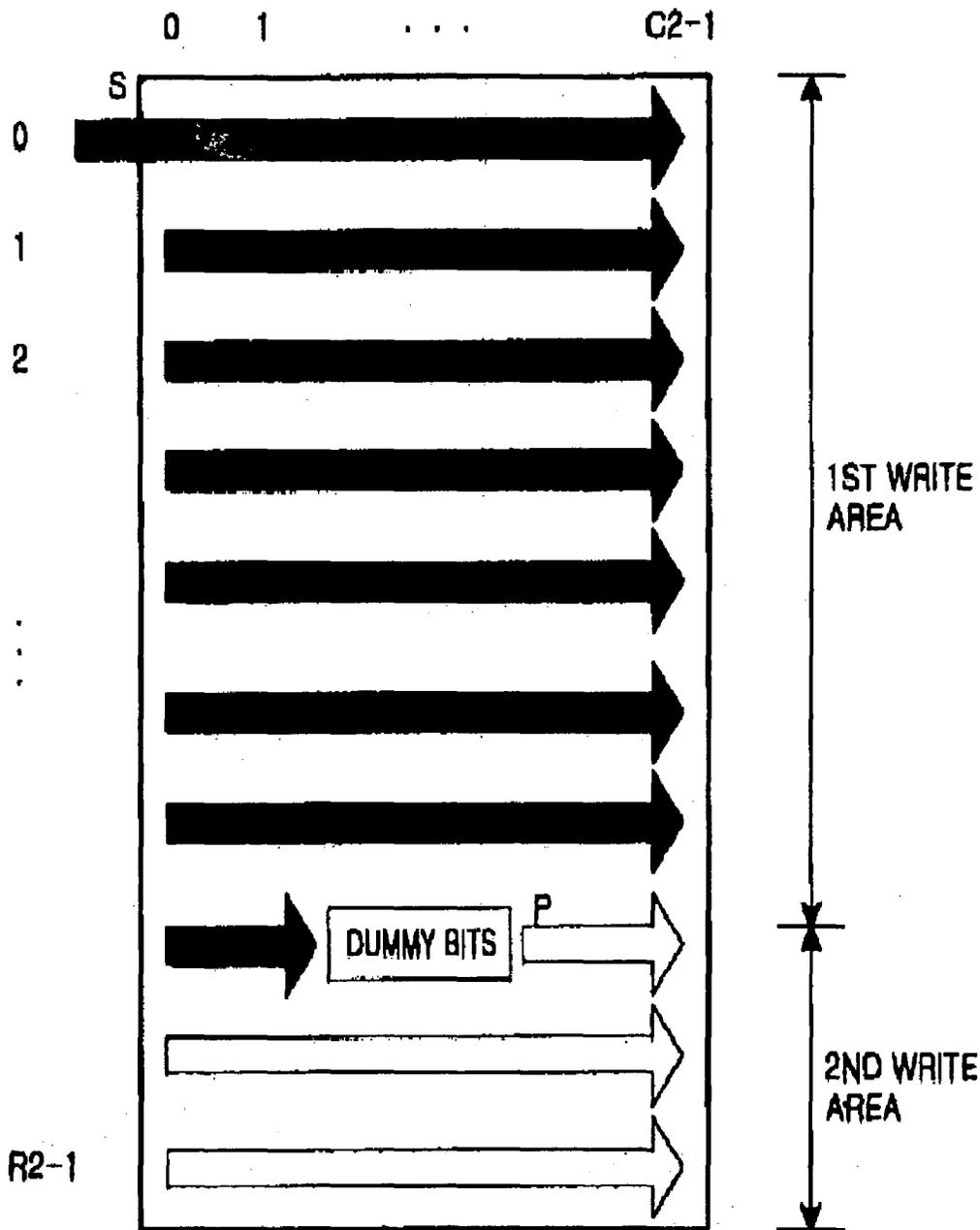


FIG. 10D

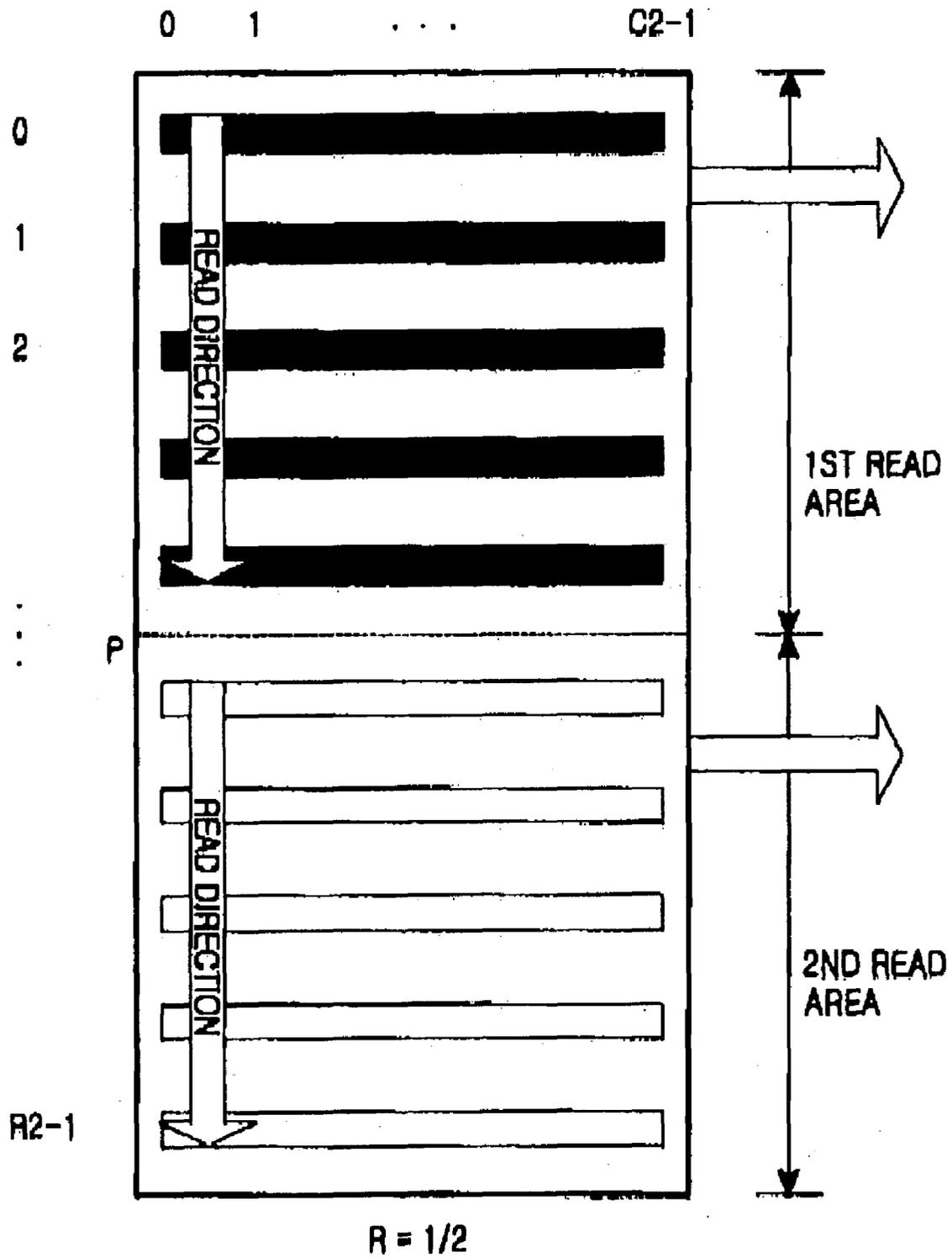


FIG.11A

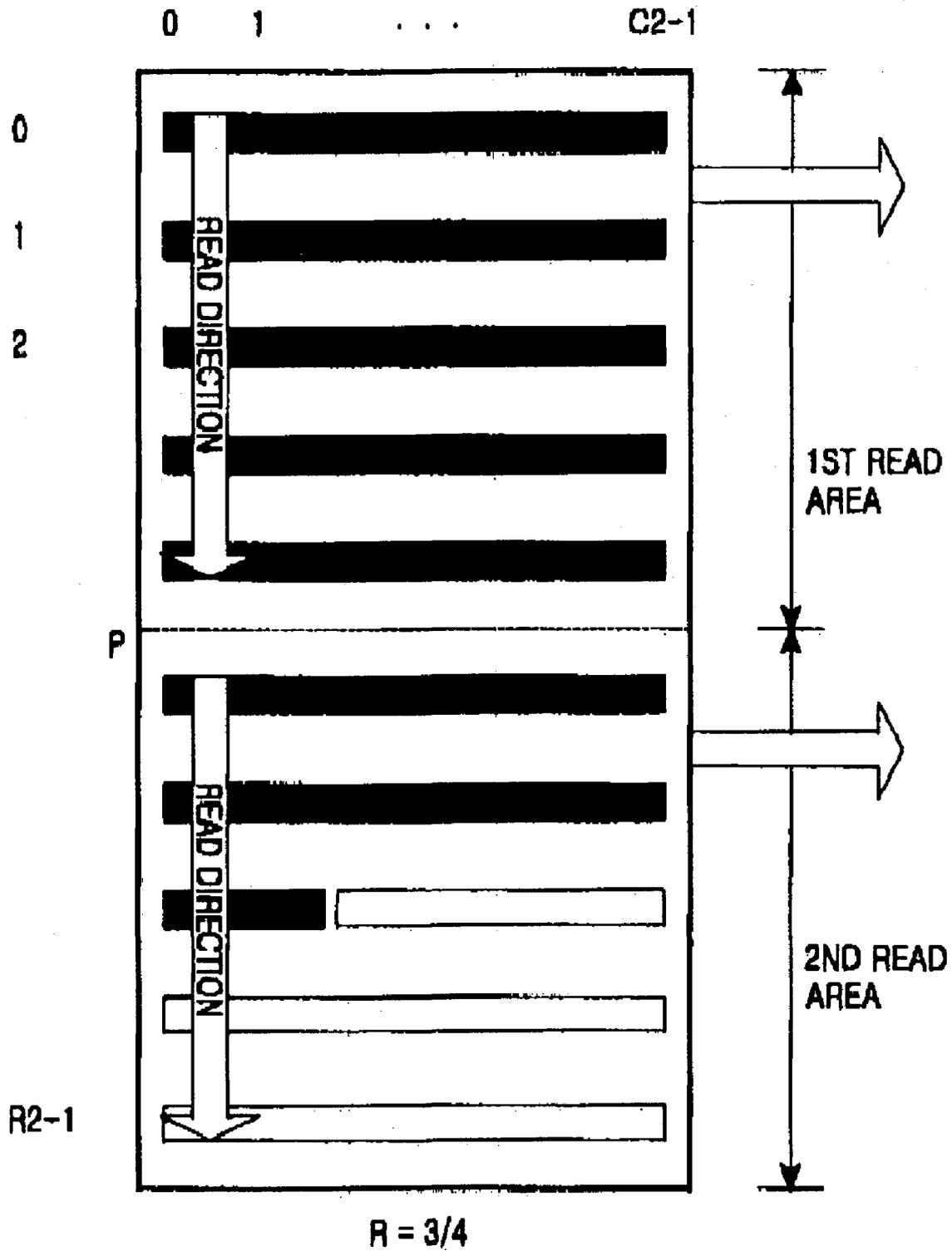


FIG. 11B

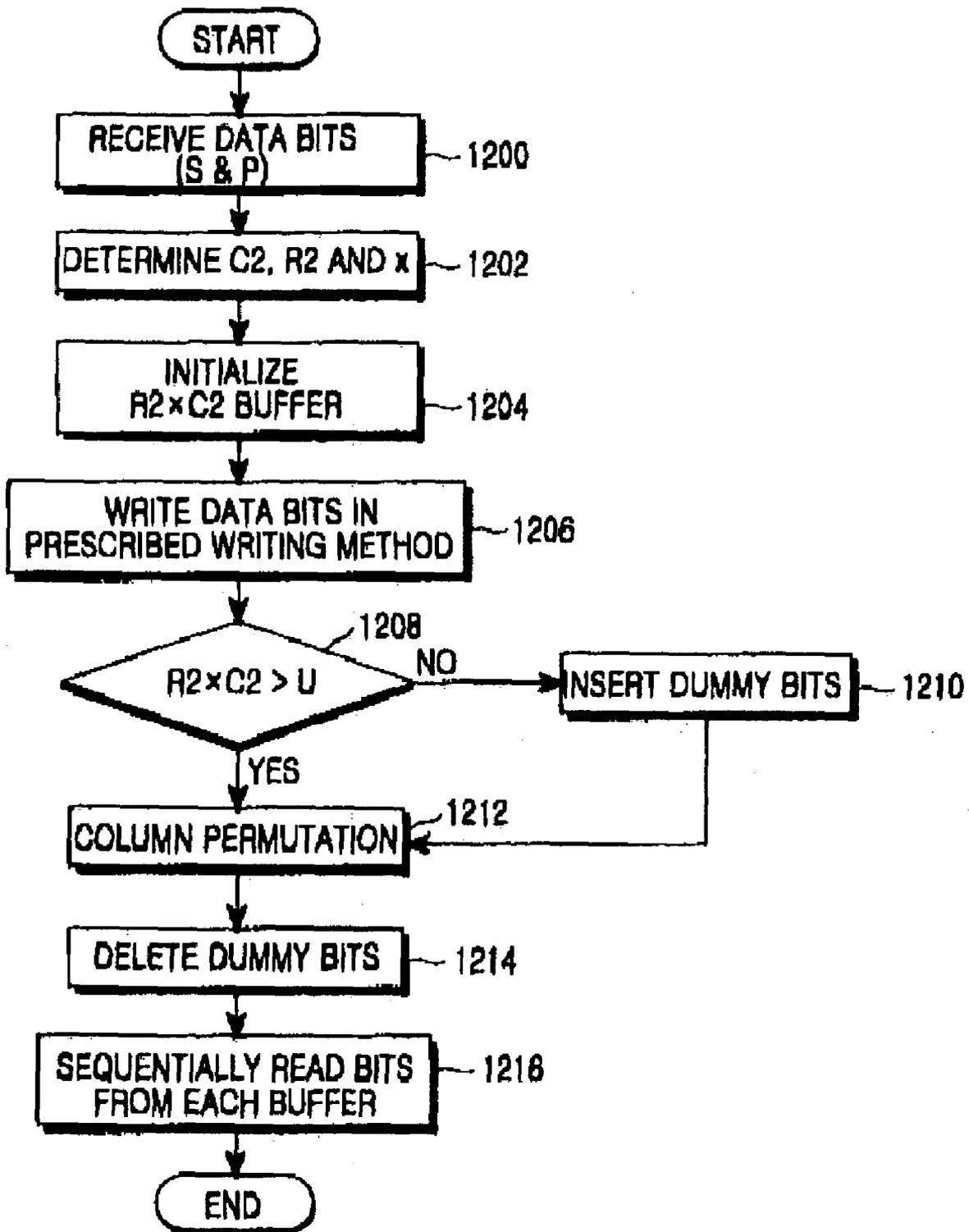


FIG.12

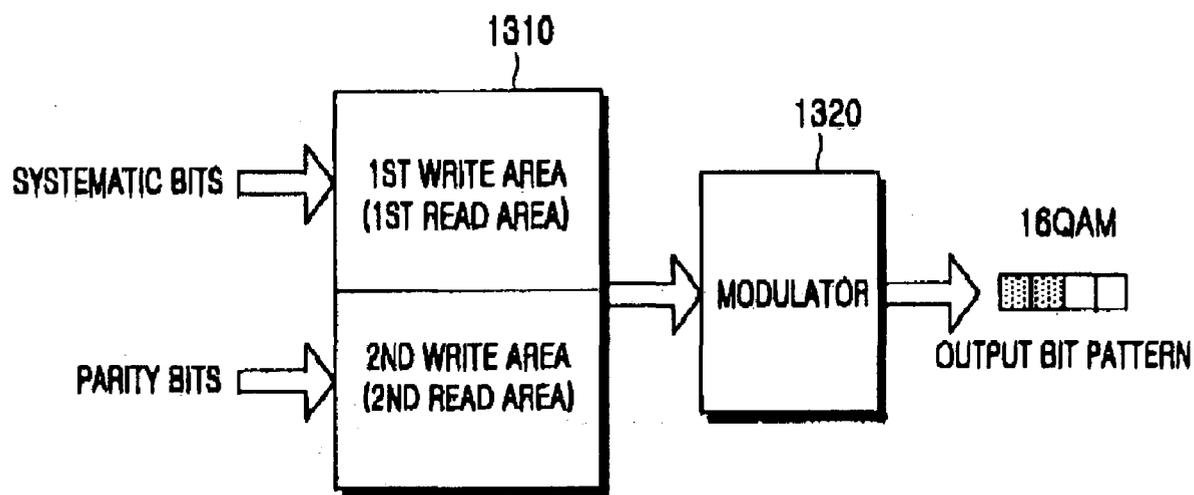


FIG. 13

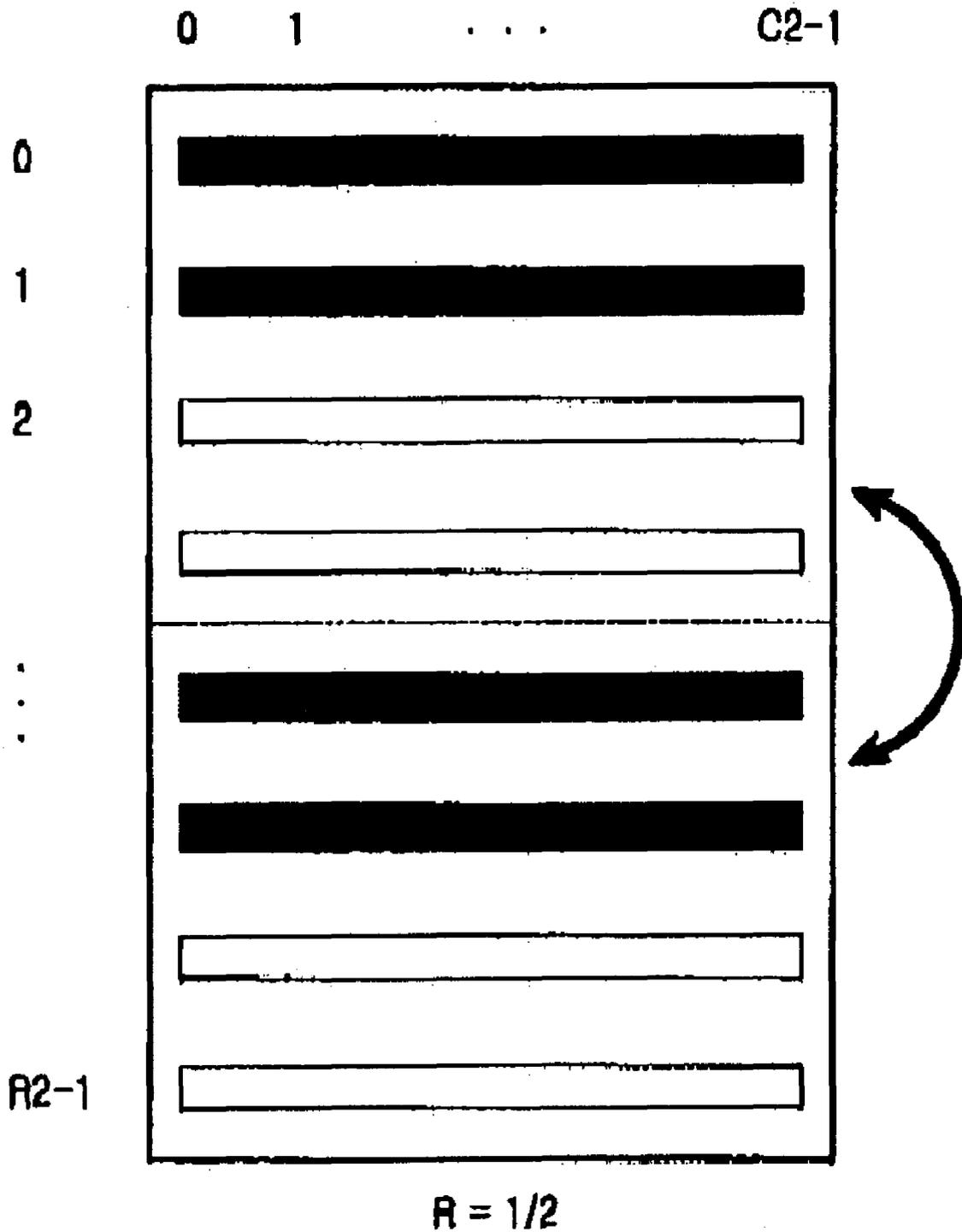


FIG. 14A

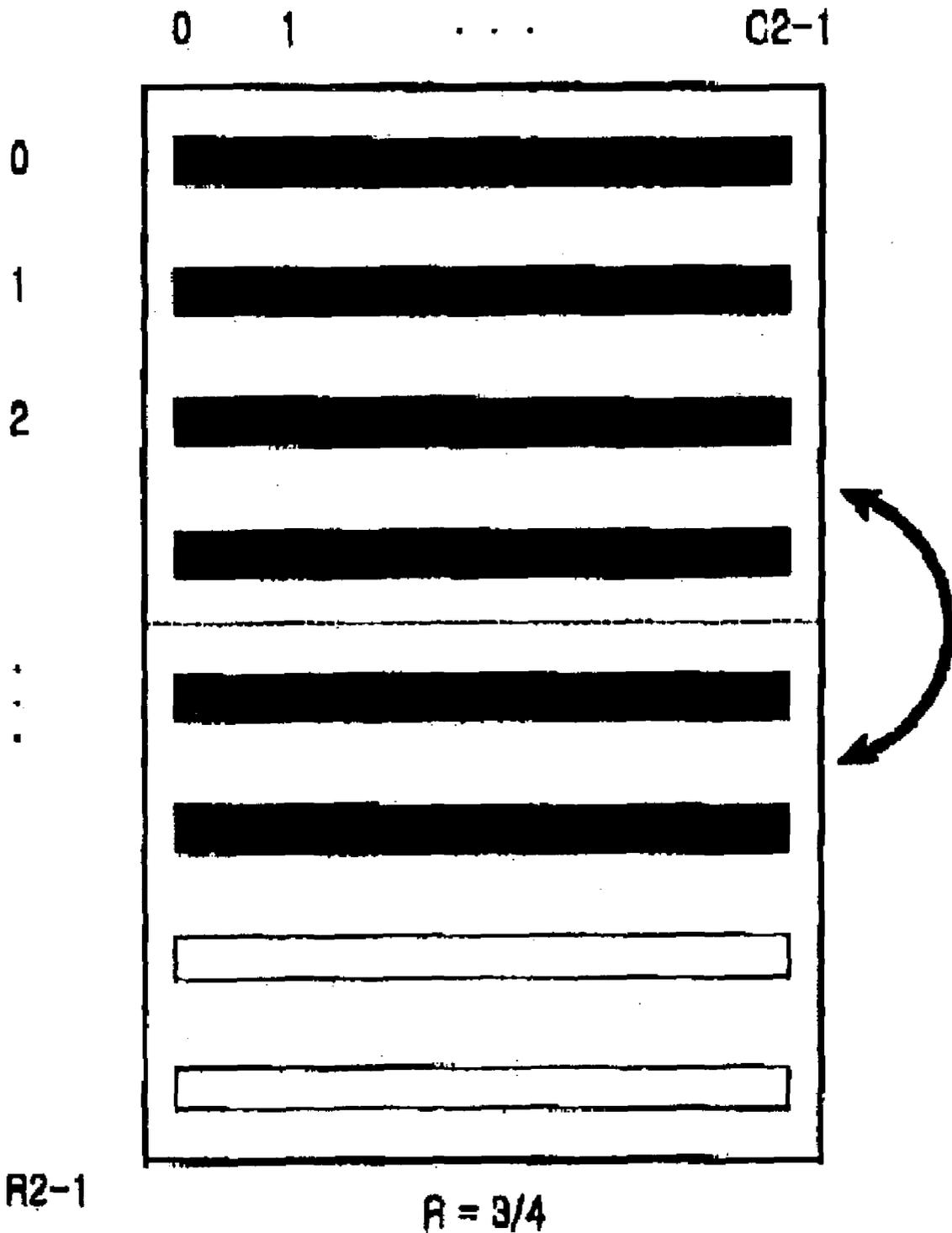


FIG. 14B

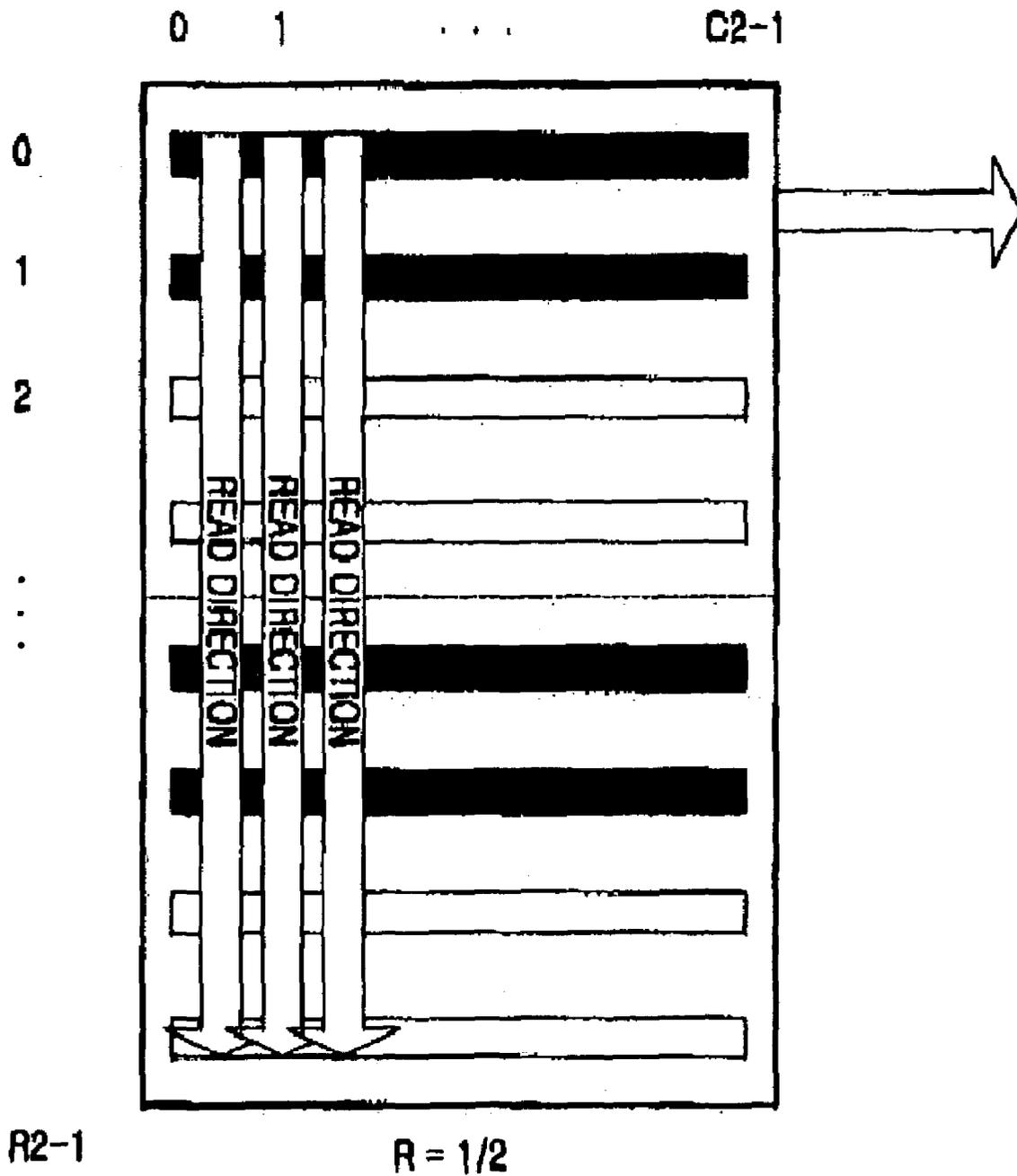


FIG. 15A

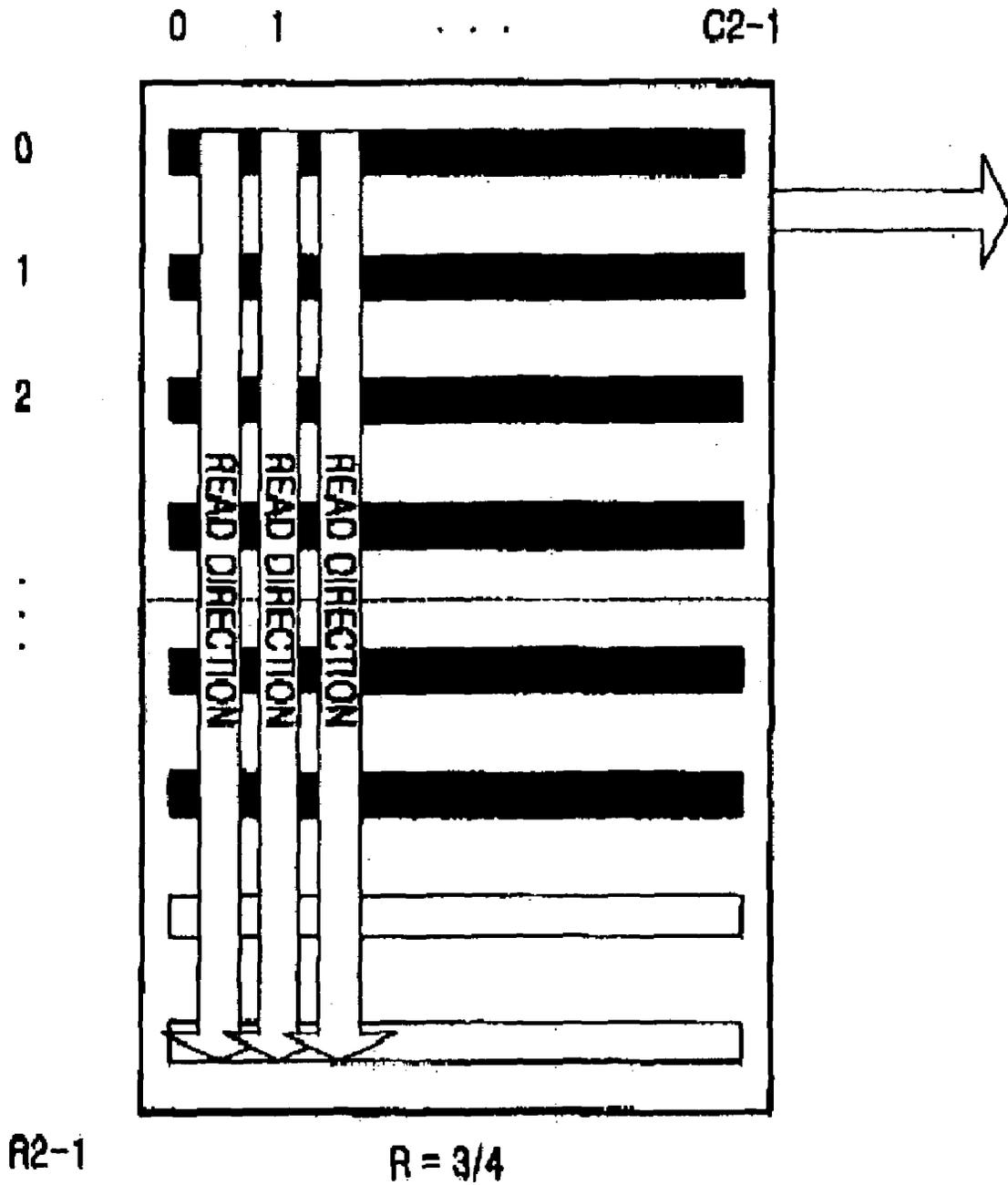


FIG. 15B

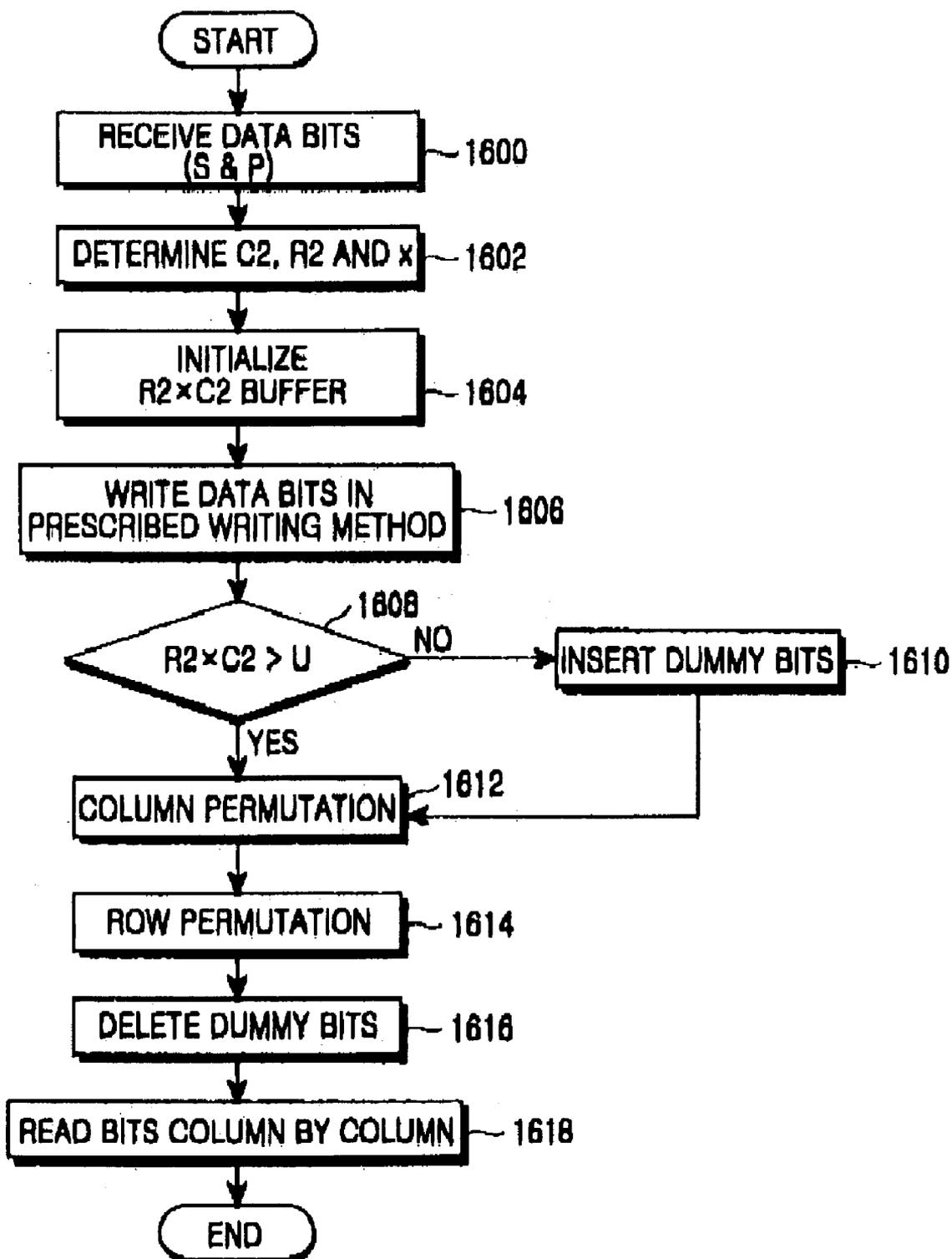


FIG. 16

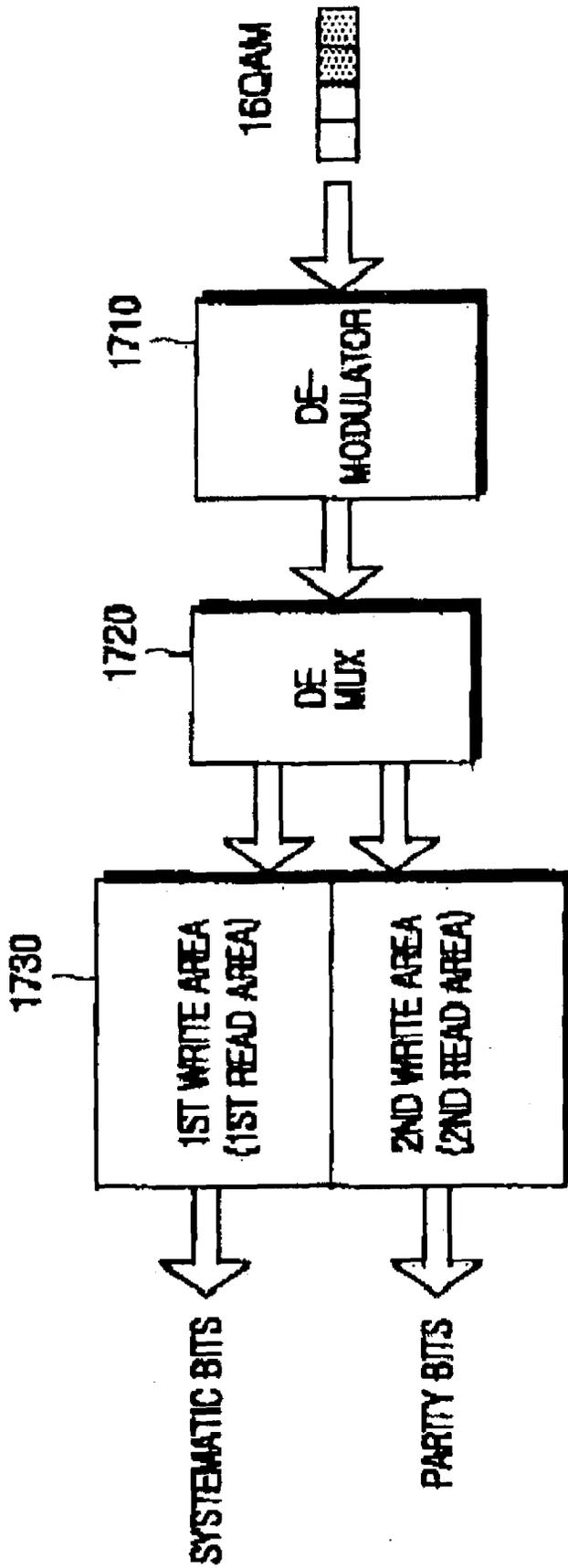


FIG.17

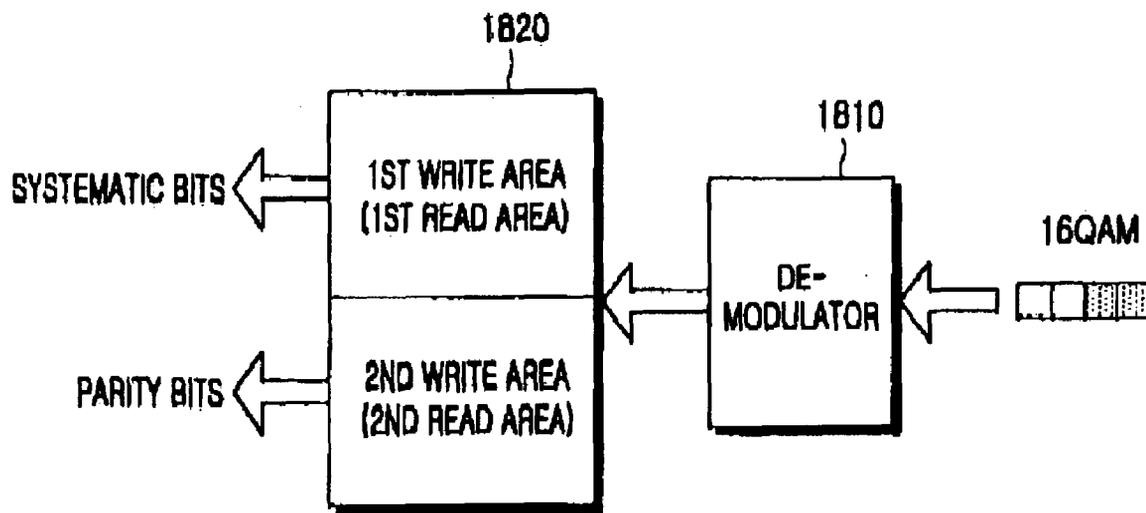


FIG. 18

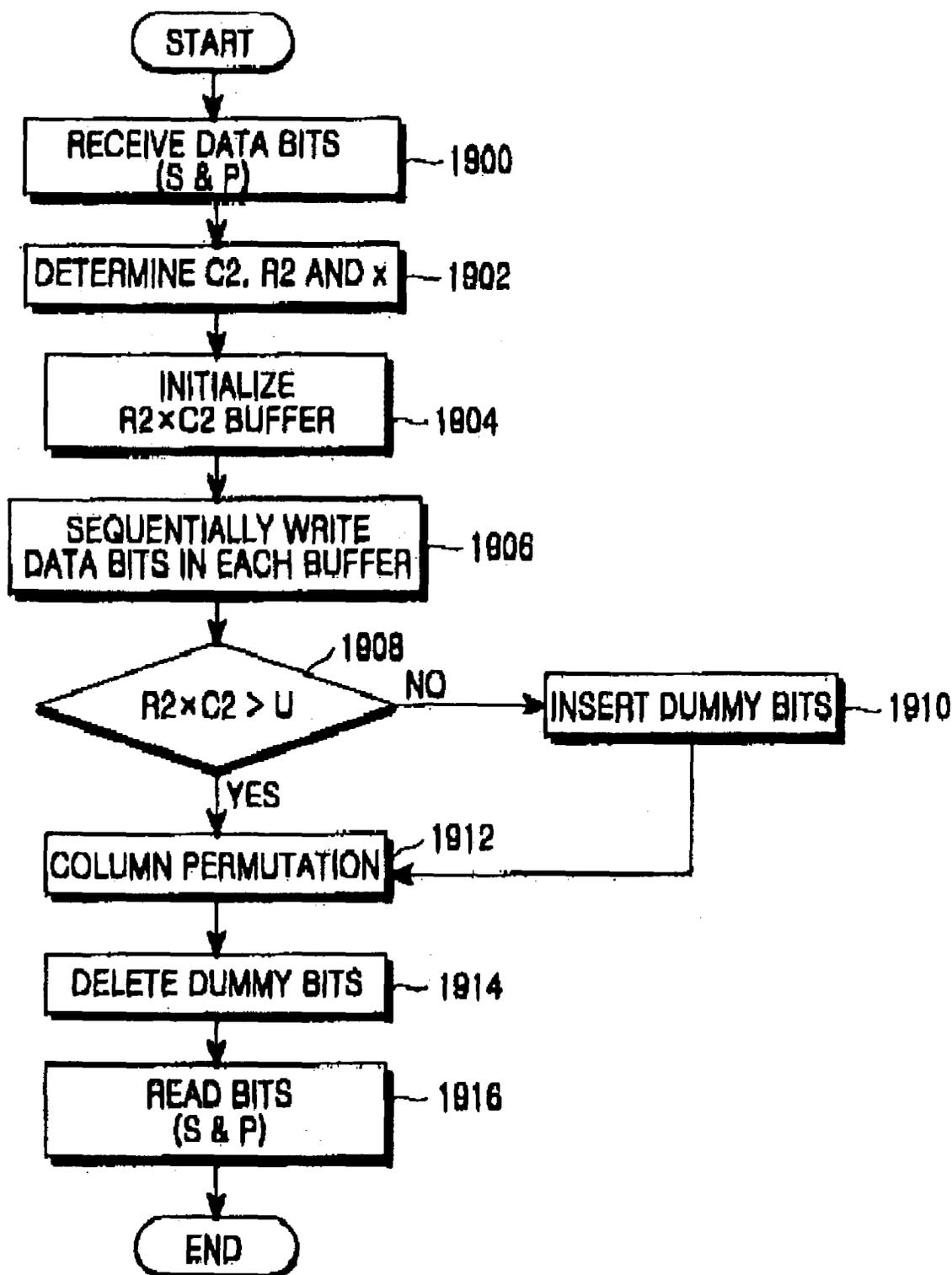


FIG. 19

# INTERLEAVING APPARATUS AND METHOD FOR SYMBOL MAPPING IN AN HSDPA MOBILE COMMUNICATION SYSTEM

PRIORITY

This application claims priority to an application entitled "Interleaving Apparatus and Method for Symbol Mapping in an HSDPA Mobile Communication System" filed in the Korean Industrial Property Office on Dec. 21, 2001 and assigned Ser. No. 2001-83064, the contents of which are incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates generally to a data transmission/reception apparatus and method in a CDMA (Code Division Multiple Access) mobile communication system, and in particular, to a data transmission/reception apparatus and method for improving reliability of transmission data bits.

### 2. Description of the Related Art

In reality, in a communication system, it is impossible to receive a transmitted signal without any distortion or noise. Particularly, a mobile communication system that transmits and receives signals through a wireless network is more susceptible to the distortion or noise, compared with a communication system that transmits and receives signals through a wired network.

Therefore, various techniques for minimizing the influence of the distortion or noise have been proposed, and an error control coding technique is one of the typical proposed techniques. Codes used for the error control coding technique are classified into memoryless codes and memory codes. The memoryless codes include linear block codes, and the memory codes include convolutional codes and turbo codes. A device for creating such codes is called a "channel encoder," and its outputs can be divided into systematic bits and parity bits according to the error control coding technique in use. The turbo codes are typically used for the error control coding technique for separately outputting the systematic bits and the parity bits. Of course, in addition to the turbo codes, systematic convolutional codes, a kind of the convolutional codes, are used to separately output the systematic bits and the parity bits. Here, the systematic bits mean actual signals to be transmitted, and the parity bits are signals added to correct a possible transmission error of the systematic bits during decoding. However, even in the case of the error control-coded signals, if a burst error occurs in the systematic bits or parity bits, it is not easy to correct the burst error. Such a phenomenon frequently occurs when a signal passes through a fading channel, and an interleaving technique is typically used to prevent this phenomenon.

The interleaving technique is used to more efficiently overcome the burst error by dispersing a defective part into several positions instead of concentrating the defective part on a particular position.

The interleaved signal undergoes symbol mapping in a digital modulator. Here, if an order of the modulator is increased, the number of bits included in one symbol is also increased. Particularly, in the case of a high-order modulation technique of over 16QAM (16-ary Quadrature Amplitude Modulation), one symbol includes 4 or more information bits, and the information bits can be classified according to their reliability. Here, as to the reliability, in a process of

modulating one symbol by a transmitter, a symbol representing two bits in a macro region like the left/right quadrants or upper/lower quadrants on the X/Y-axis has "high reliability," and a symbol representing two bits in a micro region has "low reliability."

FIG. 1 schematically illustrates a structure of a transmitter in an HSDPA (High Speed Downlink Packet Access) mobile communication system. As illustrated, the transmitter includes a channel encoder, an interleaver and a modulator.

Referring to FIG. 1, input information bits to which CRC (Cyclic Redundancy Check) bits, or error detection data, are added in a CRC generator 110, are provided to a channel encoder 120, and the channel encoder 120 encodes the CRC bit-added input information bits through a predetermined coding process, and outputs coded bits, i.e., systematic bits S and parity bits P. The channel encoder 120 has at least one code rate in order to encode the information bits. The code rate may become  $\frac{1}{2}$  or  $\frac{3}{4}$ . In addition, when the channel encoder 120 supports a plurality of code rates through symbol puncturing or symbol repetition based on a rate  $R=\frac{1}{2}$  or  $\frac{1}{3}$  mode code, an operation of selecting a particular code rate from the supportable code rates is required. In FIG. 1, for example, the channel encoder 120 determines a code rate under the control of a controller 160. The coded bits are subject to rate matching in a rate matcher 130. Commonly, the rate matching is performed through repetition and/or puncturing on the coded bits, when a transport channel is subject to multiplexing or the output symbols of the channel encoder 120 are not identical in number to the symbols transmitted over the air. The puncturing or repetition function of the rate matcher 130 is identical to the puncturing or repetition function performed to adjust a code rate of the channel encoder 120, the functions can be united. That is, the channel encoder 120 and the rate matcher 130 can be integrated into one block, but they are separately illustrated in FIG. 1, for the sake of convenience. The coded bits rate-matched by the rate matcher 130 are subject to interleaving in an interleaver 140. The interleaving operation is performed to minimize a data loss even though data is lost during transmission. The interleaved coded bits are subject to symbol mapping in a modulator 150 according to a modulation technique of QPSK (Quadrature Phase Shift Keying), 8PSK (8-ary Phase Shift Keying), 16QAM (16-ary Quadrature Amplitude Modulation) or 64QAM. The controller 160 controls a coding operation of the channel encoder 120 and a modulation technique of the modulator 150 according to a current state of a radio channel. In the HSDPA mobile communication system, AMCS (Adaptive Modulation and Coding Scheme) is used for the controller 160 in order to adaptively select one of the modulation techniques QPSK, 8PSK, 16QAM and 64QAM according to the radio environment.

Though not illustrated in the drawing, a CDMA mobile communication system spreads transmission data with a Walsh code W and a PN (Pseudo Noise) orthogonal code (PN) so that a corresponding UE (User Equipment), or a mobile terminal, can identify a channel over which the data is transmitted, and a Node B, or a base station, which transmits the data.

In the transmitter structure stated above, as a matter of course, systematic bits and parity bits output from the channel encoder 120 have different priorities. In other words, in the case where errors occur in transmission data at a certain rate, the transmission data can be decoded more correctly at a receiver when the errors occur in the parity bits, compared with when the errors occur in the systematic bits. The reason is because, as stated above, the systematic

bits are the actual data bits, while the parity bits are the bits added to correct the transmission errors during decoding. For this, a symbol mapping (SMP) technique has been proposed, and the SMP technique is disclosed in Korean patent application No. 2001-17925, filed by the applicant on Apr. 4, 2001 the contents of which are incorporated herein by reference.

The SMP technique is a technique for increasing system performance by reducing an error probability of the systematic bits having higher priority than the parity bits. That is, the SMP technique enables the modulator **150** to map the systematic bits with higher priority to the bits with higher reliability among the bits constituting a symbol, and map the parity bits with lower priority to the bits with lower reliability, during symbol mapping based on a predetermined modulation technique. Therefore, in the transmitter of the conventional mobile communication system, it is necessary to improve the interleaver **140** which interleaves coded bits regardless of their priority. That is, in order to apply the SMP technique, the interleaver **140** must be improved such that it can separately interleave the systematic bits and the parity bits.

#### SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a method for reducing complexity and securing compatibility with an existing algorithm in realizing an interleaver for a SMP technique.

It is another object of the present invention to provide a data transmission/reception apparatus and method for improving performance of a mobile communication system by realizing an SMP technique for differentially mapping reliabilities according to priority.

It is further another object of the present invention to provide a method for efficiently realizing SMP in a mobile communication system.

It is yet another object of the present invention to provide an algorithm for an interleaver in a mobile communication system.

It is still another object of the present invention to provide an apparatus for realizing SMP in a mobile communication system.

It is still another object of the present invention to provide an apparatus and method for reducing complexity in realizing SMP.

To achieve the above and other objects, the present invention provides a new method for realizing SMP with a minimized increase in complexity and minor modification of the algorithm, compared with an existing interleaving algorithm. Further, the present invention proposes a condition to which the method can be applied.

According to a first aspect of the present invention, the present invention provides a method for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The method comprises separating the area of the buffer into a first write area and a second write area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and sequentially writing a stream of the coded bits with lower priority in a row direction from a first column to a last column among the columns in the second write area; per-

muting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; and alternately reading as many bits as a number determined based on a prescribed modulation technique from the first read area and the second read area in such a manner that the bits are sequentially read in a column direction from a first row to a last row among the rows of each of the first read area and the second read area.

According to a second aspect of the present invention, the present invention provides a method for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The method comprises separating the area of the buffer into a first write area and a second write area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and sequentially writing a stream of the coded bits with lower priority in a row direction from a first column to a last column among the columns in the second write area; permuting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; permuting, between the first read area and the second read area, as many rows as a number determined based on a prescribed modulation technique among the rows of each of the first read area and the second read area; and sequentially reading the rows in the entire buffer area comprised of the first read area and the second read area, in a column direction from a first row to a last row.

According to a third aspect of the present invention, the present invention provides a method for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The method comprises separating the area of the buffer into a first write area and a second write area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and writing a stream of the coded bits with lower priority in a row direction from a last column to a first column among the columns in the second write area in such a manner that the stream of coded bits is written in a reverse direction from a last row to a first row in the second write area; permuting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; and alternately reading as many bits as a number determined based on a prescribed modulation technique from the first read area and the second read area in such a manner that the bits are sequentially read in a column direction from a first row to a last row among the rows of each of the first read area and the second read area.

According to a fourth aspect of the present invention, the present invention provides a method for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The method comprises separating the area of the buffer into a first write area and a second write

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area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and writing a stream of the coded bits with lower priority in a row direction from a last column to a first column among the columns in the second write area in such a manner that the stream of coded bits is written in a reverse direction from a last row to a first row in the second write area; permuting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; permuting, between the first read area and the second read area, as many rows as a number determined based on a prescribed modulation technique among the rows of each of the first read area and the second read area; and sequentially reading the rows in the entire buffer area comprised of the first read area and the second read area, in a column direction from a first row to a last row.

According to a fifth aspect of the present invention, the present invention provides a method for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including two buffers each having an area comprised of a plurality of rows and columns, for writing the coded bits. The method comprises writing coded bits with higher priority among the coded bits in a first buffer and writing coded bits with lower priority in a second buffer, in such a manner that a stream of the coded bits with higher priority is sequentially written in a row direction from a first column to a last column among the columns in the write area of the first buffer and a stream of the coded with lower priority is sequentially written in a row direction from a first column to a last column among the columns in the write area of the second buffer; permuting the columns of the write areas in the first buffer and the second buffer according to a given rule; and alternately reading as many bits as a number determined based on a prescribed modulation technique from the write area of the first buffer and the write area of the second buffer in such a manner that the bits are sequentially read in a column direction from a first row to a last row among the rows of the write areas in each of the first buffer and the second buffer.

According to a sixth aspect of the present invention, the present invention provides an apparatus for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including an encoder for encoding transmission data into coded bits at the prescribed code rate, the coded bits including coded bits with higher priority and coded bits with lower priority, and a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The apparatus comprises an interleaver for separating the area of the buffer included therein into a first write area and a second write area according to a ratio of the coded bits with higher priority to the coded bits with lower priority, sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and sequentially writing a stream of the coded bits with lower priority in a row direction from a first column to a last column among the columns in the second write area, and permuting the columns in the buffer area according to a given rule. Further, the apparatus comprises a multiplexer for dividing the rows in the buffer area into a first read area and a second read area having the same size, and alternately reading as many bits as a number determined based on a prescribed modulation

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technique from the first read area and the second read area in such a manner that the bits are sequentially read in a column direction from a first row to a last row among the rows of each of the first read area and the second read area, and multiplexing the read coded bits.

According to a seventh aspect of the present invention, the present invention provides an apparatus for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including an encoder for encoding transmission data into coded bits at the prescribed code rate, the coded bits including coded bits with higher priority and coded bits with lower priority, and a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The apparatus comprises an interleaver for separating the area of the buffer into a first write area and a second write area according to a ratio of coded bits with higher priority to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and sequentially writing a stream of the coded bits with lower priority in a row direction from a first column to a last column among the columns in the second write area; permuting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; and permuting, between the first read area and the second read area, as many rows as a number determined based on a prescribed modulation technique among the rows of each of the first read area and the second read area.

According to an eighth aspect of the present invention, the present invention provides an apparatus for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including an encoder for encoding transmission data into coded bits at the prescribed code rate, the coded bits including coded bits with higher priority and coded bits with lower priority, and a buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The apparatus comprises an interleaver for separating the area of the buffer into a first write area and a second write area according to a ratio of the coded bits with higher priority to the coded bits with lower priority, sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and writing a stream of the coded bits with lower priority in a row direction from a last column to a first column among the columns in the second write area in such a manner that the stream of coded bits is written in a reverse direction from a last row to a first row in the second write area, and permuting the columns in the buffer area according to a given rule. Further, the apparatus comprises a multiplexer for dividing the rows in the buffer area into a first read area and a second read area having the same size, alternately reading as many bits as a number determined based on a prescribed modulation technique from the first write area and the second write area, and sequentially reading coded bits in a column direction from a first row to a last row among the rows in the first read area and the second read area, and multiplexing the read coded bits.

According to a ninth aspect of the present invention, the present invention provides an apparatus for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including an encoder for encoding transmission data into coded bits at the prescribed code rate, the coded bits including coded bits with higher priority and coded bits with lower priority, and a

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buffer having an area comprised of a plurality of rows and columns, for writing the coded bits. The apparatus comprises an interleaver for separating the area of the buffer into a first write area and a second write area according to a ratio of coded bits with higher priority to coded bits with lower priority; sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the first write area, and writing a stream of the coded bits with lower priority in a row direction from a last column to a first column among the columns in the second write area in such a manner that the stream of coded bits is written in a reverse direction from a last row to a first row in the second write area; permuting the columns in the buffer area according to a given rule; dividing the rows in the buffer area into a first read area and a second read area having the same size; and permuting, between the first read area and the second read area, as many rows as a number determined based on a prescribed modulation technique among the rows of each of the first read area and the second read area.

According to a tenth aspect of the present invention, the present invention provides an apparatus for interleaving coded bits encoded at a prescribed code rate in a transmitter for a mobile communication system including an encoder for encoding transmission data into coded bits at the prescribed code rate, the coded bits including coded bits with higher priority and coded bits with lower priority, and buffers each having an area comprised of a plurality of rows and columns, for writing the coded bits. The apparatus comprises an interleaver including a first buffer for sequentially writing a stream of the coded bits with higher priority in a row direction from a first column to a last column among the columns in the write area thereof, and a second buffer for sequentially writing a stream of the coded bits with lower priority in a row direction from a first column to a last column among the columns in the write area thereof, the interleaver permuting the columns of the write areas in the first buffer and the second buffer according to a given rule; and a multiplexer for alternately reading as many bits as a number determined based on a prescribed modulation technique from the write area of the first buffer and the write area of the second buffer in such a manner that the bits are sequentially read in a column direction from a first row to a last row among the rows of the write areas in each of the first buffer and the second buffer, and multiplexing the read coded bits.

According to a eleventh aspect of the present invention, the present invention provides a method for deinterleaving coded bits demodulated by a prescribed demodulation technique in a receiver for a mobile communication system including a buffer having an area comprised of rows and columns, for writing the coded bits. The method comprises demultiplexing the coded bits at prescribed periods; separating a use area of the buffer into a first write area and a second write area having the same size; sequentially writing one demultiplexed output into the first write area and sequentially writing another demultiplexed output into the second write area; dividing the use area into a first read area and a second read area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; and reading coded bits from the first read area and the second read area according to the ratio of the coded bits with higher priority to the coded bits with lower priority.

According to a twelfth aspect of the present invention, the present invention provides an apparatus for deinterleaving coded bits demodulated by a prescribed demodulation technique in a receiver for a mobile communication system

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including a buffer having an area comprised of rows and columns, for writing the coded bits. The apparatus comprises a deinterleaver for separating a use area of the buffer into a first write area and a second write area having the same size; sequentially writing one demultiplexed output into the first write area and sequentially writing another demultiplexed output into the second write area; dividing the use area into a first read area and a second read area according to a ratio of coded bits with higher priority among the coded bits to coded bits with lower priority; and reading coded bits from the first read area and the second read area according to the ratio of the coded bits with higher priority to the coded bits with lower priority, and deinterleaving the read coded bits.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram illustrating a structure of a high-speed packet transmission system according to the prior art;

FIG. 2 is a block diagram illustrating a structure of a high-speed packet transmission system supporting SMP for differentially mapping reliabilities according to priority, according to an embodiment of the present invention;

FIG. 3 is a block diagram illustrating a process of mapping systematic bits and parity bits, applied in the same ratio to two physically separated interleaving buffers having a sufficient size, to a 16QAM or 64QAM-modulated symbol in the case where a code rate is  $\frac{1}{2}$ , according to an embodiment of the present invention;

FIG. 4 is a block diagram illustrating a process of mapping systematic bits and parity bits, applied in a different ratio to two physically separated interleaving buffers having a sufficient size, to a 16QAM or 64QAM-modulated symbol in the case where a code rate is  $\frac{3}{4}$ , according to an embodiment of the present invention;

FIG. 5 is a block diagram illustrating a process of mapping systematic bits and parity bits, applied in a different ratio to two physically separated interleaving buffers having a minimum size, to a 16QAM or 64QAM-modulated symbol in the case where a code rate is  $\frac{3}{4}$ , according to an embodiment of the present invention;

FIG. 6 is a flowchart illustrating a process of applying an SMP technique by physically separating an interleaver according to an embodiment of the present invention;

FIG. 7 is a block diagram illustrating a structure of a transmitter according to a first embodiment of the present invention;

FIGS. 8A and 8B illustrate examples of a writing process for a code rate  $\frac{1}{2}$  according to a first embodiment of the present invention;

FIGS. 9A and 9B illustrate examples of a writing process for a code rate  $\frac{3}{4}$  according to the first embodiment of the present invention;

FIGS. 10A to 10D illustrate examples of a writing process for a code rate  $\frac{3}{4}$ , using dummy bits, according to the first embodiment of the present invention;

FIGS. 11A and 11B illustrate examples of a process of reading coded bits according to the first embodiment of the present invention;

FIG. 12 is a flowchart illustrating a process of applying an SMP technique by logically separating an interleaver according to the first embodiment of the present invention;

FIG. 13 is a block diagram illustrating a structure of a transmitter according to a second embodiment of the present invention;

FIGS. 14A and 14B illustrate examples of a writing process according to the second embodiment of the present invention;

FIGS. 15A and 15B illustrate examples of a read process according to the second embodiment of the present invention;

FIG. 16 is a flowchart illustrating a process of applying an SMP technique by logically separating an interleaver according to the second embodiment of the present invention;

FIG. 17 is a block diagram illustrating a structure of a receiver corresponding to the transmitter according to the first embodiment of the present invention;

FIG. 18 is a block diagram illustrating a structure of a receiver corresponding to the transmitter according to the second embodiment of the present invention; and

FIG. 19 is a flowchart illustrating an operation of the receiver according to an embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

The present invention provides examples for an interleaver required for applying the SMP technique. Commonly, in a mobile communication system, an amount of (or the number of) systematic bits and the number of parity bits, mapped to each symbol, are different according to a code rate and a modulation technique. Therefore, in order to adjust the number of systematic bits and parity bits, an input of a modulator must be formed in a proper pattern according to the above condition. That is, an interleaver for applying the SMP technique must be improved such that it can separately interleave the systematic bits and the parity bits. There are several methods for realizing such an interleaver arranged in front of the modulator according to a given condition.

The method for improving an interleaver can be divided into one method for separating the interleaver physically and another method for separating the interleaver logically. The physical separation method separates the interleaver into an interleaver for interleaving coded bits with higher priority and an interleaver for interleaving coded bits with lower priority. The logical separation method separates a storage area of a buffer included in one interleaver into an area for storing coded bits with higher priority and an area for storing coded bits with lower priority.

##### 1. Physical Separation Method

FIG. 2 illustrates a structure of a high-speed packet transmission system to which the SMP technique is applied using two physically-separated interleavers. The structure of FIG. 2 includes two physically-separated interleavers, and the systematic bits S and the parity bits P are separately interleaved by the different interleavers. To this end, an interleaving block includes a distributor 240, two interleavers 250 and 260, and a parallel-to-serial (P/S) converter 270.

Referring to FIG. 2, the distributor 240 properly distributes input coded bits to the two interleavers 250 and 260. For example, the distributor 240 distributes the bits with higher

priority among the coded bits to the first interleaver 250, and the bits with lower priority to the second interleaver 260. In addition, if a code rate for encoding is asymmetric, the distributor 240 can uniformly distribute the coded bits to the first interleaver 250 and the second interleaver 260 according to priority of the coded bits and the code rate. Meanwhile, the first interleaver 250 and the second interleaver 260 separately interleave the coded bits distributed from the distributor 240, and provide the interleaved coded bits in parallel to the P/S converter 270. The P/S converter 270 converts the interleaved coded bits provided in parallel into serial data in the form of a proper bit stream according to a code rate and a modulation technique. To this end, the P/S converter 270 should be able to select the two inputs in series for a variable period according to the code rate and the modulation technique under the control of a controller.

Meanwhile, examples of applying the SMP technique using the two physically-separated interleavers are illustrated in FIGS. 3 to 5.

Referring to FIG. 3, in the case where a code rate is  $\frac{1}{2}$ , and the systematic (S) bits and the parity (P) bits are properly distributed to the two interleavers 250 and 260, the systematic bits and the parity bits can be mapped to H positions with higher reliability and L positions with lower reliability of each symbol by a modulator 280, respectively. Here, the distributor 240 is optional, and the P/S converter 270 simply serves as a multiplexer (MUX).

Referring to FIG. 4, in the case where a code rate is  $\frac{3}{4}$ , and the two interleavers 250 and 260 sufficiently receive the systematic bits and the parity bits, an output pattern of the modulator 280 can become optimal as described in conjunction with FIG. 3. Likewise, the distributor 240 in FIG. 4 is also optional. As illustrated in FIG. 4, since two patterns are required for 64QAM, the P/S converter 270 must control its operation according to a modulation order. For example, the P/S converter 270 outputs 1 parity bit per 5 systematic bits for an initial symbol, and outputs 2 parity bits for 4 systematic bits for the next symbol. For an operation proper to the modulation technique and the code rate, the P/S converter 270 plays an important role.

Referring to FIG. 5, in the case where a size of a first buffer 250 is smaller than the total number of systematic bits, a second buffer 260 must accept the excessive number of systematic bits. As illustrated, in the case of 16QAM, there is no output pattern which violates a general idea of SMP. However, in the case of 64QAM, some patterns are formed such that the systematic bits can be mapped to the bit positions having higher reliability than the parity bits. The reason is because after the input bits of the second buffer 260 are randomly interleaved, the P/S converter 270 cannot distinguish the systematic bits and the parity bits stored in the second buffer 260.

As can be understood from FIGS. 3 to 5, if the size of the buffer (buffer size={the number of systematic bits}+{the number of parity bits}) is minimized, a symbol pattern for the 64QAM cannot be optimally mapped. In other words, in the case where the interleaving buffer is physically separated, if a high-order modulation technique of 64QAM is applied, it is necessary to sufficiently increase the sizes of the two buffers for all code rates, in order to create optimal mapping patterns. However, in the case of the modulation technique with a modulation order of below 16QAM, the optimal mapping patterns can be generated even though the size of the buffer is minimized.

Herein, the present invention provides a method for minimizing a size of the buffer to minimize hardware complexity as described in conjunction with FIG. 5, in the

case where the modulation technique with a modulation order of below 16QAM is used. In addition, the present invention provides a method for modifying the existing 3GPP Re199 interleaving algorithm.

FIG. 6 is a flowchart illustrating a method for applying an SMP technique using physically-separated interleavers according to an embodiment of the present invention. With reference to FIG. 6, a method for applying the SMP technique using physically-separated interleavers will be described.

Referring to FIG. 6, a block interleaver with an inter-column permutation (or column permutation) function is used for interleaving. The interleaver receives  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U}$  (Step 612). Here,  $p$  represents the number of physical channels, and  $U$  represents the number of bits per frame of a physical channel.

(1) First, the total number of columns  $C2$  is set to 30 (Step 614). The columns are assigned column numbers 0, 1, 2, . . . ,  $C2-1$  from left to right.

(2) The minimum integer indicating a row of a matrix  $R2$ , satisfying a condition of  $U \leq R2 \times C2$ , is determined. The rows of the matrix are assigned row numbers 0, 1, 2, . . . ,  $R2-1$  from top to bottom (Step 616).

(3) The inputs  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U}$  are written row by row in an  $R2 \times C2$  rectangular matrix beginning at position  $y_{p,1}$  in a  $0^{th}$  row and a  $0^{th}$  column (Step 618), in accordance with Equation (1).

$$\begin{bmatrix} y_{p,1} & y_{p,2} & y_{p,3} & \dots & y_{p,C2} \\ y_{p,(C2+1)} & y_{p,(C2+2)} & y_{p,(C2+3)} & \dots & y_{p,(2 \times C2)} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y_{p,((R2-1) \times C2+1)} & y_{p,((R2-1) \times C2+2)} & y_{p,((R2-1) \times C2+3)} & \dots & y_{p,(R2 \times C2)} \end{bmatrix}$$

Equation (1)

Here,  $Y_{p,k} = U_{p,k}$  for  $k=1, 2, \dots, U$ . If  $R2 \times C2 > U$  (Step 620), then dummy bits of  $Y_{p,k} = 0$  or 1 (for  $k=U+1, U+2, \dots, R2 \times C2$ ) are inserted (Step 622). The dummy bits are deleted (Step 626) after being subject to column permutation (Step 624).

(4) After the column permutation is performed according to a rule (Step 624), the resulting bits  $Y'_{p,k}$  are expressed as

$$\begin{bmatrix} y'_{p,1} & y'_{p,(R2+1)} & y'_{p,(2 \times R2+1)} & \dots & y'_{p,((C2-1) \times R2+1)} \\ y'_{p,2} & y'_{p,(R2+2)} & y'_{p,(2 \times R2+2)} & \dots & y'_{p,((C2-1) \times R2+2)} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y'_{p,R2} & y'_{p,(2 \times R2)} & y'_{p,(3 \times R2)} & \dots & y'_{p,(C2 \times R2)} \end{bmatrix}$$

Equation (2)

(5) Outputs of the block interleaver are read column by column from the column-permuted  $R2 \times C2$  matrix (Step 628). The outputs are represented by  $v_{p,1}, v_{p,2}, v_{p,3}, \dots, v_{p,U}$ .

However, in the normal SMP technique, since two interleavers are physically separated, a distributor for properly distributing systematic bits and parity bits, the number of which is variable according the code rate, to the two interleavers is necessarily required. If the distributor is not provided, each of the interleavers must have a buffer capable of storing the entire input coded bits. The reason is because in a high-speed packet transmission system supporting an HARQ (Hybrid Automatic Retransmission Request) tech-

nique, only systematic bits or parity bits can be transmitted during retransmission when occasion demands.

Meanwhile, in the case where the two interleavers are physically separated, in order to convert outputs from each of the two separated interleavers into one bit stream, a serial-to-parallel (S/P) converter controlled by a control signal from an external device is necessarily required.

2. First Embodiment of Logical Separation Method

Now, a first embodiment for realizing the SMP technique by logically separating a buffer included in one interleaver will be described.

2.1 Structure of Transmitter According to First Embodiment

FIG. 7 illustrates a structure of a transmitter for realizing the SMP technique by logically separating a buffer included in one interleaver according to the first embodiment of the present invention.

Referring to FIG. 7, an interleaver 710 includes a buffer having a prescribed area therein. The prescribed area of the buffer means a partial area determined by the total number of coded bits received from an encoder (not shown). Hereinafter, the prescribed area determined by the total number of coded bits will be referred to as "use area" (or an area in use). The interleaver 710 divides the determined use area into two virtual write areas of a first write area and a second write area according to a ratio of the bits with first priority (hereinafter, referred to as "systematic bits") to the bits with

second priority (hereinafter, referred to as "parity bits"), constituting the coded bits. Here, the ratio of the systematic bits to the parity bits is determined depending on a code rate used by the encoder. For example, if the code rate is  $1/2$ , the use area is equally divided into two virtual write areas having the same size, and one of the two areas is defined as the first write area and the other area is defined as the second

write area. FIGS. 8A and 8B illustrate an example of the interleaver 710 in which the first write area and the second write area are equal in size. However, if the code rate is  $3/4$ , the use area is equally divided into four areas having the same size, and three of the four areas are defined as a first write area and the remaining one area is defined as a second write area. FIGS. 9A and 9B illustrate an example of the interleaver 710 in which the first write area and the second write area are asymmetric in size. It is assumed in FIG. 7 that the interleaver 710 equally divides the use area into the first write area and the second write area, for the code rate  $1/2$ .

Upon receiving coded bits from the encoder, the interleaver 710 sequentially writes the systematic bits among the

coded bits in the first write area, and sequentially writes the parity bits in the second write area. Here, the interleaver **710** inserts dummy bits into an area left over after writing the systematic bits in the first write area, and inserts the dummy bits into an area left over after writing the parity bits in the second write area. Exemplary methods of writing the systematic bits and exemplary methods of writing the parity bits are illustrated in FIGS. **8A** to **10D**.

After completion of writing the systematic bits and the parity bits in this manner, the interleaver **710** interleaves the coded bits including the dummy bits stored in the use area through column permutation. The column permutation permutes the coded bits in the use area column by column, so that the written systematic bits are never mixed with the parity bits.

Further, the interleaver **710** equally divides the use area into a first read area and a second read area in order to read the written coded bits. Therefore, if the code rate is  $\frac{1}{2}$ , the first read area is identical to the first write area, and the second read area is identical to the second write area. Thus, only the systematic bits are previously written in the first read area, and only the parity bits are previously written in the second read area. However, if the code rate is  $\frac{3}{4}$ , the first write area includes the first read area and a part of the second read area, and the remaining part of the second read area becomes the second write area. Thus, only the systematic bits are previously written in the first read area, and the systematic bits and the parity bits are previously written in the second read area row by row.

After interleaving, the interleaver **710** sequentially reads the coded bits written in the first read area and the second read area. Exemplary methods of reading the coded bits from the first read area and the second read area are illustrated in FIGS. **11A** and **11B**. Herein, the column permutation operation and the reading operation for interleaving have been separately described. However, it would be obvious to those skilled in the art that the column permutation operation and the reading operation can be united into one operation by changing the order of reading.

The coded bits read from the first read area and the second read area of the interleaver **710**, are provided to a multiplexer (MUX) **720**. The MUX **720** multiplexes the coded bits from the first read area and the second read area in a prescribed ratio, and outputs one bit stream. The ratio for multiplexing the coded bits from the first read area and the coded bits from the second read area is determined depending on the modulation technique used by a modulator **730**. For example, if the modulation technique is 16QAM, 4 coded bits are mapped to one symbol. In this case, the MUX **720** multiplexes the 2 coded bits from the first read area and the 2 coded bits from the second read area, for each symbol.

The coded bits multiplexed by the MUX **720** are applied to the modulator **730**. The modulator **730** performs symbol mapping on the multiplexed coded bits. For example, when using a modulation technique of 16QAM, the modulator **730** maps 2 coded bits read from the first read area to the bits with higher reliability (hereinafter, referred to as "first reliability") of a particular symbol. Further, the modulator **730** maps 2 coded bits read from the second read area to the bits with lower reliability (hereinafter, referred to as "second reliability") of the symbol.

As stated above, the present invention provides a method for interleaving the systematic bits and the parity bits by logically separating one interleaver, so that the modulator can perform symbol mapping by the SMP technique.

## 2.2 Writing of Coded Bits

A method of writing coded bits in the buffer included in the interleaver **710** according to an embodiment of the present invention can be divided into one case where dummy bits are used and another case where the dummy bits are not used. The dummy bits are used to fill an area left over after writing coded bits in the use area of the buffer, determined depending on the total number of the coded bits provided from the encoder. The dummy bits are deleted after being subject to column permutation for interleaving.

Before a description of the methods for writing the coded bits, a method for determining whether to use the dummy bits will be described.

Whether to use the dummy bits is determined according to whether the total number  $U$  of the coded bits received from the encoder is a multiple of the total number  $C2$  of columns constituting a buffer matrix for the use area. Here, the  $C2$  can be previously determined according to a size of a buffer in the interleaver. Further, the total number  $R2$  of rows, used to determine the use area, can be determined according to the total number  $U$  of the coded bits, as the  $C2$  is previously determined. Therefore, the use area is determined by the product of the  $C2$  and the  $R2$  ( $C2 \times R2$ ). In addition, whether to use the dummy bits can be determined by comparing the product of the  $C2$  and the  $R2$  with the  $U$ . For example, if a condition of  $U = C2 \times R2$  is satisfied as the  $U$  is a multiple of the  $C2$ , then the dummy bits are not used. However, if a condition of  $U < C2 \times R2$  is satisfied as the  $U$  is not a multiple ( $R2$ ) of the  $C2$ , then the dummy bits are used.

### 2.2.1 No Dummy Bit Used

FIGS. **8A**, **8B**, **9A** and **9B** illustrate exemplary methods of writing coded bits in the interleaver **710** in the case where the dummy bits are not used. Specifically, FIGS. **8A** and **8B** illustrate a case where a code rate used by the encoder is  $\frac{1}{2}$ , and FIGS. **9A** and **9B** illustrate a case where a code rate used by the encoder is  $\frac{3}{4}$ .

First, a description will be made of a case where systematic bits and parity bits are received in the same ratio, as the code rate of the encoder is  $\frac{1}{2}$ .

FIG. **8A** illustrates a method of writing the parity bits beginning at the end of the use area in the case where the code rate is  $\frac{1}{2}$ , and FIG. **8B** illustrates a method of writing the parity bits beginning at the head of the second write area of the use area in the case where the code rate is  $\frac{1}{2}$ .

Referring to FIG. **8A**, the use area, a part of the entire area for the buffer included in the interleaver **710**, is determined depending on the total number  $U$  of coded bits received from the encoder. The use area is determined in such a matter that if no remainder exists after dividing the  $U$  by the predefined  $C2$ , a quotient obtained by the division is defined as the total number  $R2$  of rows. However, if a remainder exists after the division, the  $R2$  is determined by adding 1 to the quotient. The use area can be defined as the sum of a first write area and a second write area illustrated in FIG. **8A**, and the first write area and the second write area are determined by equally dividing the use area into two areas. In the writing method of FIG. **8A**, it is not necessary to physically definitely separate the first write area and the second write area. The reason is because the systematic bits out of the coded bits are written beginning at the head of the use area (represented by black arrows), while the parity bits among the coded bits are written beginning at the end of the use area (represented by white arrows). In other words, the systematic bits are written in a forward direction beginning at  $(0,0)$  of the use area, and the parity bits are written in a reverse direction beginning at  $(R2-1, C2-1)$  of the use area. Here,  $C2$  represents the total number of columns constituting a

buffer matrix in the use area, and R2 represents the total number of rows constituting the buffer matrix in the use area. Therefore, when the coded bits are completely written in the use area, the first write area and the second write area can be naturally separated by the coded bits written therein.

Referring to FIG. 8B, the use area, a part of the entire area for the buffer included in the interleaver 710, is determined depending on the total number U of coded bits received from the encoder. The use area can be defined as the sum of a first write area and a second write area illustrated in FIG. 8B, and the first write area and the second write area are determined by equally dividing the use area into two areas. After the first write area and the second write area are determined, the systematic bits out of the coded bits are written beginning at the head of the first write area (represented by black arrows), and the parity bits out of the coded bits are written beginning at the head of the second write area (represented by white arrows). In other words, the systematic bits are written in a forward direction beginning at (0,0) of the use area, and the parity bits are written in a forward direction beginning at (y,z) of the use area. Here, since the code rate is  $\frac{1}{2}$ ,  $y=R2/2$  and  $z=0$ .

Next, a description will be made of a case where systematic bits and parity bits are received in a ratio of 3:1, as the code rate of the encoder is  $\frac{3}{4}$ .

FIG. 9A illustrates a method of writing the parity bits beginning at the end of the use area in the case where the code rate is  $\frac{3}{4}$ , and FIG. 9B illustrates a method of writing the parity bits beginning at the head of the second write area of the use area in the case where the code rate is  $\frac{3}{4}$ .

Referring to FIG. 9A, the use area, a part of the entire area for the buffer included in the interleaver 710, is determined depending on the total number U of coded bits received from the encoder. The use area is determined in such a matter that a quotient obtained by dividing the U by the predefined C2 is defined as R2. The use area can be defined as the sum of a first write area and a second write area illustrated in FIG. 9A. In the writing method of FIG. 9A, it is not necessary to physically definitely separate the first write area and the second write area. The reason is because the systematic bits out of the coded bits are written beginning at the head of the use area (represented by black arrows), while the parity bits out of the coded bits are written beginning at the end of the use area (represented by white arrows). In other words, the systematic bits are written in a forward direction beginning at (0,0) of the use area, and the parity bits are written in a reverse direction beginning at (R2-1,C2-1) of the use area. The systematic bits and the parity bits written in the use area are separated by a boundary point (y,z) between the first write area and the second write area. The (y,z), a boundary point between the first write area and the second write area, is a coordinate designating a particular point in the use area. If there exists a quotient or a remainder obtained by dividing the total number of systematic bits by the C2, the is defined as a value determined by adding 1 to the quotient, and the z becomes the remainder. Therefore, the first write area can be defined as an area from the (0,0) to the (y,z) of the use area, and the second write area can be defined as an area from the (y,z) to the (R2-1,C2-1) of the use area.

Referring to FIG. 9B, the use area, a part of the entire area for the buffer included in the interleaver 710, is determined depending on the total number U of coded bits received from the encoder. The use area can be defined as the sum of a first write area and a second write area illustrated in FIG. 9B. After the first write area and the second write area are determined, the systematic bits out of the coded bits are written beginning at the head of the first write area (repre-

sented by black arrows), and the parity bits out of the coded bits are written beginning at the head of the second write area, i.e., beginning at the (y,z) (represented by white arrows). In other words, the systematic bits are written in a forward direction beginning at (0,0) of the use area, and the parity bits are written in a forward direction beginning at (y,z) of the use area. As stated above, if there exists a quotient or a remainder obtained by dividing the total number of systematic bits by the C2, the y is defined as a value determined by adding 1 to the quotient, and the z becomes the remainder.

#### 2.2.2 Dummy Bits Used

Although a method of writing the coded bits using the dummy bits will be described with reference to a code rate  $\frac{3}{4}$ , it would be obvious to those skilled in the art that the same method can be applied even to a code rate  $\frac{1}{2}$ .

As defined above, the dummy bits are used when there remains an empty area even after the systematic bits and the parity bits are completely written in the use area. That is, the dummy bits are used when the U is not a multiple of the C2. A method of inserting the dummy bits is realized in different ways according to a position in the use area, where the dummy bits are to be inserted. FIGS. 10A to 10D illustrate methods of writing the coded bits according to a position of the dummy bits. The position of the dummy bits can be determined depending on a direction in which the parity bits are written in the second write area, and a write starting point of the parity bits.

FIG. 10A illustrates a method of writing coded bits in the case where the dummy bits are written in a reverse direction and a point shifted from an end of the second write area by the dummy bits is defined as a starting point. FIG. 10B illustrates a method of writing coded bits in the case where the dummy bits are written in a forward direction and a head of the second write area is defined as a starting point. FIG. 10C illustrates a method of writing coded bits in the case where the dummy bits are written in a reverse direction and an end of the second write area is defined as a starting point. FIG. 10D illustrates a method of writing coded bits in the case where the dummy bits are written in a forward direction and a point shifted from a head of the second write area by the dummy bits is defined as a starting point.

Referring to FIG. 10A, the use area, a part of the entire area for the buffer included in the interleaver 710, is determined depending on the total number U of coded bits received from the encoder. The use area can be defined as the sum of a first write area and a second write area illustrated in FIG. 10A. In the writing method of FIG. 10A where the dummy bits are located at the end of the second write area, it is not necessary to physically definitely separate the first write area and the second write area. The reason is because the systematic bits out of the coded bits are written beginning at the head of the use area (represented by black arrows), while the parity bits out of the coded bits are written beginning at the end of the use area (represented by white arrows). In other words, the systematic bits are written in a forward direction beginning at (0,0) of the use area, and the parity bits are written in a reverse direction beginning at (R2-1,x) of the use area. The x can be calculated by subtracting the number of the dummy bits from a column number corresponding to the C2-1. Therefore, as stated above, the systematic bits and the parity bits written in the use area are separated by a boundary point (y,z) between the first write area and the second write area.

Referring to FIG. 10B, the systematic bits are written in the same way as described in the above methods. However, the parity bits are written in a forward direction beginning at

a boundary (y,z) between the first write area and the second write area. Here, the (y,z) can be newly defined taking into account the dummy bits to be inserted. After the parity bits are completely written, the dummy bits are inserted in a remaining area existing at the end of the second write area.

Referring to FIG. 10C, the systematic bits are written in a forward direction beginning at the head of the first write area, and the parity bits are written in a reverse direction beginning at the end of the second write area. Thereafter, the dummy bits are inserted in an area left over after the systematic bits are written and an area left over after the parity bits are written.

Referring to FIG. 10D, the systematic bits are written in a forward direction beginning at the head of the first write area, and the parity bits are written in a forward direction beginning at an end of an area between a point where writing of the systematic bits is expected to be completed and a point where the dummy bits are to be inserted. Therefore, the dummy bits are inserted in a part of the first write area and a part of the second write area.

bits and the number of parity bits, respectively. The sum of the Us and Up is equal to the number of bits per frame of one physical channel.

(1) First, the total number of columns C2 is set to 30. The columns are assigned column numbers 0, 1, 2, . . . , C2-1 from left to right. The minimum integer indicating a row of a matrix R2, satisfying a condition of  $U=U_s+U_p \leq R2 \times C2$ , is determined (Step 1202). The rows of the matrix are assigned row numbers 0, 1, 2, . . . , R2-1 from top to bottom (Step 1204).

(2) The inputs  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U_s}$  are written in a forward direction row by row in an  $R2 \times C2$  rectangular matrix beginning at  $y_{p,1}$  in a 0<sup>th</sup> row and a 0<sup>th</sup> column, and the inputs  $u_{p,U_s+1}, u_{p,U_s+2}, u_{p,U_s+3}, \dots, u_{p,U_s+U_p}$  are written in a reverse direction row by row beginning at a point in an  $(R2-1)$ <sup>th</sup> row and a  $(x-1)$ <sup>th</sup> column (Step 1206). Here, x means a remainder obtained by dividing the U by the C2, and is larger than or equal to 1 and smaller than C2 ( $1 \leq x < C2$ ). Equation (3) shows an example of the matrix generated in this manner.

$$\begin{bmatrix} y_{p,1} & y_{p,2} & y_{p,3} & \dots & y_{p,C2} \\ y_{p,(C2+1)} & y_{p,(C2+2)} & y_{p,(C2+3)} & \dots & y_{p,(2 \times C2)} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y_{p,((R2-1) \times C2+1)} & y_{p,((R2-1) \times C2+2)} & y_{p,((R2-1) \times C2+3)} & \dots & y_{p,(R2 \times C2)} \end{bmatrix} \quad \text{Equation (3)}$$

2.3 Reading of Coded Bits

The use area of a buffer in the interleaver 710, in which the coded bits are written, is separated into two virtual read areas for reading. The two read areas can be separated by equally dividing the use area into two areas with the same size. The interleaver 710 reads the coded bits written in the separated first read area and second read area.

FIGS. 11A and 11B illustrate exemplary methods of reading coded bits from the first read area and the second read area by the interleaver 710. Specifically, FIG. 11A illustrates a method of reading the coded bits written at a code rate 1/2, and FIG. 11B illustrates a method of reading the coded bits written at a code rate 3/4.

Referring to FIGS. 11A and 11B, the interleaver 710 sequentially reads coded bits written in the first read area column by column. In addition, the interleaver 710 sequentially reads coded bits written in the second read area as well, column by column. As a result, in the case of FIG. 11A, only the systematic bits are read from the first read area and only the parity bits are read from the second read area. However, in the case of FIG. 11B, only the systematic bits are read from the first read area, and the systematic bits and the parity bits are read from second read area.

2.4 Operation of Transmitter According to First Embodiment

FIG. 12 is a flowchart illustrating an interleaving process according to the first embodiment of the present invention. That is, FIG. 12 illustrates a modified interleaving algorithm for separately writing and reading systematic bits and parity bits. It will be assumed herein that the writing operation is performed in the manner described in conjunction with FIG. 10A, for convenience.

Referring to FIG. 12, the interleaver receives U coded bits from an encoder (Step 1200). The coded bits are represented by  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U_s}$ , and  $u_{p,U_s+1}, u_{p,U_s+2}, u_{p,U_s+3}, \dots, u_{p,U_s+U_p}$ . Here, p represents a physical channel number, and Us and Up represent the number of systematic

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Here,  $y_{p,k}=u_{p,k}$  for  $k=1,2, \dots, U$ . If  $R2 \times C2 > U$  (Step 1208), then dummy bits of  $Y_{p,k}=0$  or 1 (for  $k=U+1, U+2, \dots, R2 \times C2$ ) are inserted (Step 1210). The dummy bits are deleted (Step 1214) after being subject to column permutation (Step 1212).

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(3) After the column permutation is performed according to a rule (Step 1212), the resulting bits are divided into an H part with higher reliability and an L part with lower reliability, and expressed with  $y_{p,k}^H$  and  $y_{p,k}^L$ , as follows.

$$\begin{bmatrix} y_{p,1}^H & y_{p,(R2/2+1)}^H & y_{p,R2+1}^H & \dots & y_{p,((C2-1) \times R2/2+1)}^H \\ y_{p,2}^H & y_{p,(R2/2+2)}^H & y_{p,R2+2}^H & \dots & y_{p,((C2-1) \times R2/2+2)}^H \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y_{p,R2/2}^H & y_{p,R2}^H & y_{p,3 \times R2/2}^H & \dots & y_{p,(C2 \times R2/2)}^H \\ y_{p,1}^L & y_{p,(R2/2+1)}^L & y_{p,R2+1}^L & \dots & y_{p,((C2-1) \times R2/2+1)}^L \\ y_{p,2}^L & y_{p,(R2/2+2)}^L & y_{p,R2+2}^L & \dots & y_{p,((C2-1) \times R2/2+2)}^L \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y_{p,R2/2}^L & y_{p,R2}^L & y_{p,3 \times R2/2}^L & \dots & y_{p,(C2 \times R2/2)}^L \end{bmatrix} \quad \text{Equation (4)}$$

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(4) Outputs of the block interleaver are read by two bits column by column by equally dividing the column-permuted  $R2 \times C2$  matrix into a part with higher reliability and a part with lower reliability (Step 1216). The outputs are represented by  $v_{p,1}, v_{p,2}, v_{p,3}, \dots, v_{p,U_s}$ .

3. Second Embodiment of Logical Separation Method

FIG. 13 illustrates a structure of a transmitter for realizing the SMP technique by logically separating a buffer included in one interleaver according to a second embodiment of the present invention.

Referring to FIG. 13, an interleaver 1310 includes a buffer having a prescribed area therein. The prescribed area of the buffer defines a use area determined by the total number of coded bits received from an encoder (not shown). The

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interleaver 1310 divides the use area into a first write area and a second write area according to a ratio of systematic bits to parity bits, constituting the coded bits. Here, the ratio of the systematic bits to the parity bits is determined depending on a code rate used by the encoder. It is assumed

Upon receiving coded bits from the encoder, the interleaver 1310 sequentially writes the systematic bits among the coded bits in the first write area, and sequentially writes the parity bits in the second write area. Here, the interleaver 1310 inserts dummy bits into an area left over after writing the systematic bits in the first write area, and inserts the dummy bits into an area left over after writing the parity bits in the second write area.

After completion of writing the systematic bits and the parity bits in this manner, the interleaver 1310 interleaves the coded bits including the dummy bits stored in the use area through column permutation. The column permutation permutes the coded bits in the use area column by column, so that the written systematic bits are never mixed with the written parity bits. After the column permutation, the interleaver 1310 permutes lower half columns among rows constituting the first write area with upper half columns among rows constituting the second write area. As a result, the coded bits written in the first write area and the second write area can be properly read in the form of a bit stream according to the SMP technique. Examples of the inter-row permutation (or row permutation) are illustrated in FIGS. 14A and 14B. Specifically, FIG. 14A illustrates row permutation for a code rate 1/2, and FIG. 14B illustrates row permutation for a code rate 3/4.

Thereafter, the interleaver 1310 sequentially reads the written coded bits. Exemplary methods of reading the coded bits by the interleaver 1310 are illustrated in FIGS. 15A and 15B. Specifically, FIG. 15A illustrates a method for reading the coded bits in the case where the code rate 1/2 is used, and FIG. 15B illustrates a method for reading the coded bits in the case where the code rate 3/4 is used.

Herein, the column permutation operation and the reading operation for interleaving have been separately described. However, it would be obvious to those skilled in the art that the column permutation operation and the reading operation can be united into one operation by changing the order of reading.

As stated above, the coded bits read by the interleaver 1310 have a format required for applying the SMP tech-

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Re199 reading algorithm. That is, the MUX can be excluded, if the algorithm is changed such that the coded bits written in the two write areas should be read by two bits. In other words, in the case of logically separated interleaving buffers, it is possible to exclude a hardware device for the MUX by simply modifying the reading algorithm in the above-stated manner. A novel algorithm which will be described herein below includes modification of the reading algorithm. In addition, in the case where R2 of a buffer matrix is a multiple of 4, it is possible to realize the existing reading algorithm for reading the entire buffer in the interleaver, through row permutation in stead of using the MUX.

FIGS. 15A and 15B illustrate symbol patterns of a modulator based on the row permutation, for the code rates 1/2 and 3/4, respectively. Referring to FIGS. 15A and 15B, both patterns do not violate an idea of the SMP technique that differentially maps reliabilities according to priority. When an extended amount of actual data is applied, it is possible to obtain the same result as the result obtained by the first embodiment.

FIG. 16 is a flowchart illustrating an interleaving process according to the second embodiment of the present invention. Referring to FIG. 16, a block interleaver with a column permutation function is used for interleaving. The interleaver receives  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,Us}$ , and  $u_{p,Us+1}, u_{p,Us+2}, u_{p,Us+3}, \dots, u_{p,Us+Up}$  (Step 1600). Here, p represents a physical channel number, and Us and Up represent the number of systematic bits and the number of parity bits, respectively. The sum of the Us and Up is equal to the number of bits per frame of one physical channel.

(1) First, the total number of columns C2 is set to 30. The columns are assigned column numbers 0, 1, 2, . . . , C2-1 from left to right. The minimum integer indicating a row of a matrix R2, satisfying a condition of  $U=Us+Up \leq R2 \times C2$ , is determined (Step 1602). The rows of the matrix are assigned row numbers 0, 1, 2, . . . , R2-1 from top to bottom (Step 1604).

(2) The inputs  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,Us}$  are written in a forward direction row by row in an  $R2 \times C2$  rectangular matrix beginning at  $y_{p,1}$  in a 0<sup>th</sup> row and a 0<sup>th</sup> column, and the inputs  $u_{p,Us+1}, u_{p,Us+2}, u_{p,Us+3}, \dots, u_{p,Us+Up}$  are written in a reverse direction row by row beginning at a point in an  $(R2-1)$ <sup>th</sup> row and a  $(x-1)$ <sup>th</sup> column (Step 1606). Here, x means a remainder obtained by dividing the U by the C2, and is larger than or equal to 1 and smaller than C2 ( $1 \leq x < C2$ ). Equation (5) shows an example of the matrix generated in this manner.

$$\begin{bmatrix} y_{p,1} & y_{p,2} & y_{p,3} & \dots & y_{p,C2} \\ y_{p,(C2+1)} & y_{p,(C2+2)} & y_{p,(C2+3)} & \dots & y_{p,(2 \times C2)} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ y_{p,(R2-1) \times C2+1} & y_{p,(R2-1) \times C2+2} & y_{p,(R2-1) \times C2+3} & \dots & y_{p,(R2 \times C2)} \end{bmatrix} \quad \text{Equation (5)}$$

nique. Therefore, the coded bits output from the interleaver 1310 are provided to a modulator 1320, where they are subject to symbol mapping by the SMP technique.

As described above, the present invention interleaves systematic bits and parity bits by logically separating one interleaver so that a modulator can perform symbol mapping by the SMP technique. Further, in order to exclude the MUX used in the first embodiment, it is necessary to modify a

Here,  $y_{p,k} = u_{p,k}$  for  $k=1, 2, \dots, U$ . If  $R2 \times C2 > U$  (Step 1608), then dummy bits of  $y_{p,k} = 0$  or 1 (for  $k=U+1, U+2, \dots, R2 \times C2$ ) are inserted (Step 1610).

(3) After the column permutation is performed according to a rule (Step 1612), the resulting bits are divided into an H part with higher reliability and an L part with lower reliability, and expressed with  $y_{p,k}^H$  and  $y_{p,k}^L$ , as follows.

$$\begin{bmatrix} y_{p,1}^H & y_{p,(R2/2+1)}^H & y_{p,R2+1}^H & \cdots & y_{p,((C2-1)\times R2/2+1)}^H \\ y_{p,2}^H & y_{p,(R2/2+2)}^H & y_{p,R2+2}^H & \cdots & y_{p,((C2-1)\times R2/2+2)}^H \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ y_{p,R2/2}^H & y_{p,R2}^H & y_{p,3\times R2/2}^H & \cdots & y_{p,(C2\times R2/2)}^H \\ y_{p,1}^L & y_{p,(R2/2+1)}^L & y_{p,R2+1}^L & \cdots & y_{p,((C2-1)\times R2/2+1)}^L \\ y_{p,2}^L & y_{p,(R2/2+2)}^L & y_{p,R2+2}^L & \cdots & y_{p,((C2-1)\times R2/2+2)}^L \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ y_{p,R2/2}^L & y_{p,R2}^L & y_{p,3\times R2/2}^L & \cdots & y_{p,(C2\times R2/2)}^L \end{bmatrix} \quad \text{Equation (6)}$$

(4) Rows with lower reliability are permuted with rows with higher reliability so that rows with higher reliability bits and rows with lower reliability bits should be repeated by two rows, as follows (Step 1614). The dummy bits are deleted (Step 1616) after being subject to row column permutation (Step 1614).

$$\begin{bmatrix} y_{p,1}^H & y_{p,(R2/2+1)}^H & y_{p,R2+1}^H & \cdots & y_{p,((C2-1)\times R2/2+1)}^H \\ y_{p,2}^H & y_{p,(R2/2+2)}^H & y_{p,R2+2}^H & \cdots & y_{p,((C2-1)\times R2/2+2)}^H \\ y_{p,1}^L & y_{p,(R2/2+1)}^L & y_{p,R2+1}^L & \cdots & y_{p,((C2-1)\times R2/2+1)}^L \\ y_{p,2}^L & y_{p,(R2/2+2)}^L & y_{p,R2+2}^L & \cdots & y_{p,((C2-1)\times R2/2+2)}^L \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ y_{p,R2/2-1}^H & y_{p,R2-1}^H & y_{p,3\times R2/2-1}^H & \cdots & y_{p,(C2\times R2/2-1)}^H \\ y_{p,R2/2}^H & y_{p,R2}^H & y_{p,3\times R2/2}^H & \cdots & y_{p,(C2\times R2/2)}^H \\ y_{p,R2/2-1}^L & y_{p,R2-1}^L & y_{p,3\times R2/2-1}^L & \cdots & y_{p,(C2\times R2/2-1)}^L \\ y_{p,R2/2}^L & y_{p,R2}^L & y_{p,3\times R2/2}^L & \cdots & y_{p,(C2\times R2/2)}^L \end{bmatrix} \quad \text{Equation (7)}$$

(5) Outputs of the block interleaver are read column by column from the column-permuted, row-permuted  $R2 \times C2$  matrix (Step 1618). The outputs are represented by  $v_{p,1}, v_{p,2}, v_{p,3}, \dots, v_{p,U_s}$ .

### 3. Receiver According to Invention

Now, a description will be made of a receiver corresponding to the transmitter that realizes the SMP technique by logically separating a buffer included in one interleaver. The receiver has a symmetrical structure of the transmitter illustrated in FIG. 2. A deinterleaver for the receiver is illustrated in FIGS. 17 and 18.

Since a received signal is in the form of a symbol modulated by a modulator in the transmitter, the received signal is first demodulated by a demodulator and then provided to a deinterleaver. The deinterleaver has a symmetrical structure of the interleaver illustrated in FIG. 2. The serial input bits must be converted to parallel bits, so that they can be written in upper and lower areas of the interleaving buffer. The logically separated buffers perform deinterleaving in a reverse operation of the interleaver, and a distributor distributes the output bits into systematic bits and parity bits. A rate matcher determines positions of the bits rate-matched by the transmitter and inserts 0's in the determined positions, so that other bits can be applied to a proper input terminal of the demodulator. The demodulator, a device for decoding the bits encoded by an encoder in the transmitter, corrects errors occurring on a channel. The error-corrected output undergoes CRC checking by a CRC checker in order to determine whether the transmitted signal is correctly received. If an error is detected, the receiver sends a retransmission request to the transmitter. Since a

high-speed packet transmission system uses various modulation orders and code rates, each element is controlled by a controller.

### 3.1 Structure of Receiver According to First Embodiment

FIG. 17 illustrates a structure of a receiver according to a first embodiment of the present invention. The receiver corresponds to the transmitter described in conjunction with FIG. 7.

Referring to FIG. 17, data bits decoded by a demodulator 1710 are demultiplexed by a demultiplexer (DEMUX) 1720. The DEMUX 1720 demultiplexes as many input bits as a prescribed number according to a modulation technique, and provides the demultiplexed bits to a first write area and a second write area in a buffer 1730 of the deinterleaver. For example, if the modulation technique is 16QAM, the DEMUX 1720 provides the input bits by 2 bits to each of the first and second write areas in the buffer 1730. However, if the modulation technique is 64QAM, the DEMUX 1720 provides the input bits by 3 bits to each of the first and second write areas.

If the code rate is  $1/2$ , systematic bits and parity bits are separately provided to the first and second write areas. However, if the code rate is  $3/4$ , only the systematic bits are provided to the first write area, and the systematic bits and parity bits are provided to the second write area.

The data bits written in the buffer 1730 of the deinterleaver are deinterleaved in a reverse operation of the interleaver, separately generating the systematic bits and the parity bits.

### 3.2 Structure of Receiver According to Second Embodiment

FIG. 18 illustrates a structure of a receiver according to the second embodiment of the present invention. The receiver corresponds to the transmitter described in conjunction with FIG. 13.

Referring to FIG. 18, data bits decoded by a demodulator 1810 are provided to a first write area and a second write area in a buffer 1820 of the deinterleaver, without being demultiplexed by a demultiplexer. As described in conjunction with FIG. 13, since the coded bits stored in the buffer 1310 are subject to row permutation in the interleaving process, the transmitter performs multiplexing though a prescribed reading method, without a multiplexer. Likewise, the receiver also can perform deinterleaving without a demultiplexing process, by performing row permutation on the received bits.

For example, if the modulation technique is 16QAM, the bits written in the buffer 1820 undergo row permutation by two rows between the first write area and the second write area. However, if the modulation technique is 64QAM, the bits written in the buffer 1820 undergo row permutation by three rows between the first write area and the second write area.

The data bits written in the buffer 1820 of the deinterleaver are deinterleaved in a reverse operation of the interleaver, separately generating the systematic bits and the parity bits.

When the interleaver is logically separated, the deinterleaver has the structures illustrated in FIGS. 17 and 18, based on a deinterleaving algorithm proposed by the present invention. The deinterleaving algorithm is illustrated in FIG. 19.

### 3.3 Operation of Receiver According to Invention

FIG. 19 is a flowchart illustrating a deinterleaving process according to an embodiment of the present invention. The deinterleaving process is performed somewhat differently according to the interleaving processes performed by the

interleaver in the transmitter. In order to finally create the original systematic bits and parity bits, the received bits are deinterleaved in a method corresponding to each method performed by the transmitter.

With reference to FIG. 19, a description will be made of an operation of the deinterleaver in the receiver according to an embodiment of the present invention. The deinterleaver receives  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U_s}$ , and  $u_{p,U_s+1}, u_{p,U_s+2}, u_{p,U_s+3}, \dots, u_{p,U_s+U_p}$  (Step 1900).

(1) First, the total number of columns C2 is set to 30. The columns are assigned column numbers 0, 1, 2, . . . , C2-1 from left to right. The minimum integer indicating a row of a matrix R2, satisfying a condition of  $U=U_s+U_p \leq R2 \times C2$ , is determined (Step 1902). The rows of the matrix are assigned row numbers 0, 1, 2, . . . , R2-1 from top to bottom (Step 1904).

(2) The inputs  $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U_s}$  are written in a forward direction row by row in an  $R2 \times C2$  rectangular matrix beginning at  $y_{p,1}$  in a  $0^{th}$  row and a  $0^{th}$  column, and the inputs  $u_{p,U_s+1}, u_{p,U_s+2}, u_{p,U_s+3}, \dots, u_{p,U_s+U_p}$  are written in a reverse direction row by row beginning at a point in an  $(R2-1)^{th}$  row and a  $(x-1)^{th}$  column (Step 1906). Here, x means a remainder obtained by dividing the U by the C2, and is larger than or equal to 1 and smaller than C2 ( $1 \leq x < C2$ ). If  $R2 \times C2 > U$  (Step 1908), then dummy bits of  $y_{p,k}=0$  or 1 (for  $k=U+1, U+2, \dots, R2 \times C2$ ) are inserted (Step 1910). The dummy bits are deleted (Step 1914) after being subject to column permutation (Step 1912).

(3) After the column permutation is performed according to a rule (Step 1912), the resulting bits are divided into a systematic bit (S) part and a parity bit (P) part.

(4) Outputs of the deinterleaver are read by two bits column by column, by dividing the column-permuted  $R2 \times C2$  matrix into a systematic bit part and a parity bit part (Step 1916).

As described above, the present invention provides a method for efficiently performing interleaving in mapping the bits with higher priority to the position with higher reliability of a symbol, thereby preventing an increase in hardware complexity and maintaining compatibility with an existing interleaving technique. Since the SMP technique for differentially mapping reliabilities according to priority shows theoretically sufficient effects, it is very important to realize the SMP technique. The present invention, when applied to a high-speed packet transmission system, especially HSDPA or 1xEV-DV system, can be realized through minor modification of an algorithm and minor addition of hardware, while maintaining its gain.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An apparatus for data transmission in a communication system, comprising:

- a turbo encoder for coding data bits to generate systematic bits and parity bits;
- a rate matcher for rate matching the systematic bits and parity bits;
- a first interleaver for writing the rate-matched systematic bits on a row by row basis, and performing inter-column permutation;
- a second interleaver for writing the rate-matched parity bits on a row-by-row basis, and performing inter-column permutation;

a modulator for alternatively collecting the permuted bits on a column by column basis from the first interleaver and the second interleaver, and mapping collected bits from the first interleaver and second interleaver onto one modulation symbol,

wherein a size of the first interleaver is equal to a size of the second interleaver.

2. The apparatus of claim 1, wherein if a number of the rate-matched systematic bits is less than a number of the rate-matched parity bits, part of the rate-matched parity bits is written next to the rate-matched systematic bits in the first interleaver.

3. The apparatus of claim 1, wherein if a number of the rate-matched systematic bits is greater than a number of the rate-matched parity bits, part of the rate-matched systematic bits is written prior to the rate-matched parity bits in the second interleaver.

4. The apparatus of claim 1, wherein if the modulation scheme is 16QAM (16-ary Quadrature Amplitude Modulation), alternatively outputting 2 bits on a column by column basis from the first interleaver and second interleaver.

5. The apparatus of claim 1, wherein if the modulation scheme is 16QAM (16-ary Quadrature Amplitude Modulation), mapping onto one modulation symbol 2 bits from the first interleaver and 2 bits from the second interleaver.

6. A method for data transmission in a communication system, comprising the steps of:

- turbo coding data bits to generate systematic bits and parity bits;
- rate matching the systematic bits and parity bits;
- writing the rate-matched systematic bits on a row by row basis in a first interleaver and the rate-matched parity bits on a row by row basis in a second interleaver;
- performing inter-column permutation in the first interleaver and in the second interleaver;
- alternatively collecting the permuted bits on a column by column basis from the first interleaver and the second interleaver;
- mapping the collected bits from the first interleaver and second interleaver onto one modulation symbol,
- wherein a size of the first interleaver is equal to a size of the second interleaver.

7. The method of claim 6, wherein if a number of the rate-matched systematic bits is less than a number of the rate-matched parity bits, part of the rate-matched parity bits is written next to the rate-matched systematic bits in the first interleaver.

8. The method of claim 6, wherein if a number of the rate-matched systematic bits is greater than a number of the rate-matched parity bits, part of the rate-matched systematic bits is written prior to the rate-matched parity bits in the second interleaver.

9. The method of claim 6, wherein if the modulation scheme is 16QAM (16-ary Quadrature Amplitude Modulation), alternatively outputting 2 bits on a column by column basis from the first interleaver and second interleaver.

10. The method of claim 6, wherein if the modulation scheme is 16QAM (16-ary Quadrature Amplitude Modulation), mapping onto one modulation symbol 2 bits from the first interleaver and 2 bits from the second interleaver.

11. An apparatus for receiving data in a communication system, comprising:

- a demodulator for demodulating a received symbol into a plurality of systematic bits and parity bits;
- a first deinterleaver for writing the plurality of systematic bits on a column by column basis and performing inter-column permutation;

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a second deinterleaver for writing the plurality of parity bits on a column by column basis and performing inter-column permutation;  
a rate matcher for rate matching the de-interleaved systematic bits and parity bits; and  
a decoder for decoding the rate matched systematic bits and parity bits,  
wherein a size of the first deinterleaver is equal to a size of the second deinterleaver.

12. The apparatus of claim 11, wherein if a number of the systematic bits is less than a number of the parity bits, part of the parity bits is written next to systematic bits in the first deinterleaver.

13. The apparatus of claim 11, wherein if a number of the systematic bits is greater than a number of the parity bits, part of the systematic bits is written prior to the parity bits in the second deinterleaver.

14. A method for receiving data in a communication system, comprising:  
demodulating a received symbol into a plurality of systematic bits and parity bits;

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writing the plurality of systematic bits on a column by column basis in a first deinterleaver and performing inter-column permutation, and writing the plurality of parity bits on a column by column basis in a second deinterleaver and performing inter-column permutation;  
rate marching the de-interleaved systematic bits and parity bits; and  
decoding the rate matched systematic bits and parity bits, wherein a size of the first deinterleaver is equal to a size of the second deinterleaver.

15. The method of claim 14, wherein if a number of the systematic bits is less than a number of the parity bits, part of the parity bits is written next to the systematic bits in the first deinterleaver.

16. The method of claim 14, wherein if a number of the systematic bits is greater than a number of the parity bits, part of the systematic bits is written prior to the parity bits in the second deinterleaver.

\* \* \* \* \*

# **EXHIBIT H**



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**Jeong**

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(45) **Date of Patent:** **\*Apr. 13, 2010**

(54) **MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL**

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(30) **Foreign Application Priority Data**

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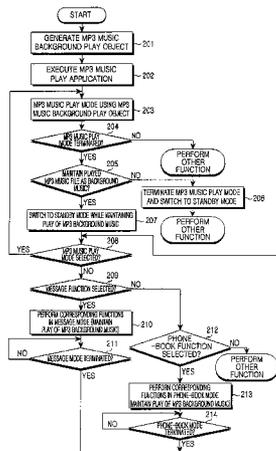
(57) **ABSTRACT**

- (51) **Int. Cl.**  
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**G06F 3/00** (2006.01)  
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- (58) **Field of Classification Search** ..... **718/1, 718/100-108; 455/1-899; 715/762-764, 715/716, 718, 727**

An apparatus and method capable of performing multiple tasks in a portable terminal are provided, in which menu functions of the portable terminal can be implemented while continuing to play the music. The multi-tasking apparatus includes a controller for performing controlling to implement at least one menu function while playing a music file and a display unit for displaying an indication that the music file is being played during the implementation of the menu function.

See application file for complete search history.

**20 Claims, 3 Drawing Sheets**



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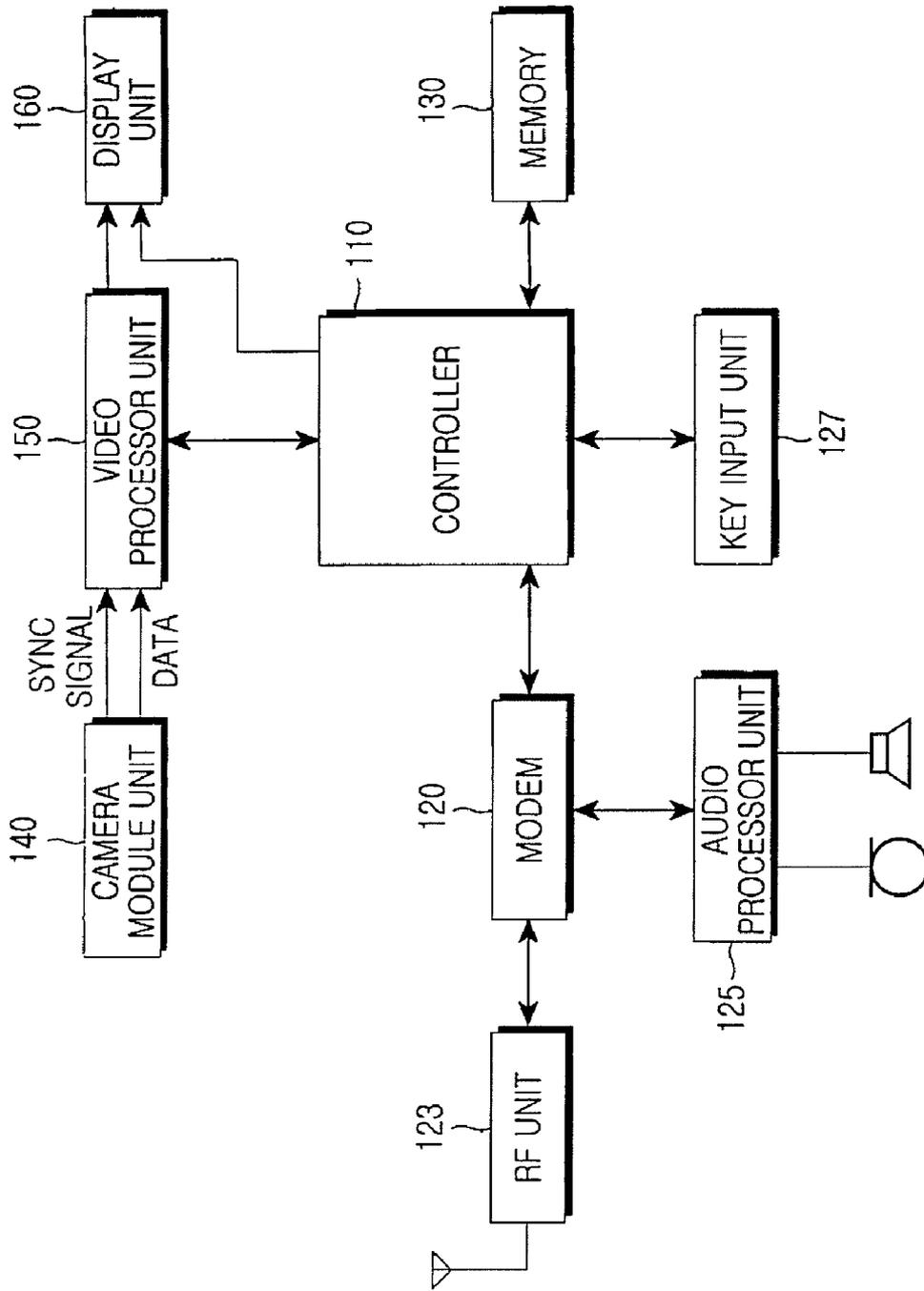


FIG.1

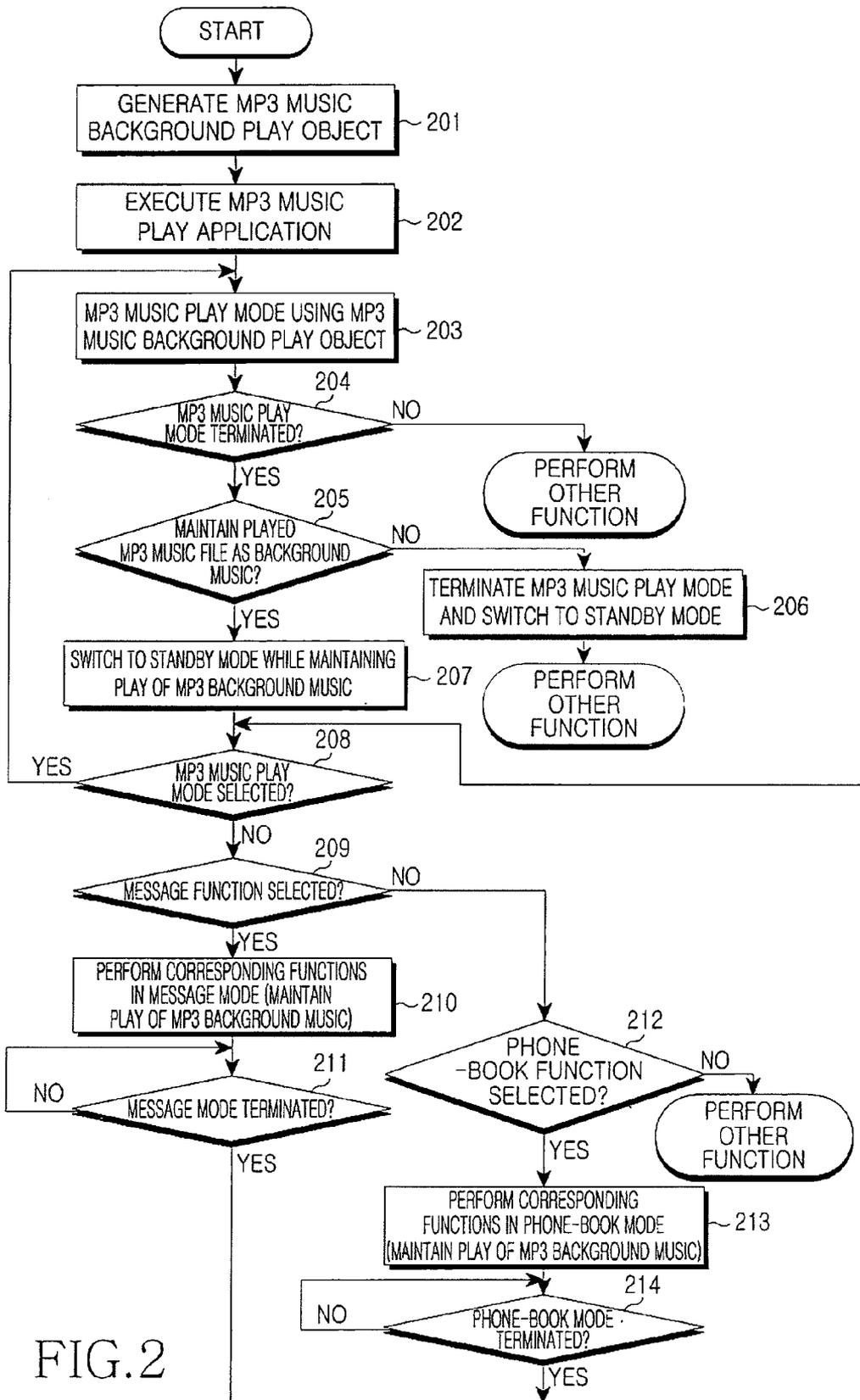


FIG. 2

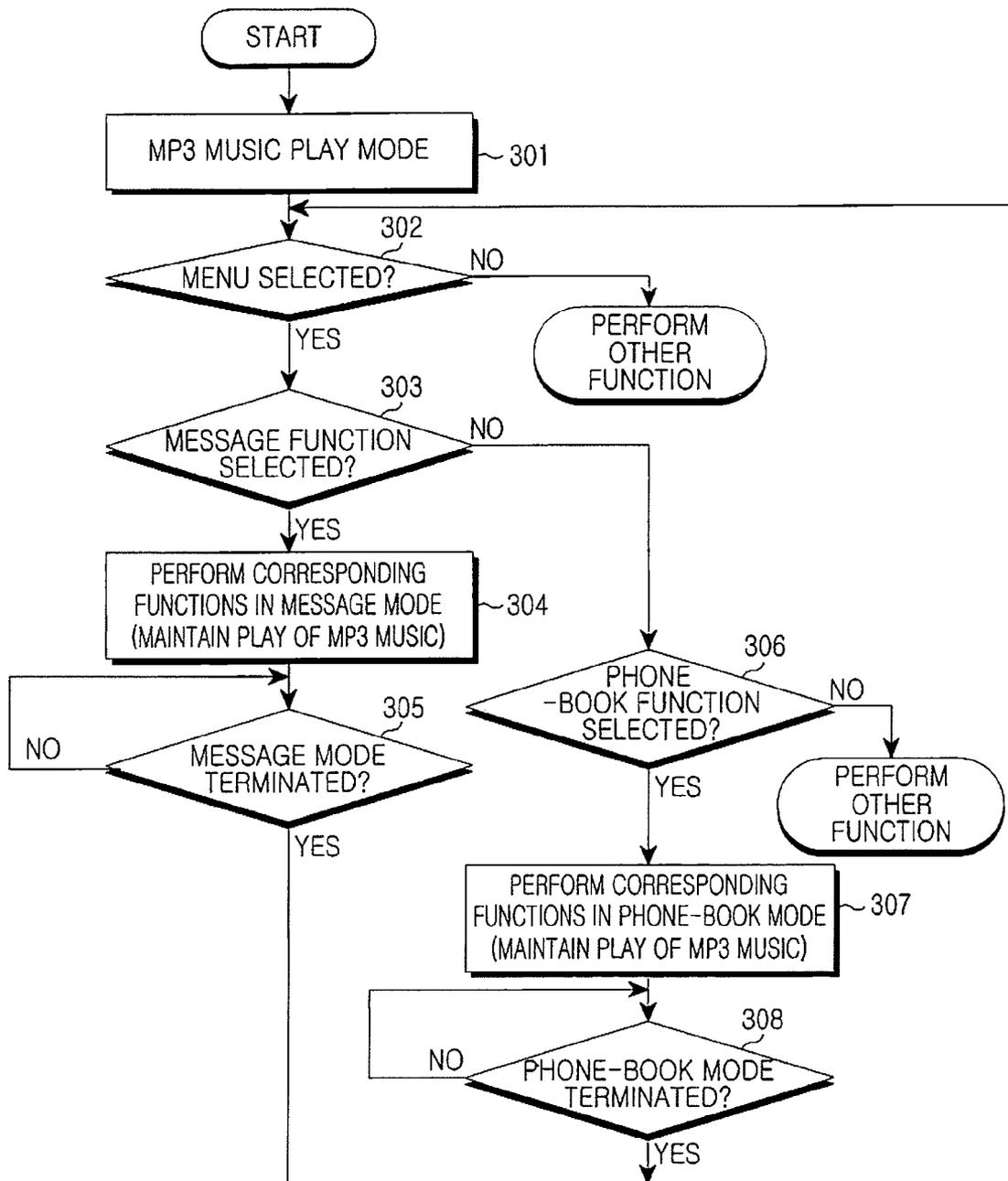


FIG. 3

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**MULTI-TASKING APPARATUS AND  
METHOD IN PORTABLE TERMINAL****CROSS-REFERENCE TO RELATED  
APPLICATIONS**

This application is a continuation of prior application Ser. No. 11/390,338, filed on Mar. 28, 2006.

**PRIORITY**

This application claims the benefit under 35 U.S.C. § 119 (a) of Korean Patent Application filed in the Korean Intellectual Property Office on Aug. 30, 2005 and assigned Serial No. 2005-79921, the entire disclosure of which is hereby incorporated by reference.

**BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention generally relates to an apparatus and method for performing multiple tasks in a portable terminal. More particularly, the present invention relates to a multi-tasking apparatus and method in a portable terminal, where menu functions of the portable terminal can be implemented while continuing to play a music file.

**2. Description of the Related Art**

Portable terminals include various applications such as scheduling, game, and Short Message Service (SMS) applications. When integrated with digital devices, portable terminals include multimedia menus such as options for MP3 music play. Generally, a portable terminal having an MP3 music play function controls and plays an MP3 music file using a separate player. For example, a user may select an MP3 music play function from menus of a portable terminal for listening to the music. The user may also selectively use control-related functions such as play, pause, repeat, and terminate the MP3 music play function.

However, the user cannot simultaneously work on several menus of the portable terminal while listening to the music using the conventional MP3 music play function. In other words, the user cannot use the other functions of scheduling, picture viewing, or game menu among others while listening to the music.

To address this problem, a control processor is added to manage only MP3 music play, resulting in an increase in cost and an increase in the complexity of hardware and software configurations.

Accordingly, there is a need for an improved system and method to allow a user to simultaneously work on multiple menus of the portable terminal while listening to music.

**SUMMARY OF THE INVENTION**

An aspect of exemplary embodiments of the present invention is to address at least the above problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of exemplary embodiments of the present invention is to provide a multi-tasking apparatus and method in a portable terminal, in which menu functions of the portable terminal can be implemented while continuing to play a music file.

According to one aspect of an exemplary embodiment of the present invention, a multi-tasking apparatus in a portable terminal is provided. The multi-tasking apparatus includes a controller for performing controlling to implement at least one menu function while playing a music file and a display

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unit for displaying an indication that the music file is being played during the implementation of the menu function.

According to another aspect of an exemplary embodiment of the present invention, a multi-tasking method in a portable terminal is provided. Use of the multi-tasking method allows a music file to be played in the portable terminal and allows menu functions of the portable terminal to be implemented while continuing to play the music file.

According to another aspect of an exemplary embodiment of the present invention, a multi-tasking method in a portable terminal is provided. Where a music background play object is prevented in a standby mode. The music background play object acquires a task for music background play and provides a control interface for music play. The music file is played through multi-tasking in the standby mode using the music background play object upon selection of a music play mode in the portable terminal. The played music file is selected as background music during the play of the music file, switching to the standby mode while continuing to play the music as background music upon selection of the played music file as background music. The menu functions of the portable terminal are implemented in the standby mode so that the play of background music is maintained and the menu functions of the portable terminal are implemented while continuing to play background music.

According to another aspect of an exemplary embodiment of the present invention, a multi-tasking method in a portable terminal is provided. Where a music background play object is generated in a standby mode. The music background play object acquires a task for music background play and provides a control interface for music play. The music file is played through multi-tasking in the standby mode using the music background play object upon selection of a music play mode in the portable terminal. A menu function of the portable terminal in the music play mode is selected. The portable terminal switches to a mode of the selected menu of the portable terminal and implements a corresponding function while continuing to play the music upon selection of the menu function of the portable terminal. The portable terminal switches to the music play mode upon termination of the mode of the selected menu of the portable terminal.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The above and other exemplary objects, features, and advantages of exemplary embodiments of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram of a portable terminal according to an exemplary embodiment of the present invention;

FIG. 2 is a flowchart illustrating a process of implementing menu functions of a portable terminal while continuing to play a music file according to a first exemplary embodiment of the present invention; and

FIG. 3 is a flowchart illustrating a process of implementing menu functions of a portable terminal while continuing to play a music file according to a second exemplary embodiment of the present invention.

Throughout the drawings, the same drawing reference numerals will be understood to refer to the same elements, features, and structures.

**DETAILED DESCRIPTION OF EXEMPLARY  
EMBODIMENTS**

The matters defined in the description such as a detailed construction and elements are provided to assist in a compre-

hensive understanding of exemplary embodiments of the invention. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. Also, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

FIG. 1 is a block diagram of a portable terminal according to an exemplary embodiment of the present invention, in which an MP3 music control processor is not included. Application modules of the portable terminal include at least one applet and each of the application modules, that is each menu of the portable terminal, independently performs multi-tasking.

Referring to FIG. 1, a Radio Frequency (RF) unit 123 performs radio communication for the portable terminal. The RF unit 123 includes an RF transmitter (not shown) for up-converting a frequency of a transmission signal and amplifying the up-converted transmission signal and an RF receiver (not shown) for low-noise-amplifying a received signal and down-converting a frequency of the low-noise-amplified signal.

A modem 120 includes a transmitter for encoding and modulating the transmission signal and a receiver for decoding and demodulating the received signal.

An audio processor unit 125 may be a codec including a data codec for processing packet data and an audio codec for processing an audio signal. The audio processor unit 125 converts a digital audio signal received from the modem 120 into an analog signal through the audio codec for reproduction. Alternatively, the audio processor unit 125 converts a transmission analog audio signal generated by a microphone into a digital audio signal through the audio codec for transmission to the modem 120. The codec is included in the controller 110 or it is provided separately. According to an exemplary embodiment of the present invention, the audio processor unit 125 performs an MP3 music play function in a standby mode of the portable terminal. In addition, the audio processor unit 125 performs the MP3 music play function while implementing menu functions of the portable terminal according to an exemplary embodiment of the present invention.

A memory 130 is comprised of program memories and data memories. The program memories store programs for controlling general operations of the portable terminal and control programs for implementing various menu functions of the portable terminal while continuing to play an MP3 music file according to an exemplary embodiment of the present invention. The data memories temporarily store data generated during execution of the programs.

A controller 110 controls the overall operation of the portable terminal. The controller 110 includes the modem 120 and the codec. The controller 110 performs controlling to switch the portable terminal to the standby mode while continuing to play an MP3 music file according to an exemplary embodiment of the present invention. The controller 110 also implements menu functions of the portable terminal while continuing to play an MP3 music file according to an exemplary embodiment of the present invention.

A camera module unit 140 includes a camera sensor and a signal processor. The camera sensor photographs image data and converts a photographed optical signal into an electric signal. A signal processor converts an analog image signal photographed by the camera sensor into digital data. The camera sensor is assumed to be a charge-coupled device (CCD) sensor and the signal processor may be implemented

with a digital signal processor (DSP). The camera sensor and the signal processor may be integrated as one body or provided separately.

A video processor unit 150 generates screen data for displaying an image signal output from the camera module unit 140. The video processor unit 150 processes an image signal output from the camera module unit 140 by the frame unit and outputs frame image data suitable for the characteristic and the size of a display unit 160. The video processor unit 150 includes a video codec and compresses frame image data displayed on the display unit 160 according to a predetermined compression method or reconstructs compressed frame image data into original frame image data. The video codec may be JPEG codec, MPEG-4 codec, or Wavelet codec. The video processor unit 150 is assumed to have an On Screen Display (OSD) function and may output OSD data according to a screen size displayed under the control of the controller 110.

The display unit 160 displays an image signal output from the video processor unit 150 on a screen and displays user data output from the controller 110. Preferably, the display unit 160 may be a liquid crystal display (LCD), and if so, the display unit 160 may include an LCD controller, a memory for storing image data, and an LCD device. When the LCD is implemented with a touch screen, the display unit 160 may also serve as an input unit. The display unit 160 displays MP3 music information in an MP3 music play mode according to an exemplary embodiment of the present invention. According to an exemplary embodiment of the present invention, the display unit 160 also displays information that an MP3 music file is being played in the standby mode of the portable terminal. The display unit 160 also displays information that the MP3 music file is being played during implementation of menu functions of the portable terminal.

A key input unit 127 includes alphanumeric keys for inputting number and character information and function keys for setting various functions. The key input unit 127 may also include a key for controlling MP3 music according to an exemplary embodiment of the present invention.

Hereinafter, a multi-tasking operation in the portable terminal will be described in detail with reference to FIGS. 2 and 3.

FIG. 2 is a flowchart illustrating a process of implementing menu functions of the portable terminal while continuing to play a music file according to a first exemplary embodiment of the present invention. In the first exemplary embodiment of the present invention, various menu functions such as message, phone-book, scheduling, game, and picture searching functions among others are simultaneously implemented.

The exemplary embodiments of the present invention will be described in detail with reference FIG. 1.

Referring to FIG. 2, the controller 110 of the portable terminal generates an MP3 music background play object in the standby mode in step 201 to play an MP3 music file as background music. The MP3 music background play object generated in step 201 internally acquires a task for MP3 music background play, returns to the standby mode, and provides a control interface to allow other applications to transmit commands for music play and control through the MP3 music background play object.

When an MP3 music play command is selected in the portable terminal, the controller 110 senses the selection and executes an MP3 music play application in step 202. The controller 110 transmits the MP3 music play command to the activated MP3 music background play object in the standby mode through an interface for an execution command provided by the MP3 music background play object. The MP3

music background play object switches to an MP3 music play mode by multi-tasking in step 203.

If termination of the MP3 music play mode is selected in the MP3 music play mode in step 204, the controller 110 senses the selection and displays a message asking whether to maintain the played MP3 music file as background music in step 205.

If the played MP3 music file is not selected as background music, the controller 110 terminates the MP3 music play mode and switches the portable terminal to the standby mode in step 206.

Alternatively, when the played MP3 music file is selected as background music, the controller 110 senses the selection and switches the portable terminal to the standby mode while maintaining the played MP3 music file, as background music in step 207. If the played MP3 music file is to be maintained as background music, in step 205, the controller 110 switches the portable terminal to the standby mode while maintaining the play of the MP3 music file as background music in step 207. Since the MP3 music file is played through multi-tasking of the MP3 music background play object activated in the standby mode in step 207, the play of the MP3 music file can continue regardless of termination of the MP3 music play mode. In the standby mode of step 207, image data indicating information relating to the MP3 music file that is being played as background music, for example a title and a singer, may be overlaid on a background image of the portable terminal. The type of the MP3 music information displayed on a standby screen may be selectively displayed. An icon or a message indicating that the MP3 music file is being played may be displayed in the standby mode of step 207.

If the MP3 music play mode is selected in the standby mode maintaining the play of MP3 background music in step 208, the controller 110 senses the selection and switches the portable terminal to the MP3 music play mode of step 203.

If the message function is selected in the standby mode maintaining the play of MP3 background music in step 209, the controller 110 senses the selection and switches the portable terminal to a message mode in step 210. In the message mode of step 210, the controller 110 performs controlling to implement functions such as message transmission and message checking while continuing to play MP3 background music. In the message mode of step 210, an icon or a message indicating that the MP3 music file is being played is displayed.

If termination of the message mode maintaining the play of MP3 background music is selected in step 211, the controller 110 senses the selection and switches the portable terminal to the standby mode of step 207 maintaining the play of MP3 background music.

If the phone-book function is selected in the standby mode maintaining the play of MP3 background music in step 212, the controller 110 senses the selection and switches the portable terminal to a phone-book mode in step 213. In the phone-book mode of step 213, the controller 110 performs controlling to implement functions such as telephone number searching and registration while continuing to play MP3 background music. In the phone-book mode of step 213, an icon or a message indicating that the MP3 music file is being played is displayed.

If termination of the phone-book mode maintaining the play of MP3 background music is selected in step 214, the controller 110 senses the selection and switches the portable terminal to the standby mode of step 207 maintaining the play of MP3 background music.

As such, MP3 music files selected in the MP3 music play mode of step 203 are repetitively played in the standby mode, the message mode, and the phone-book mode.

FIG. 3 is a flowchart illustrating a process of implementing menu functions of the portable terminal while continuing to play a music file according to a second exemplary embodiment of the present invention. In the second exemplary embodiment of the present invention, a message function and a phone-book function such as message, phone-book, scheduling, game, and picture searching functions among others are simultaneously implemented.

The exemplary embodiments of the present invention will be described in detail with reference FIG. 3.

Referring to FIG. 3, if a menu is selected in step 302 where MP3 music files selected in an MP3 music play mode of the portable terminal of step 301 are being played, the controller 110 senses the selection and displays menus of the portable terminal that can be implemented in the MP3 music play mode.

If the message function is selected among the menu functions of the portable terminal in step 303, the controller 110 senses the selection and switches the portable terminal to the message mode. In the message mode of step 304, the controller 110 implements functions such as message transmission and message checking while continuing to play the MP3 music file that is being played in the MP3 music play mode in step 304. In the message mode of step 304, an icon or a message indicating that the MP3 music file is being played may be displayed.

If termination of the message mode maintaining the play of the MP3 music file is selected in step 305, the controller 110 senses the selection and switches the portable terminal to the MP3 music play mode of step 301.

If the phone-book function is selected in step 306, the controller 110 senses the selection and switches the portable terminal to the phone-book mode. In the phone-book mode of step 307, the controller 110 implements functions such as telephone number searching and registration while continuing to play MP3 background music. In the phone-book mode of step 307, an icon or a message indicating that the MP3 music file is being played may be displayed.

If termination of the phone-book mode maintaining the play of MP3 music is selected, the controller 110 senses the selection and switches the portable terminal to the MP3 music play mode of step 301.

As such, MP3 music files selected in the MP3 music play mode of step 301 are repetitively played in the standby mode, the message mode, and the phone-book mode.

As described above, according to the exemplary embodiments of the present invention, menu functions can be implemented while continuing to play music in a portable terminal. Therefore, various applications of the portable terminal can be simultaneously implemented during the play of music, thereby maximizing user convenience.

Moreover, a separate music control processor is not included in a portable terminal, thereby preventing cost increase in the portable terminal and complexity in hardware and software configurations. Furthermore, exemplary embodiments of the present invention can also be used for portable terminal applications to be developed without a requirement for separate processing.

While the present invention has been shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A multi-tasking method in a pocket-sized mobile communication device including an MP3 playing capability, the multi-tasking method comprising:
  - generating a music background play object, wherein the music background play object includes an application module including at least one applet;
  - providing an interface for music play by the music background play object;
  - selecting an MP3 mode in the pocket-sized mobile communication device using the interface;
  - selecting and playing a music file in the pocket-sized mobile communication device in the MP3 mode;
  - switching the MP3 mode to a standby mode while the playing of the music file continues;
  - displaying an indication that the music file is being played in the standby mode;
  - selecting and performing at least one function of the pocket-sized mobile communication device from the standby mode while the playing of the music file continues; and
  - continuing to display the indication that the music file is being played while performing the selected function.
2. The multi-tasking method of claim 1, wherein the displaying of the indication comprises displaying an icon.
3. The multi-tasking method of claim 1, wherein the displaying of the indication comprises displaying information relating to the music file.
4. The multi-tasking method of claim 3, wherein the information comprises at least one of a music title, a musician and an album title.
5. The multi-tasking method of claim 3, wherein the displaying of the information comprises overlaying the information relating to the music file on a screen.
6. The multi-tasking method of claim 1, further comprising selecting to continue the playing of the music file.
7. The multi-tasking method of claim 1, wherein the function selected from the standby mode comprises a message function.
8. The multi-tasking method of claim 1, wherein the function selected from the standby mode comprises a phone-book function.
9. A multi-tasking apparatus in a pocket-sized mobile communication device including an MP3 playing capability, the multi-tasking apparatus comprising:
  - a controller for generating a music background play object, wherein the music background play object includes an application module including at least one applet, for providing an interface for music play by the music background play object, for selecting an MP3 mode in the pocket-sized mobile communication device using the interface, for selecting and playing a music file in the pocket-sized mobile communication device in the MP3

- mode, for switching from the MP3 mode to a standby mode while the playing of the music file continues and for selecting and performing at least one function of the pocket-sized mobile communication device from the standby mode while the playing of the music file continues; and
- a display unit for displaying an indication that the music file is being played in the standby mode and for continuing to display the indication that the music file is being played while performing the selected function.
10. The multi-tasking apparatus of claim 9, wherein the indication comprises an icon.
11. The multi-tasking apparatus of claim 9, wherein the indication comprises information relating to the music file.
12. The multi-tasking apparatus of claim 11, wherein the information comprises at least one of a music title, a musician and an album title.
13. The multi-tasking apparatus of claim 11, wherein the display unit overlays the information relating to the music file on a screen.
14. The multi-tasking apparatus of claim 9, wherein the controller selects to continue the playing of the music file.
15. The multi-tasking apparatus of claim 9, wherein the function selected from the standby mode comprises a message function.
16. The multi-tasking apparatus of claim 9, wherein the function selected from the standby mode comprises a phone-book function.
17. A multi-tasking apparatus in a pocket-sized mobile communication device consisting of a single display unit and including an MP3 playing capability, the multi-tasking apparatus comprising:
  - a controller for generating a music background play object, wherein the music background play object includes an application module including at least one applet, for providing an interface for music play by the music background play object, for selecting an MP3 mode in the pocket-sized mobile communication device using the interface, for selecting and playing a music file in the pocket-sized mobile communication device in the MP3 mode, and for switching from the MP3 mode to a standby mode while the playing of the music file continues; and
  - a display unit for displaying an indication that the music file is being played in the standby mode.
  18. The multi-tasking apparatus of claim 17, wherein the indication comprises an icon.
  19. The multi-tasking apparatus of claim 17, wherein the indication comprises information relating to the music file.
  20. The multi-tasking apparatus of claim 17, wherein the controller selects to continue the playing of the music file.

# **EXHIBIT I**



UNITED STATES PATENT AND TRADEMARK OFFICE

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

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 11/778,466      | 04/13/2010 | 7698711    | 0201-0055           | 1475             |

68103 7590 03/24/2010  
Jefferson IP Law, LLP  
1130 Connecticut Ave., NW  
Suite 420  
Washington, DC 20036

**ISSUE NOTIFICATION**

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Moon-Sang JEONG, Daegu, KOREA, REPUBLIC OF;



## Electronic Patent Application Fee Transmittal

|  |   |          |        |                      |
|--|---|----------|--------|----------------------|
| <b>Application Number:</b>                     | 11778466  |          |        |                      |
| <b>Filing Date:</b>                            | 16-Jul-2007   |          |        |                      |
| <b>Title of Invention:</b>                     | MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL |          |        |                      |
| <b>First Named Inventor/Applicant Name:</b>    | Moon-Sang JEONG   |          |        |                      |
| <b>Filer:</b>                                  | George Charles Eckert/Stephanie Bolger                  |          |        |                      |
| <b>Attorney Docket Number:</b>                 | 0201-0055   |          |        |                      |
| Filed as Large Entity                          |   |          |        |                      |
| <b>Utility under 35 USC 111(a) Filing Fees</b> |   |          |        |                      |
| Description                                    | Fee Code  | Quantity | Amount | Sub-Total in USD(\$) |
| <b>Basic Filing:</b>                           |   |          |        |                      |
| <b>Pages:</b>                                  |   |          |        |                      |
| <b>Claims:</b>                                 |   |          |        |                      |
| <b>Miscellaneous-Filing:</b>                   |   |          |        |                      |
| <b>Petition:</b>                               |   |          |        |                      |
| <b>Patent-Appeals-and-Interference:</b>        |   |          |        |                      |
| <b>Post-Allowance-and-Post-Issuance:</b>       |   |          |        |                      |
| Utility Appl Issue fee                         | 1501  | 1        | 1510   | 1510                 |
| Publ. Fee- early, voluntary, or normal         | 1504  | 1        | 300    | 300                  |

SAMNDCA00007842

| Description        | Fee Code | Quantity | Amount                   | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------------------------|----------------------|
| Extension-of-Time: |          |          |                          |                      |
| Miscellaneous:     |          |          |                          |                      |
| -                  |          |          | <b>Total in USD (\$)</b> | <b>1810</b>          |

## Electronic Acknowledgement Receipt

|                                      |   |
|--------------------------------------|---|
| EFS ID:                              | 7218601   |
| Application Number:                  | 11778466  |
| International Application Number:    |   |
| Confirmation Number:                 | 1475  |
| Title of Invention:                  | MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL |
| First Named Inventor/Applicant Name: | Moon-Sang JEONG   |
| Customer Number:                     | 68103   |
| Filer:                               | George Charles Eckert/Stephanie Bolger                  |
| Filer Authorized By:                 | George Charles Eckert                                   |
| Attorney Docket Number:              | 0201-0055   |
| Receipt Date:                        | 16-MAR-2010   |
| Filing Date:                         | 16-JUL-2007   |
| Time Stamp:                          | 14:49:43  |
| Application Type:                    | Utility under 35 USC 111(a)                             |

### Payment information:

|  |                  |
|--|------------------|
| Submitted with Payment                   | yes              |
| Payment Type                             | Credit Card      |
| Payment was successfully received in RAM | \$ 1810          |
| RAM confirmation Number                  | 1169             |
| Deposit Account                          | 504100           |
| Authorized User                          | ECKERT,GEORGE C. |

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

SAMNDCA00007844

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)  
 Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)  
 Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

**File Listing:**

| Document Number | Document Description        | File Name                              | File Size(Bytes)/ Message Digest                         | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------|--|--|------------------|------------------|
| 1               | Issue Fee Payment (PTO-85B) | 0201-0055FeeTransmittalAsFile<br>d.pdf | 141171<br><br>a7f9617e57613768b65142d542824bd27c<br>cca8 | no               | 1                |

Warnings:

Information:

|   |                         |              |  |    |   |
|---|-------------------------|--------------|--|----|---|
| 2 | Fee Worksheet (PTO-875) | fee-info.pdf | 32071<br><br>3005342937ab1305827e04ba0646c1c17e<br>9a22a | no | 2 |
|---|-------------------------|--------------|--|----|---|

Warnings:

Information:

|                                     |        |
|-------------------------------------|--------|
| <b>Total Files Size (in bytes):</b> | 173242 |
|-------------------------------------|--------|

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

**New Applications Under 35 U.S.C. 111**

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

**National Stage of an International Application under 35 U.S.C. 371**

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

**New International Application Filed with the USPTO as a Receiving Office**

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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NOTICE OF ALLOWANCE AND FEE(S) DUE

68103 7590 01/13/2010
Jefferson IP Law, LLP
1130 Connecticut Ave., NW
Suite 420
Washington, DC 20036

EXAMINER
TO, JENNIFER N
ART UNIT PAPER NUMBER
2195
DATE MAILED: 01/13/2010

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

11778.466 07/16/2007 Moon-Sang JEONG 0201-0055 1475
TITLE OF INVENTION: MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL

Table with 7 columns: APPLN. TYPE, SMALL ENTITY, ISSUE FEE DUE, PUBLICATION FEE DUE, PREV. PAID ISSUE FEE, TOTAL FEE(S) DUE, DATE DUE

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

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

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.
B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

- A. Pay TOTAL FEE(S) DUE shown above, or
B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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

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

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 or **Fax** (571)-273-2885

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

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

68103 7590 01/13/2010  
 Jefferson IP Law, LLP  
 1130 Connecticut Ave., NW  
 Suite 420  
 Washington, DC 20036

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

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

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 11778.466       | 07/16/2007  | Moon-Sang JEONG      | 0201-0055           | 1475             |

TITLE OF INVENTION: MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL

| APPLN. TYPE    | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | NO           | \$1510        | \$300               | \$0                  | \$1810           | 04/13/2010 |

| EXAMINER       | ART UNIT | CLASS-SUBCLASS |
|----------------|----------|----------------|
| TO, JENNIFER N | 2195     | 718-107000     |

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

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

"Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

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

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

\_\_\_\_\_ 3

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

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

(A) NAME OF ASSIGNEE \_\_\_\_\_ (B) RESIDENCE: (CITY and STATE OR COUNTRY) \_\_\_\_\_

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

4a. The following fee(s) are submitted:

Issue Fee

Publication Fee (No small entity discount permitted)

Advance Order - # of Copies \_\_\_\_\_

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

A check is enclosed

Payment by credit card. Form PTO-2036 is attached.

The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

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

a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.  b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application forms to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
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www.uspto.gov

| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 11778.466   | 07/16/2007  | Moon-Sang JEONG      | 0201-0055           | 1475             |
| 68103   | 7590        | 01/13/2010           | EXAMINER            |                  |
| Jefferson IP Law, LLP<br>1130 Connecticut Ave., NW<br>Suite 420<br>Washington, DC 20036 |             |                      | TO, JENNIFER N      |                  |
|   |             |                      | ART UNIT            | PAPER NUMBER     |
|   |             |                      | 2195                |                  |
| DATE MAILED: 01/13/2010   |             |                      |                     |                  |

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

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

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

|                               |                 |                  |  |
|-------------------------------|-----------------|------------------|--|
| <b>Notice of Allowability</b> | Application No. | Applicant(s)     |  |
|                               | 11/778,466      | JEONG, MOON-SANG |  |
|                               | Examiner        | Art Unit         |  |
|                               | JENNIFER N. TO  | 2195             |  |

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

1.  This communication is responsive to communication filed 12/08/2009.
2.  The allowed claim(s) is/are 1-20.
3.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a)  All    b)  Some\*    c)  None    of the:
    1.  Certified copies of the priority documents have been received.
    2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(e)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4.  A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5.  CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a)  including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1)  hereto or 2)  to Paper No./Mail Date \_\_\_\_\_.
  - (b)  including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying Indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |  |  |
|--|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 5. <input type="checkbox"/> Notice of Informal Patent Application                      |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____    | 7. <input type="checkbox"/> Examiner's Amendment/Comment                               |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material | 8. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance              |
|  | 9. <input type="checkbox"/> Other _____.   |

/Meng-Ai An/  
Supervisory Patent Examiner, Art Unit 2195

|                                   |                                       |   |             |
|-----------------------------------|---------------------------------------|---|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>11/778,466 | Applicant(s)/Patent Under Reexamination<br>JEONG, MOON-SANG |             |
|                                   | Examiner<br>JENNIFER N. TO            | Art Unit<br>2195  | Page 1 of 1 |

U.S. PATENT DOCUMENTS

| * | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name            | Classification |
|---|--|-----------------|-----------------|----------------|
| * | A US-7,594,181                                   | 09-2009         | Rothwein et al. | 715/763        |
| * | B US-2004/0021697                                | 02-2004         | Beaton et al.   | 345/810        |
| * | C US-7,222,304                                   | 05-2007         | Beaton et al.   | 715/744        |
|   | D US-  |                 |                 |                |
|   | E US-  |                 |                 |                |
|   | F US-  |                 |                 |                |
|   | G US-  |                 |                 |                |
|   | H US-  |                 |                 |                |
|   | I US-  |                 |                 |                |
|   | J US-  |                 |                 |                |
|   | K US-  |                 |                 |                |
|   | L US-  |                 |                 |                |
|   | M US-  |                 |                 |                |

FOREIGN PATENT DOCUMENTS

| * | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Country | Name | Classification |
|---|--|-----------------|---------|------|----------------|
|   | N  |                 |         |      |                |
|   | O  |                 |         |      |                |
|   | P  |                 |         |      |                |
|   | Q  |                 |         |      |                |
|   | R  |                 |         |      |                |
|   | S  |                 |         |      |                |
|   | T  |                 |         |      |                |

NON-PATENT DOCUMENTS

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

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

|  |                                     |   |
|--|-------------------------------------|---|
| <b>Issue Classification</b><br> | Application/Control No.<br>11778466 | Applicant(s)/Patent Under Reexamination<br>JEONG, MOON-SANG |
|  | Examiner<br>JENNIFER N TO           | Art Unit<br>2195  |

| ORIGINAL           |                                   |          |     | INTERNATIONAL CLASSIFICATION |   |   |   |                   |             |  |  |  |  |  |  |  |
|--------------------|-----------------------------------|----------|-----|------------------------------|---|---|---|-------------------|-------------|--|--|--|--|--|--|--|
| CLASS              |                                   | SUBCLASS |     | CLAIMED                      |   |   |   |                   | NON-CLAIMED |  |  |  |  |  |  |  |
| 718                |                                   | 107      |     | G                            | 0 | 8 | F | 9/48 (2006.01.01) |             |  |  |  |  |  |  |  |
| CROSS REFERENCE(S) |                                   |          |     | G                            | 0 | 6 | F | 3/00 (2006.01.01) |             |  |  |  |  |  |  |  |
|                    |                                   |          |     | G                            | 0 | 8 | F | 3/18 (2006.01.01) |             |  |  |  |  |  |  |  |
|                    |                                   |          |     | H                            | 0 | 4 | M | 1/00 (2006.01.01) |             |  |  |  |  |  |  |  |
| CLASS              | SUBCLASS (ONE SUBCLASS PER BLOCK) |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
| 715                | 716                               | 716      | 727 |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
| 455                | 556.1                             | 556.2    |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |
|                    |                                   |          |     |                              |   |   |   |                   |             |  |  |  |  |  |  |  |

Claims renumbered in the same order as presented by applicant     CPA     T.D.     R.1.47

| Final | Original |
|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
|       | 1        |       | 17       |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 2        |       | 18       |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 3        |       | 19       |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 4        |       | 20       |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 5        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 6        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 7        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 8        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 9        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 10       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 11       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 12       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 13       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 14       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 15       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|       | 16       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |

|  |            |                       |                   |
|--|------------|-----------------------|-------------------|
| /JENNIFER N TO/<br>Examiner Art Unit 2195                  | 01/07/2010 | Total Claims Allowed: |                   |
| (Assistant Examiner)                                       | (Date)     | 20                    |                   |
| /Meng-Ai An/<br>Supervisory Patent Examiner, Art Unit 2195 | 1/10/10    | O.G. Print Claim(s)   | O.G. Print Figure |
| (Primary Examiner)   | (Date)     | 1                     | 2                 |

|  |                                     |   |
|--|-------------------------------------|---|
| <b>Search Notes</b><br><br> | Application/Control No.<br>11778466 | Applicant(s)/Patent Under Reexamination<br>JEONG, MOON-SANG |
|  | Examiner<br>JENNIFER N TO           | Art Unit<br>2195  |

| SEARCHED |               |          |          |
|----------|---------------|----------|----------|
| Class    | Subclass      | Date     | Examiner |
| 718      | 107           | 1/5/2010 | JT       |
| 455      | 556.1, 556.2  | 1/5/2010 | JT       |
| 715      | 716, 718, 727 | 1/7/2010 | JT       |

| SEARCH NOTES                |          |          |
|-----------------------------|----------|----------|
| Search Notes                | Date     | Examiner |
| EAST SEARCH                 | 1/5/2010 | JT       |
| INVENTOR NAME SEARCH UPDATE | 1/4/2010 | JT       |
| NPL SEARCH (GOOGLE SCHOLAR) | 1/7/2010 | JT       |

| INTERFERENCE SEARCH |               |          |          |
|---------------------|---------------|----------|----------|
| Class               | Subclass      | Date     | Examiner |
| 718                 | 107           | 1/7/2010 | JT       |
| 455                 | 556.1, 556.2  | 1/7/2010 | JT       |
| 715                 | 716, 718, 727 | 1/7/2010 | JT       |

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## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits | Search Query                            | DBs                                  | Default Operator | Plurals | Time Stamp          |
|-------|------|---|--------------------------------------|------------------|---------|---------------------|
| L1    | 4725 | apple.as.                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L2    | 516  | L1 and mp3                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L3    | 3933 | panasonic.as.                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L4    | 46   | L3 and (portable near2 communication)   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L5    | 33   | L3 and (audio near2 player)             | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L6    | 1    | L3 and (digital adj audio near2 player) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L7    | 4725 | apple.as.                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L8    | 70   | L7 and (digital adj audio near2 player) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L9    | 516  | L7 and mp3                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |
| L10   | 0    | L7 and mp3 and standy                   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR               | ON      | 2010/01/07<br>09:31 |

|     |      |  |                                      |    |    |                     |
|-----|------|--|--------------------------------------|----|----|---------------------|
| L11 | 8    | L7 and mp3 and standby                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L12 | 35   | L7 and mp3 and (mode near2 switch\$3)                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L13 | 31   | audio adj player with (mode near2 switch\$3)         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L14 | 56   | audio adj player same (mode near2 switch\$3)         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L15 | 25   | L14 not L13  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L16 | 2201 | sony adj ericsson.as.                                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L17 | 2268 | (cell adj1 phone) with mp3                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L18 | 0    | (cell adj1 phone) with mp3 and (while near4 music)   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L19 | 0    | (cell adj1 phone) with mp3 and (while near4 play\$3) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L20 | 0    | (cell adj1 phone) with mp3 and (while)               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L21 | 0    | L16 and L17  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L22 | 104  | sony adj ericsson.as. and (cell near2 phone)         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |

|     |      |  |                                      |    |    |                     |
|-----|------|--|--------------------------------------|----|----|---------------------|
| L23 | 93   | sony adj ericsson.as.<br>and (audio near2<br>player)                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L24 | 1402 | (creat\$3 generat\$3)<br>with (icon object) with<br>music                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L25 | 69   | (creat\$3 generat\$3)<br>with (icon object) with<br>music with background                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L26 | 12   | (creat\$3 generat\$3)<br>with (icon object) with<br>music with background<br>same portable | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L27 | 24   | (creat\$3 generat\$3)<br>with (icon object) with<br>music with background<br>and portable  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L28 | 12   | L27 not L26  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L29 | 230  | (creat\$3 generat\$3)<br>with (icon object) near2<br>music                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L30 | 6    | (creat\$3 generat\$3)<br>with (icon object) near2<br>music.ab.                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L31 | 5    | (creat\$3 generat\$3)<br>with (icon object) near2<br>music and multitask\$3                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L32 | 7    | (creat\$3 generat\$3)<br>with (icon object) near2<br>music with background                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L33 | 5240 | (creat\$3 generat\$3)<br>with (icon object) with<br>background                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L34 | 0    | (creat\$3 generat\$3)<br>with (icon object) with<br>background same<br>myliltask\$3        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |

|     |    |   |                                      |    |    |                     |
|-----|----|---|--------------------------------------|----|----|---------------------|
| L35 | 0  | (creat\$3 generat\$3)<br>with (icon object) with<br>background same<br>multitask\$3 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L36 | 32 | (creat\$3 generat\$3)<br>with (icon object) with<br>background same<br>portable     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L37 | 1  | "20050083642"   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L38 | 1  | "20050054379"   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L39 | 0  | MP3 near2 player with<br>play near2 object  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L40 | 1  | MP3 near2 player with<br>play near2 icon  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L41 | 2  | MP3 near2 player same<br>play near2 icon  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L42 | 1  | "20060036569"   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L43 | 1  | "5956029".pn.   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L44 | 0  | edit\$3 near3 thumb<br>near2 icon   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L45 | 9  | (thumb near2 icon) with<br>(creat\$3 edit\$3 general<br>\$3)                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L46 | 0  | "2002035595"  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |

|     |      |  |                                      |    |    |                     |
|-----|------|--|--------------------------------------|----|----|---------------------|
| L47 | 1    | "20020035595"  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L48 | 1    | "20050097506"  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L49 | 7278 | object adj interface   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L50 | 1    | object adj interface and<br>L2   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L51 | 0    | object adj interface and<br>L4   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L52 | 640  | object adj interface and<br>mp3  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L53 | 13   | object adj interface and<br>mp3 and standby  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L54 | 0    | (thumb near2 icon) with<br>(creat\$3 edit\$3 general<br>\$3) same using adj4<br>icon     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L55 | 2    | (thumb near2 icon) with<br>(creat\$3 edit\$3 general<br>\$3) same icon with<br>interface | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L56 | 47   | object adj interface and<br>mp3 and "178"  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L75 | 578  | icon with applet   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L76 | 113  | icon with applet and<br>"715".clas.  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |

|     |     |  |                             |    |    |                  |
|-----|-----|--|-----------------------------|----|----|------------------|
| L77 | 2   | icon with applet and "715".clas. and (portable adj device) | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L78 | 0   | icon with applet.ab. and (portable adj device)             | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L79 | 23  | icon with applet and (portable adj device)                 | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L80 | 712 | (icon button) adj10 applet                                 | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L81 | 135 | (icon button) adj10 applet and "715".clas.                 | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L82 | 0   | (icon button) adj10 applet and portabale and "715".clas.   | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L83 | 23  | (icon button) adj10 applet and portable and "715".clas.    | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L84 | 1   | "20060246955"  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L85 | 1   | "7123945".pn.  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L86 | 1   | "20050083642".pn.  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L87 | 34  | (generat\$3 creat\$3) near3 icon with applet               | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L88 | 1   | icon with application adj module with applet               | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |

|      |     |  |                                      |    |    |                     |
|------|-----|--|--------------------------------------|----|----|---------------------|
| L89  | 0   | button with application<br>adj module with applet          | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L90  | 0   | buton with application<br>adj module with applet           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L91  | 154 | application adj module<br>with applet                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L92  | 7   | application adj module<br>with applet and "715".<br>clas.  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L93  | 3   | menu with application<br>adj module with applet            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L94  | 1   | "20020077156".PN.  | US-PGPUB                             | OR | ON | 2010/01/07<br>09:31 |
| L95  | 3   | application adj module<br>with applet with menu            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L96  | 1   | application adj module<br>with applet with list            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L97  | 8   | application adj module<br>with applet with display         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L98  | 154 | application adj module<br>with applet                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L99  | 0   | application adj module<br>with applet same<br>multitask\$3 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |
| L100 | 4   | application adj module<br>with applet and<br>multitask\$3  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/07<br>09:31 |

|      |     |   |                             |    |    |                  |
|------|-----|---|-----------------------------|----|----|------------------|
| L101 | 7   | application adj module with applet and multi \$1task\$3                         | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L102 | 7   | application adj module with applet and "715". clas.                             | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L103 | 7   | application adj module with applet and "455". clas.                             | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:31 |
| L104 | 5   | ("20020067308"   "20020077156"   "20050054379"   "20050083642"   "7123945").PN. | US-PGPUB; USPAT; USOCR      | OR | ON | 2010/01/07 09:31 |
| L105 | 1   | "20040221697"   | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:59 |
| L106 | 2   | "20040021697"   | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/07 09:59 |
| S402 | 574 | icon with applet  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/05 07:52 |
| S403 | 112 | icon with applet and "715".clas.  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/05 07:52 |
| S404 | 2   | icon with applet and "715".clas. and (portable adj device)                      | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/05 07:53 |
| S405 | 0   | icon with applet.ab. and (portable adj device)                                  | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/05 07:54 |
| S406 | 23  | icon with applet and (portable adj device)                                      | US-PGPUB; USPAT; USOCR; EPO | OR | ON | 2010/01/05 07:54 |

|      |     |  |                                      |    |    |                     |
|------|-----|--|--------------------------------------|----|----|---------------------|
| S407 | 702 | (icon button) adj10<br>applet                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>07:56 |
| S408 | 131 | (icon button) adj10<br>applet and "715".clas.                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>07:56 |
| S409 | 0   | (icon button) adj10<br>applet and portabale<br>and "715".clas. | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>07:56 |
| S410 | 22  | (icon button) adj10<br>applet and portable and<br>"715".clas.  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>07:56 |
| S411 | 1   | "20060246955"  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:06 |
| S412 | 1   | "7123945".pn.  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:07 |
| S413 | 1   | "20050083642".pn.  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:07 |
| S414 | 33  | (generat\$3 creat\$3)<br>near3 icon with applet                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:08 |
| S415 | 1   | icon with application adj<br>module with applet                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:20 |
| S416 | 0   | button with application<br>adj module with applet              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:20 |
| S417 | 0   | bulon with application<br>adj module with applet               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:20 |
| S418 | 154 | application adj module<br>with applet                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:21 |

|      |     |   |                                      |    |    |                     |
|------|-----|---|--------------------------------------|----|----|---------------------|
| S419 | 7   | application adj module with applet and "715". clas.     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:21 |
| S420 | 3   | menu with application adj module with applet            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:23 |
| S421 | 1   | "20020077156".PN.                                       | US-PGPUB                             | OR | ON | 2010/01/05<br>08:24 |
| S422 | 3   | application adj module with applet with menu            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:24 |
| S423 | 1   | application adj module with applet with list            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:25 |
| S424 | 8   | application adj module with applet with display         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:25 |
| S425 | 154 | application adj module with applet                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:27 |
| S426 | 0   | application adj module with applet same multitask\$3    | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:27 |
| S427 | 4   | application adj module with applet and multitask\$3     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:28 |
| S428 | 7   | application adj module with applet and multi \$1task\$3 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:28 |
| S429 | 7   | application adj module with applet and "715". clas.     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:29 |
| S430 | 7   | application adj module with applet and "455". clas.     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO | OR | ON | 2010/01/05<br>08:29 |

|      |   |   |                              |    |    |                     |
|------|---|---|------------------------------|----|----|---------------------|
| S431 | 5 | ("20020067308"  <br>"20020077156"  <br>"20050054379"  <br>"20050083642"  <br>"7123945").PN. | US-PGPUB;<br>USPAT;<br>USOCR | OR | ON | 2010/01/05<br>08:30 |
|------|---|---|------------------------------|----|----|---------------------|

## EAST Search History (Interference)

| Ref # | Hits | Search Query   | DBs            | Default Operator | Plurals | Time Stamp       |
|-------|------|--|----------------|------------------|---------|------------------|
| L57   | 3    | object adj interface<br>and mp3 and<br>standby   | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L58   | 0    | (thumb near2 icon)<br>with (creat\$3 edit\$3<br>general\$3) same<br>icon with interface    | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L59   | 3    | (creat\$3 general\$3)<br>with (icon object)<br>near2 music with<br>background              | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L60   | 42   | touch adj screen<br>with (phone mobile<br>portable) .ab. and<br>"455".clas.                | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L61   | 18   | (creat\$3 general\$3)<br>with (icon object)<br>with background<br>same portable            | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L62   | 0    | (creat\$3 general\$3)<br>with (icon object)<br>with background<br>same portable and<br>L60 | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L63   | 0    | (creat\$3 general\$3)<br>with (icon object)<br>with background<br>same portable and<br>L60 | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L64   | 18   | (creat\$3 general\$3)<br>with (icon object)<br>with background<br>same portable            | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L65   | 1379 | 455/556.1.ccls.  | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |
| L66   | 0    | 455/556.1.ccls. and<br>L57   | USPAT;<br>UPAD | OR               | ON      | 2010/01/07 09:31 |

|     |      |  |                |    |    |                  |
|-----|------|--|----------------|----|----|------------------|
| L67 | 1    | 455/556.1.ccls. and L60  | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L68 | 1995 | 715/716-727.ccls.  | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L69 | 0    | L61 and L68<br>-   | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L70 | 665  | 718/107.CCLS.  | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L71 | 0    | 718/107.CCLS. and L60  | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L72 | 0    | audio adj player same (mode near2 switch\$3) and 718/107.ccls.           | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L73 | 0    | multitask\$3 same (mode near2 switch \$3) and portable and 718/107.ccls. | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |
| L74 | 0    | multitask\$3 same (mode near2 switch \$3) and portable and L70           | USPAT;<br>UPAD | OR | ON | 2010/01/07 09:31 |

1/7/2010 10:11:05 AM

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applet <near> icon <near> mobile communication

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... and Apparatus for Automatic Near Field Communication Application Selection in ...

V Sklovsky, Y Bertrand, T Buhci - 2009 - freepatentsonline.com

... of a near field communication application without requiring the user to manually silt through lists of icons or menus. ... Allocation of applet into, Mobile Element ID ... 6, illustrated therein are the steps of one method for automatically selecting a near field communication application from ...

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Designing LoL@, a mobile tourist guide for UMTS

G Pospisich, M Umlauf, E Michlmayr - Lecture Notes in Computer Science, 2002 - Springer

... due to technical constraints: the screen size and resolution of currently (and in the near future) available ... Multi-modal interactions: Users can interact with LoL@ by clicking on icons, hypertext links ... does not provide all functionality that is required for the map viewer applet and the ...

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Infrastructure for mobile agents: Requirements and design

Y Aridor, M Oshima - Lecture notes in computer science, 1998 - Springer

... Future versions will have icons of itinerary objects (ie, objects encapsulating multiple locations and a scheme for routing between them) in ... controlled by the applet security manager ... They are likely to be more readily accepted by clients, at least in the near future, than stand-alone ...

[Cited by 79](#) - [Related articles](#) - [BL Direct](#) - [All 6 versions](#)

Controlling multimedia players using NFC enabled mobile phones

I Sánchez, M Cortés, J Rieki - ... international conference on Mobile ..., 2007 - portal.acm.org

... Figure 5. HTTP Streaming algorithm In both cases the necessary applet objects and scripts are loaded in the browser when a display is registered. ... An RFID icon advertising the player would be placed near the display, and an RFID tag under the icon. ...

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[PDF] C-MAP: Building a context-aware mobile assistant for exhibition tours

[nagoya-u.ac.jp \[PDF\]](#)

Y Sumi, T Etani, S Fels, N Simonet, K ... - Lecture notes in ..., 1996 - mase.itc.nagoya-u.ac.jp

... Guide character appearing in an exhibit ap-tions will be removed in the near future, we ... We applied the semantic map applet to graph social networks by representing exhibits with rectangular ... The

exhibit icons which are directly connected to the "USER-A" icon are the exhibits ...

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Augment-able reality: Situated communication through physical and digital spaces

[osu.edu \(PDF\)](#)

J Rekimoto, Y Ayatsuka, K ... - Proceedings of the ..., 1998 - doi.ieee.computersociety.org  
... Figure 9). The user can display or playback attached data simply by clicking a corresponding icon on the floor map. ... Figure 9: Accessing situated information from a Java applet ... Other possibilities include wireless tags[1], near field radio[7] and the global positioning system (GPS ...

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LoL@, a mobile tourist guide for UMTS

[osu.edu \(PDF\)](#)

M Umiauti, G Pospischil, G Nikfield, E ... - ... Technology &# 38; ..., 2000 - ingentiaconnect.com  
... Clear icon design improves usability, especially for disabled (color blind) users or elderly far-sighted ... the future of wireless Web services; however, for products to be deployed in the near future ... Maps are displayed with a map viewer applet in the terminal (GISquadrat, 2001). ...

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(PDF) ... offered functionality in the information society and a prediction of (Near) ...

[umassd.edu \(PDF\)](#)

B Hermans - First Monday, 1997 - umassd.edu  
... Questions such as "how will agents be used in the near future?", "who will be offering agents (and why)?", and "which problems/needs can be ... see this WWW page: <http://wombat.doc.ic.ac.uk/?AI13> This is a discussion list (using e-mail as the means of communication) about the ...

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Estimating communication context through location information and schedule ...

[osu.edu \(PDF\)](#)

Y Nakarishi, N Kitacka, K Hakuzaki, M ... - Conference on Human ..., 2002 - portal.acm.org  
... information to anyone, anywhere, in order to facilitate making contact among users in the mobile environment [1 ... which were home office workers, did not wish to share location names or use the mapping Java applet. ... If a user is at home, her icon is in the box; otherwise, it is out of ...

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(PDF) A mobile-aware city guide application

[furb.br \(PDF\)](#)

B Kraßer, D Carrega, J Shankar, P Sakson, S ... - ... Mobile Communication ... - in furb.br  
... in Figure 4. It consists of a simple dialog box with several icons to indicate ... Implementing the City Guide v1 as a JDK 1.0 Java applet was the main ... et al, 'Client/Server Architecture for Mobile Users: The ACTS OnTheMove Project', ACTS Mobile Communication Summit, Granada ...

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... AppleTalk tab, 772 applets AppleScript, 580, 583 launching, 258 AppleTypeServer (ATS) log entry, 766 Application ... 233-234 in digital images, 475-476 for e-mail, 407 for icons, 68 in ... IP hostnames to IP addresses, 774 cookies, 342-343, 345 cooperative multitasking, 6 Copies ...

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[CITATION] [Windows 200 Professional Bible](#)

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MOS Finder - [media.wiley.com](#)

... For details on your selected icon, go to File > Get Info (Command+I). An application's memory can be adjusted using Get Info. ... With Mac OS X pre-emptive multitasking, the system remains responsive, so you can do a whole bunch of other things while ... Pre-emptive multi-tasking ...

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M Partners - MEAR Partners

[PDF] [Educational improvements applying an MPLS network simulator: a technical ...](#)

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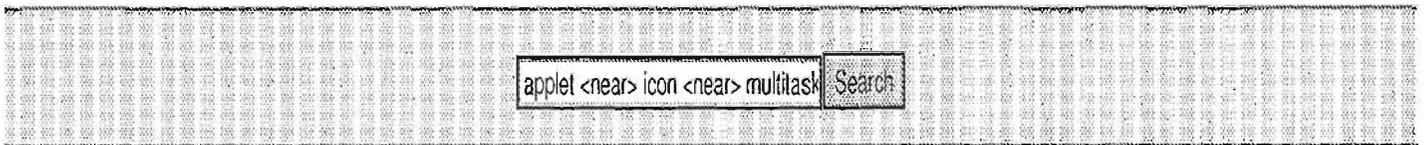
M Domínguez-Dorado, FJ Rodríguez-Pérez, J ... - [marolodominguez.com](#)

... although of factio it is free-of-charge and easy to install (it is an runnable applet located at ... Finally, we can start the simulation by clicking the first icon that shows a gear ... Java has also allowed the implementation of the simulator as a multitask application (it is able to simulate more ...

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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO | CONFIRMATION NO. |
|---|-------------|----------------------|--------------------|------------------|
| 11/778,466  | 07/16/2007  | Moon-Sang JEONG      | 0201-0055          | 1475             |
| 68103   | 7590        | 12/16/2009           | EXAMINER           |                  |
| Jefferson IP Law, LLP<br>1130 Connecticut Ave., NW<br>Suite 420<br>Washington, DC 20036 |             |                      | TO, JENNIFER N     |                  |
|   |             |                      | ART UNIT           | PAPER NUMBER     |
|   |             |                      | 2195               |                  |
|   |             |                      | MAIL DATE          | DELIVERY MODE    |
|   |             |                      | 12/16/2009         | PAPER            |

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

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

|                          |                               |                                  |  |
|--------------------------|-------------------------------|----------------------------------|--|
| <i>Interview Summary</i> | Application No.<br>11/778,466 | Applicant(s)<br>JEONG, MOON-SANG |  |
|                          | Examiner<br>JENNIFER N. TO    | Art Unit<br>2195                 |  |

All participants (applicant, applicant's representative, PTO personnel):

- |                            |                           |
|----------------------------|---------------------------|
| (1) <u>JENNIFER N. TO.</u> | (3) <u>GEORGE ECKERT.</u> |
| (2) <u>MENG-AI AN.</u>     | (4) <u>MAENG-HO SHIN</u>  |
|                            | (5) <u>SEOK-KYUN PARK</u> |
|                            | (6) <u>KI-SANG LEE.</u>   |

Date of Interview: 08 December 2009.

Type: a)  Telephonic b)  Video Conference  
c)  Personal (copy given to: 1)  applicant 2)  applicant's representative)

Exhibit shown or demonstration conducted: d)  Yes e)  No.  
If Yes, brief description: \_\_\_\_\_.

Claim(s) discussed: 1.

Identification of prior art discussed: KOKUBO (U.S. PATENT NO. 7,123,945) & SENPUKU (U.S PUBLICATION 2005/0083642).

Agreement with respect to the claims f)  was reached. g)  was not reached. h)  N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: See Continuation Sheet.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Meng-Ai An/  
Supervisory Patent Examiner, Art Unit 2195

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

### Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

### 37 CFR §1.2 Business to be transacted in writing

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: (1) The details discussion between examiners and applicants with regarding mapping "music background play object" as recited in claim 1 with the teaching of "music icon" as taught in KOKUBO. Examiner suggested to further include the definition of "a music background play object" as "wherein the music background play objects including an application module includes at least one applet" as argued during the interview to distinct from the icon as taught by KOKUBO. (2) The teaching of switching from the MP3 mode to a standby mode while the playing of the music file continue by KOKUBO and SENPUKU was discussed. Examiners point out that KOKUBO teaching of switching from the MP3 mode to another mode while the playing of the music file continues, and SENPUKU teaching of switching from an active mode to a standby mode. (3) The obvious type double patenting over U.S. Patent 7,526,558 was discussed. Examiners agreed to re-introduce the obvious type double patenting rejection as previously indicated in the office action mail dated 05/27/2009 to explain the obvious reasons in view of the claims filed 10/30/2009 to make the records clear. In additon, applicants also mentioned to re-introduce the limitation of "generating a music background play object in a standby mode" as an alternated way of overcome the prior arts of record.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

|              |   |                  |                  |
|--------------|---|------------------|------------------|
| Appl. No.    | : 11/778,466  | Confirmation No. | : 1475           |
| Applicant(s) | : Moon-Sang JEONG   | TC/A.U.          | : 2195           |
| Filed        | : July 16, 2007   | Examiner         | : Jennifer N. To |
| Title        | : Multi-Tasking Apparatus<br>and Method in Portable<br>Terminal | Docket No.       | : 0201-0055      |

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**Amendment in Response to Non-Final Office Action**

Sir:

In response to the Office Action dated November 09, 2009, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.

**Amendments to the Claims:**

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

1. (Currently Amended) A multi-tasking method in a pocket-sized mobile communication device including an MP3 playing capability, the multi-tasking method comprising:

generating a music background play object, wherein the music background play object includes an application module including at least one applet;

providing an interface for music play by the music background play object;

selecting an MP3 mode in the pocket-sized mobile communication device using the interface;

selecting and playing a music file in the pocket-sized mobile communication device in the MP3 mode;

switching from the MP3 mode to a standby mode while the playing of the music file continues;

displaying an indication that the music file is being played in the standby mode;

selecting and performing at least one function of the pocket-sized mobile communication device from the standby mode while the playing of the music file continues; and

continuing to display the indication that the music file is being played while performing the selected function.

2. (Original) The multi-tasking method of claim 1, wherein the displaying of the indication comprises displaying an icon.

3. (Original) The multi-tasking method of claim 1, wherein the displaying of the indication comprises displaying information relating to the music file.

4. (Original) The multi-tasking method of claim 3, wherein the information comprises at least one of a music title, a musician and an album title.

5. (Original) The multi-tasking method of claim 3, wherein the displaying of the information comprises overlaying the information relating to the music file on a screen.

6. (Original) The multi-tasking method of claim 1, further comprising selecting to continue the playing of the music file.

7. (Original) The multi-tasking method of claim 1, wherein the function selected from the standby mode comprises a message function.

8. (Original) The multi-tasking method of claim 1, wherein the function selected from the standby mode comprises a phone-book function.

9. (Currently Amended) A multi-tasking apparatus in a pocket-sized mobile communication device including an MP3 playing capability, the multi-tasking apparatus comprising:

a controller for generating a music background play object, wherein the music background play object includes an application module including at least one applet, for providing an interface for music play by the music background play object, for selecting an MP3 mode in the pocket-sized mobile communication device using the interface, for selecting and playing a music file in the pocket-sized mobile communication device in the MP3 mode, for switching from the MP3 mode to a standby mode while the playing of the music file continues and for selecting and performing at least one function of the pocket-sized mobile communication device from the standby mode while the playing of the music file continues; and

a display unit for displaying an indication that the music file is being played in the standby mode and for continuing to display the indication that the music file is being played while performing the selected function.

10. (Original) The multi-tasking apparatus of claim 9, wherein the indication comprises an icon.

11. (Original) The multi-tasking apparatus of claim 9, wherein the indication comprises information relating to the music file.
12. (Original) The multi-tasking apparatus of claim 11, wherein the information comprises at least one of a music title, a musician and an album title.
13. (Original) The multi-tasking apparatus of claim 11, wherein the display unit overlays the information relating to the music file on a screen.
14. (Original) The multi-tasking apparatus of claim 9, wherein the controller selects to continue the playing of the music file.
15. (Original) The multi-tasking apparatus of claim 9, wherein the function selected from the standby mode comprises a message function.
16. (Original) The multi-tasking apparatus of claim 9, wherein the function selected from the standby mode comprises a phone-book function.
17. (Currently Amended) A multi-tasking apparatus in a pocket-sized mobile communication device consisting of a single display unit and including an MP3 playing capability, the multi-tasking apparatus comprising:
  - a controller for generating a music background play object, wherein the music background play object includes an application module including at least one applet, for providing an interface for music play by the music background play object, for selecting an MP3 mode in the pocket-sized mobile communication device using the interface, for selecting and playing a music file in the pocket-sized mobile communication device in the MP3 mode, and for switching from the MP3 mode to a standby mode while the playing of the music file continues; and
  - the single display unit for displaying an indication that the music file is being played in the standby mode.
18. (Original) The multi-tasking apparatus of claim 17, wherein the indication comprises an icon.

19. (Original) The multi-tasking apparatus of claim 17, wherein the indication comprises information relating to the music file.

20. (Original) The multi-tasking apparatus of claim 17, wherein the controller selects to continue the playing of the music file.

## REMARKS/ARGUMENTS

### **I. Status of Claims**

Claims 1-20 are pending, wherein claims 1, 9 and 17 are independent. The application was previously allowed as indicated by the Notice of Allowance dated August 12, 2009. The Applicant wishes to thank the Examiner for allowing the application. However, after review of the subject matter covered by the previously allowed claims, it was believed that the scope of the allowed claims was unduly narrow. Accordingly, Applicant filed a Request for Continued Examination (RCE) which included an amendment to each of independent claims 1, 9 and 17 to delete reference to being in a standby mode of a device when generating a music background play object. In response, the Office has rejected independent claims 1, 9 and 17 as obvious over Kokubo in view of Senpuku, which references have been used in several previous rejections. An Applicant initiated interview, which is summarized below, was held with the Examiner and Supervisory Primary Examiner (SPE). Applicant wishes to thank the Examiner and SPE for granting the interview and for the candid discussion held therein. As a result of the interview, Applicant has amended each of the independent claims to better define Applicant's invention. Applicant believes that the amended claims distinguish over the prior art and thus respectfully requests withdrawal of the rejections and allowance of the application.

### **II. Interview Summary**

On December 8, 2009, a personal interview was held between the Examiner and her SPE, Mr. Gisang Lee and Mr. David Park representing the assignee, and Applicant's representatives Mr. Maeng-Ho Shin and Mr. George Eckert. All representatives of the Applicant and assignee wish to thank the Examiner and SPE for granting the interview and the candid discussion held therein. The purpose of the interview was to discuss the outstanding rejection and especially to better understand the Office's position regarding the interpretation of Kokubo.

During the interview, discussion focused on the limitation of a music background play object. It is Applicant's position that a background play object is not disclosed by Kokubo. However, it is the Office's position that the icon 10 of Kokubo does disclose a music background play object, especially in light of the disclosure by Kokubo in column 2, beginning at line 10. The Office did suggest however, that the

inclusion of a limitation further defining the music background play object would distinguish over the art of record, though not necessarily be allowable depending on the results of a further search. Specifically, the Office suggested including a limitation indicating that the music background play object includes an application module including at least one applet. Applicant appreciates the Office's suggestion and has amended the independent claims as suggested.

Discussion was also held during the interview regarding the alleged disclosure by Senpuku of a standby mode and regarding the double patenting rejection. As discussed below, it is Applicant's position that Senpuku does not disclose a standby mode and that the double patenting rejection must be clarified in light of the claim amendments made with the filing of the RCE. Regarding Senpuku, the Office maintained the position that, because Kokubo discloses switching between various modes and Senpuku discloses a standby mode, their combination makes obvious the switching to a standby mode in the disclosure of Kokubo. Regarding the double patenting rejection, the Office indicated that they would consider the propriety of the double patenting rejection in light of the claim amendments as well as the status of the terminal disclaimer. At the conclusion of the interview, the Office indicated that, once submitted, the arguments and amendments would be considered based on the discussion. Accordingly, an agreement was not reached.

### **III. Applicant's Invention as Claimed**

The present invention is drawn to a mobile communication terminal that is capable of playing an MP3 file in the background while other applications are running on the terminal.

As discussed in the originally filed specification, portable communication terminals of the prior art allowed a user to play an MP3 file by including a separate player in the terminal. *See para. [0003]*. However, when using the separate player to play an MP3 file, the user could not simultaneously use any of the other functions provided by the terminal. *See para. [0004]*. One proposed solution was to include a control processor for the playing of MP3 files. That is, a dedicated MP3 processor would be added to manage and control only the MP3 files. *See para. [0005]*. However, the addition of a dedicated processor increased both the cost and complexity of the terminal. *Id.*

The presently claimed invention addresses these issues. That is, the claimed invention provides for independently playing a music file in the background while allowing a user to execute other menu functions of the device. The present invention achieves this ability by including application modules that include at least one applet such that each application module independently performs multi-tasking. *See para. [0018]*. For the specific invention as claimed, a music background play object, wherein the music background play object includes an application module including at least one applet, is included such that an MP3 file can be played in the background while other menu tasks can be executed by the user.

Independent claims 1, 9 and 17 recite these unique features. Specifically, each of independent claims 1, 9 and 17 recite the specific method or function that allows for a terminal to play a music file in the background while allowing a user to concurrently use other functions of the terminal. Specifically, the claims recite the limitations of:

generating a music background play object, wherein the music background play object includes an application module including at least one applet;  
providing an interface for music play by the music background play object; and  
selecting an MP3 mode ... using the interface.

By use of the music background play object, which is an application module including at least one applet as discussed with reference to para. [0018], the terminal is able to perform multi-tasking. That is, by generating the application module of the music background play object, the music background play object provides an interface for the playing of music, specifically the selecting of an MP3 mode. At the same time, the user is able to execute other menu functions of the device and thus multi-task using the device.

It is Applicant's contention that independent claims 1, 9 and 17 are allowable based on the unique use of the music background play object, wherein the music background play object includes an application module including at least one applet, alone, and not based on the use of the music background play object in a standby or any other mode. That is, none of the prior art discloses a music background play object, wherein the music background play object includes an application module including at least one applet in any mode of a device. Accordingly, Applicant believes that the claims are in condition for immediate allowance.

**IV. Kokubo Does Not Disclose a Music Background Play Object, Wherein the Music Background Play Object Includes an Application Module Including at Least One Applet, as Claimed**

As amended, each of independent claims 1, 9 and 17 now recites “generating a music background play object, wherein the music background play object includes an application module including at least one applet,” support for which can be found in the originally filed application, at least in paragraph [0018]. The independent claims also recite “providing an interface for music play *by the music background play object*,” and “selecting an MP3 mode...*using the interface*.” (*emphasis added*). Applicant submits that Kokubo does not disclose any, let alone, all of these limitations.

First, Kokubo does not disclose “generating a music background play object, wherein the music background play object includes an application module including at least one applet”. In the outstanding rejection, the Office asserts that Kokubo’s disclosure of an icon reads on Applicant’s background music play object. Specifically, the Office cites to lines 9-10 of the abstract (“an icon associated with a task displayed on a first display region is generated”), lines 34-39 of col. 2 (“an icon corresponding to a task (application software) displayed in a first region is generated”), lines 2-3 of col. 3 (an icon generating means for generating icons corresponding to tasks”), and lines 8-10 of col. 13 (“and a manually or automatically generated [music note symbol] icon 10f is displayed”) as disclosing a music background play object.

Although it is not conceded that the icon of Kokubo is a disclosure of a music background play object, Applicant has amended the independent claims to further clarify that the music background play object includes an application module including at least one applet. As suggested by the Office during the interview, this clarifying limitation is not disclosed, taught or suggested by Kokubo. Rather, as acknowledged by the Office in the outstanding rejection, Kokubo merely discloses the generating of “an icon corresponding to a task (application software)” *col. 2, lines 34-39*; see also col. 13, lines 8-10 (“manually or automatically generated [music note symbol] icon 10f is displayed.” The generating of the icon by Kokubo is not a disclosure of generating a music background play object, wherein the music background play object includes an application module including at least one applet.

That is, Kokubo makes no disclosure that the icon includes an application module, or that the application module includes at least one applet as instantly claimed.

Given that icon 10 is not a music background play object, wherein the music background play object includes an application module including at least one applet, it is self-evident that the icon 10 cannot be considered as a music background play object that *provides* an interface for music play, or that an MP3 mode may be selected using the interface. Considering that Kokubo does not disclose the amended limitations, Applicant respectfully requests that the rejection be withdrawn.

V. **Senpuku Does Not Cure the Deficiencies of Kokubo and Fails to Disclose the Switching to a Standby Mode as Claimed.**

As discussed above, Kokubo does not disclose a music background play object, wherein the music background play object includes an application module including at least one applet, or the related limitations as instantly claimed. And, although Senpuku was not cited for disclosing a music background play object, a review of Senpuku indicates that it fails to disclose the limitation as well. Accordingly, for at least the reasons stated above, it is respectively requested that the rejection be withdrawn.

Senpuku was cited for allegedly disclosing the switching to a standby mode. However, while Senpuku discloses several methods regarding the use of a main display and a sub-display, including the automatic display of an execution step, the automatic display of a help screen, and the automatic display of an already running execution, Senpuku does not disclose, teach or suggest a method wherein, when the sub-display is opened, an application executing on the main display is moved to the sub-display, leaving a standby screen displayed on the main display. First, in the methods of Senpuku wherein applications are switched between the main display and sub-display, there is no discussion of a standby mode or screen. Specifically, Senpuku discloses that *images* may be switched from the sub-display to a part of the main display if the sub-display is closed (see again FIGs. 11 and 12) when the user is executing a video telephone call. Senpuku discloses in another method that, if a *plurality* of applications are being executed, when the sub-display is opened one of the applications may be displayed on the sub-display. In yet another method, Senpuku discloses that if a *plurality* of application are being executed, when the sub-display is closed, the application on the "active" screen will continue to be displayed on the

main display. However, nowhere in any of these examples does Senpuku disclose, teach or suggest that a standby screen is displayed when an application is moved from one display to the other.

Second, and in direct contrast to the assertions in the outstanding rejection, in the *only* description by Senpuku of a standby screen (FIG. 18 and para. [0110]), there is no disclosure of the moving of an application to a sub-display from a main display when the sub-display is opened. Rather, as explicitly disclosed by Senpuku, in a state in which a standby screen is *already* displayed on the main display, *and then* the sub-display is opened, a pre-registered second application may be automatically executed and displayed on the sub-display. The disclosure of Senpuku does not support the assertions made in the outstanding rejection and does not supply the element missing from Kokubo.

Senpuku does not disclose, teach or suggest the “switching from the MP3 mode to a standby mode while the playing of the music file continues.” For this reason, Applicant believes that the rejection is in error and respectfully requests withdrawal of the same.

#### **VI. The Double Patenting Rejection in Light of the Claim Amendments**

The double patenting rejection made in the Office action mailed May 27, 2009 was based on limitations that are no longer present in independent claims 1, 9 and 17. Specifically, independent claims 1, 9 and 17 were amended (with the filing of the RCE) to delete the limitation regarding generating a music background play object “in a standby mode.” However, in light of this amendment, the double patenting rejection was not asserted in the outstanding Office action, presumably because a terminal disclaimer was previously filed. However, given the previous claim amendments as well as the amendments in the present response, Applicant respectfully requests that the Office elaborate on its position regarding the propriety of the double patenting rejection.



## Electronic Acknowledgement Receipt

|   |   |
|---|---|
| <b>EFS ID:</b>                              | 6597386   |
| <b>Application Number:</b>                  | 11778466  |
| <b>International Application Number:</b>    |   |
| <b>Confirmation Number:</b>                 | 1475  |
| <b>Title of Invention:</b>                  | MULTI-TASKING APPARATUS AND METHOD IN PORTABLE TERMINAL |
| <b>First Named Inventor/Applicant Name:</b> | Moon-Sang JEONG   |
| <b>Customer Number:</b>                     | 68103   |
| <b>Filer:</b>                               | George Charles Eckert                                   |
| <b>Filer Authorized By:</b>                 |   |
| <b>Attorney Docket Number:</b>              | 0201-0055   |
| <b>Receipt Date:</b>                        | 08-DEC-2009   |
| <b>Filing Date:</b>                         | 16-JUL-2007   |
| <b>Time Stamp:</b>                          | 18:02:50  |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                             |

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### File Listing:

| Document Number | Document Description | File Name                                   | File Size(Bytes)/<br>Message Digest                                   | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|---|---|------------------|------------------|
| 1               |                      | 0201-0055AmendmentAsFiled<br>12-08-2009.pdf | 143619<br><small>49e6e76883f72d6c6fd011b010466d8e477<br/>6585</small> | yes              | 12               |

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| Document Description  | Start | End    |
| Amendment/Req. Reconsideration-After Non-Final Reject   | 1     | 1      |
| Claims  | 2     | 5      |
| Applicant Arguments/Remarks Made in an Amendment  | 6     | 12     |
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| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875 | Application or Docket Number | Filing Date | <input type="checkbox"/> To be Mailed |
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| APPLICATION AS FILED - PART I  |   |              | OTHER THAN SMALL ENTITY                  |          |              |          |
|--|---|--------------|--|----------|--------------|----------|
| (Column 1)   |   | (Column 2)   | SMALL ENTITY <input type="checkbox"/> OR |          | SMALL ENTITY |          |
| FOR  | NUMBER FILED  | NUMBER EXTRA | RATE (\$)                                | FEE (\$) | RATE (\$)    | FEE (\$) |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))        | N/A   | N/A          | N/A                                      |          | N/A          |          |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))       | N/A   | N/A          | N/A                                      |          | N/A          |          |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A   | N/A          | N/A                                      |          | N/A          |          |
| TOTAL CLAIMS<br>(37 CFR 1.16(l))   | minus 20 =  | *            | X \$ =                                   |          | X \$ =       |          |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                     | minus 3 =   | *            | X \$ =                                   |          | X \$ =       |          |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |  |          |              |          |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |   |              |  |          |              |          |
| * If the difference in column 1 is less than zero, enter "0" in column 2.  |   |              | TOTAL                                    |          | TOTAL        |          |

| APPLICATION AS AMENDED - PART II |  |                                  |                                    |               | OTHER THAN SMALL ENTITY |                     |           |                     |   |
|----------------------------------|--|----------------------------------|------------------------------------|---------------|-------------------------|---------------------|-----------|---------------------|---|
| (Column 1)                       |  | (Column 2)                       | (Column 3)                         | SMALL ENTITY  |                         | OR                  |           | SMALL ENTITY        |   |
| AMENDMENT                        | 12/08/2009   | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)               | ADDITIONAL FEE (\$) | RATE (\$) | ADDITIONAL FEE (\$) |   |
|                                  | Total (37 CFR 1.16(i))   | 20                               | Minus                              | 20            | =                       | 0                   | OR        | X \$220=            | 0 |
|                                  | Independent (37 CFR 1.16(b))   | 3                                | Minus                              | 3             | =                       | 0                   | OR        | X \$220=            | 0 |
|                                  | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |                                    |               |                         |                     |           |                     |   |
|                                  | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |                                    |               |                         |                     |           | OR                  |   |
|                                  |  |                                  |                                    |               | TOTAL ADD'L FEE         |                     | OR        | TOTAL ADD'L FEE     | 0 |

| (Column 1) |  | (Column 2)                         | (Column 3)    | SMALL ENTITY |                     | OR        |                     | SMALL ENTITY    |  |
|------------|--|------------------------------------|---------------|--------------|---------------------|-----------|---------------------|-----------------|--|
| AMENDMENT  | CLAIMS REMAINING AFTER AMENDMENT   | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)    | ADDITIONAL FEE (\$) | RATE (\$) | ADDITIONAL FEE (\$) |                 |  |
|            | Total (37 CFR 1.16(i))   | -                                  | Minus         | -            | =                   | -         | OR                  | X \$ =          |  |
|            | Independent (37 CFR 1.16(b))   | -                                  | Minus         | -            | =                   | -         | OR                  | X \$ =          |  |
|            | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                    |               |              |                     |           |                     |                 |  |
|            | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                    |               |              |                     |           |                     | OR              |  |
|            |  |                                    |               |              | TOTAL ADD'L FEE     |           | OR                  | TOTAL ADD'L FEE |  |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.  
 \*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".  
 \*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".  
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Legal Instrument Examiner:  
 /MARQUITA D. JONES/

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