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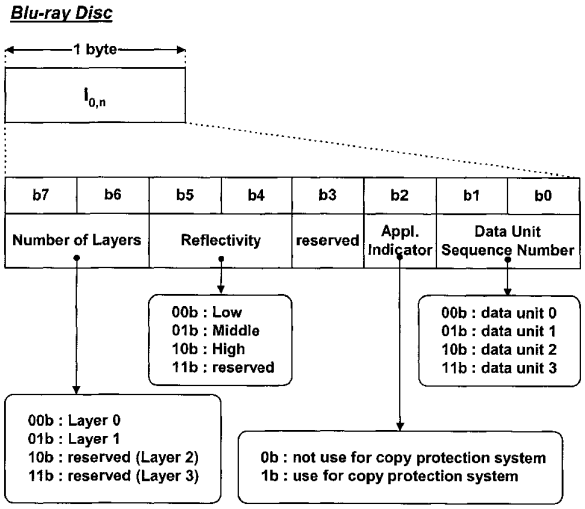
(54) Title: HIGH-DENSITY OPTICAL DISC AND RECORDING/REPRODUCING METHOD THEREOF



(57) Abstract: A high-density optical disc such as BD-RE (Blu-ray Disc Rewritable) or BD-ROM, and a recording/reproducing method thereof are disclosed. Diverse additional information such as disc reflectivity information, disc layer information or disc type information is efficiently recorded in a particular information field included in a data unit recorded on the burst cutting area of a high-density optical disc or a particular 1-byte address field included in an address unit recorded on the high-density optical disc so that it can be read when the high-density optical disc is loaded in an optical disc apparatus or when a data recording or reproducing operation for the high-density optical disc is carried out. Accordingly, it is possible to achieve optimal optical power control and automatic gain control or identification of a current position, while enabling a normal data recording or reproducing operation corresponding to the type of the optical disc.

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DESCRIPTION

HIGH-DENSITY OPTICAL DISC AND RECORDING/REPRODUCING METHOD THEREOF

1. Technical Field

The present invention relates to a high-density optical disc such as BD-RE (Blu-ray Disc Rewritable) or BD-ROM, and a recording/reproducing method thereof.

2. Background Art

Recently, high-density optical discs have been developed, for example, DVD (Digital Versatile Disc), which can store a large quantity of high-quality video and audio data. Currently, such high-density optical discs are widely commercially available.

On a DVD, main A/V data is recorded in the unit of sectors each having a size of 2,084 bytes, as shown in Fig. 1. In each sector of 2,048 bytes, additional information of 16 bytes is recorded which may include ID (Identification Data), IED (ID Error Detection Code), CPR_MAI (Copyright Management Information), and EDC (Error Detection Code).

The sector ID information, which is included in the additional information, consists of 4 bytes including 1-byte sector information and 3-byte sector number information, as shown in Fig. 2.

The 1-byte sector information includes sector format type information, tracking method information, disc reflectivity information, reserved information, data type information, and layer number information, each of which has a size of 1 bit. The sector information also includes area type information of 2 bits.

For example, where the sector formation type information

corresponds to '0b', it represents that the main A/V data recorded on the associated sector can be reproduced or recorded by a CLV (Constant Linear Velocity) type. On the other hand, where the sector formation type information corresponds to '1b', it represents that the main A/V data recorded on the associated sector can be reproduced or recorded by different types for different zones, respectively.

Also, where the tracking method information corresponds to '0b', it represents a pit-based tracking operation. On the other hand, where the tracking method information corresponds to '1b', it represents a groove-based tracking operation. Where the disc reflectivity information corresponds to '0b', it represents a reflectivity of more than 40%. On the other hand, where the reflectivity information corresponds to '1b', it represents a reflectivity of not more than 40%.

Meanwhile, where the area type information corresponds to '00b', it represents that the current position corresponds to a data area. Also, where the area type information corresponds to '01b', it represents that the current position corresponds to a lead-in area. The area type information corresponding to '10b' represents a lead-out area, whereas the area type information corresponding to '11b' represents a middle area on a dual layer optical disc. Where the data type information corresponds to '0b', it represents that the main A/V data of the associated sector is read-only data. On the other hand, where the data type information corresponds to '1b', it represents that the main A/V data of the associated sector is data other than read-only data.

Also, where the layer number information corresponds to '0b', it represents that the current disc has a single layer or that the current layer is a first layer Layer 0 in a dual layer optical disc. On the other hand, where the layer number information corresponds to '1b', it represents that the current layer is a second layer Layer 1 in the dual layer optical disc.

Accordingly, once such a DVD is loaded in an optical disc apparatus, the optical disc apparatus reads sector format type information, tracking method information, disc reflectivity information, data type information, layer number information, and area type information recorded on the DVD as sector information, in order to normally carry out a data recording or reproducing operation corresponding to the read information.

For examiner, servo control for data recording or reproduction should be determined in accordance with whether the sector formation type information represents a CLV type or a different type having different linear velocities for respective zones. Also, the gain of a read signal should be determined in accordance with the disc reflectivity information. Focus servo control also has to be determined in accordance with the layer information. Thus, the recording or reproducing condition should be determined in accordance with the additional information.

Meanwhile, standardisation of new high-density optical discs such as BD-RE and BD-ROM has recently been conducted by associated companies. However, the data format of such BDs is essentially different from that of DVDs. Furthermore, there is no method for effectively and appropriately recording diverse information corresponding to sector information, as recorded on a DVD, on the above mentioned high-density optical disc. Accordingly, such a method is strongly demanded.

It is not admitted that any of the information in this specification is common general knowledge, or that the person skilled in the art could be reasonably expected to have ascertained, understood, regarded it as relevant or combined it in anyway at the priority date.

3. Disclosure of Invention

In accordance with a first aspect of the present invention, there is provided a high-density recording medium, comprising:

a lead-in area including control information required to record or reproduce data on or from the recording medium; and

a burst cutting area located inwardly from the lead-in area, the burst cutting area including a plurality of data units;

wherein additional information is included in at least one data unit, the additional information including at least medium type information.

Preferably, the high-density recording medium is an optical disc such as BD-RE or BD-ROM.

The additional information corresponding to sector information, as used in a DVD, may be efficiently recorded in a particular information field included in a data unit recorded on a burst cutting area of the high-density optical disc or a particular 1-byte address field included in an address unit recorded on the high-density optical disc so that it can be read when the high-density optical disc is loaded in an optical disc apparatus or when a data recording or reproducing operation for the high-density optical disc is carried out.

In accordance with a second aspect of the present invention, there is provided a method for recording or reproducing data on or from a high-density recording medium, comprising the steps of:

identifying information included in at least one data unit of a burst cutting area of the recording medium, the information including at least medium type information; and

controlling a data recording or reproducing operation, based on the identified information.

In accordance with a third aspect of the present invention, there is provided a method for recording or reproducing data on or from a high-density recording medium, comprising the step of:

reading information included in a burst cutting area of the recording medium, the burst cutting area being located inwardly from the lead-in area, and including a plurality of data units, the information being included in at least one data unit and including at least a medium type information; and

controlling a data recording or reproducing operation, based on the read information.

As used herein, except where the context requires otherwise the term 'comprise' and variations of the term, such as 'comprising', 'comprises' and 'comprised', are not intended to exclude other additives, components, integers or steps.

4. Brief Description of Drawings

The accompanying drawings, which are included to provide a further understanding of the invention, illustrate the preferred embodiments of the invention, and together with the description, serve to explain the principles of the present invention.

Fig. 1 is a schematic view illustrating the structure of a data frame in a general DVD;

Fig. 2 is a schematic view illustrating the structure of sector information in a general DVD;

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Fig. 3 is a schematic view illustrating a BCA on a high-density optical disc according to the present invention;

Fig. 4 is a schematic view illustrating the structure of data units on a high-density optical disc according to an embodiment of the present invention;

Fig. 5 is a schematic view illustrating one exemplary structure of a particular information field on the high-density optical disc according to the first embodiment of the present invention;

Fig. 6 is a schematic view illustrating another exemplary structure of a particular information field on the high-density optical disc according to the first embodiment of the present invention;

Fig. 7 is a schematic view illustrating the structure of an address unit on a high-density optical disc according to a second embodiment of the present invention;

Fig. 8 is a schematic view illustrating the structure of a particular address field on the high-density optical disc according to the second embodiment of the present invention;

Fig. 9 is a schematic view illustrating the structure of a physical ADIP (Address In Pre-groove) address on the high-density optical disc according to the first or second embodiment of the present invention; and

Fig. 10 is a schematic block diagram illustrating the configuration of an optical disc apparatus for recording data on the high-density optical disc or reproducing data recorded on the high-density optical disc according to the first or second embodiment of the present invention.

Features, elements, and aspects of the invention that are referenced by the same numerals in different figures represent the same, equivalent, or similar features, elements, or aspects in accordance with one or more embodiments.

5. Modes for Carrying out the Invention

Hereinafter, preferred embodiments of a high-density

optical disc and a recording/reproducing method thereof according to the present invention will be described in detail with reference to the annexed drawings.

The high-density optical disc according to the present invention may be either a BD-RE or a BD-ROM.

In accordance with a first embodiment of the present invention, diverse additional information required to enable a normal data recording or reproducing operation may be recorded on a burst cutting area (BCA) assigned to the high-density optical disc.

The BCA, which is assigned to the high-density optical disc, as shown in Fig. 3, is an innermost area that the optical disc apparatus first accesses when the high-density optical disc is loaded therein. On the BCA, diverse information such as enciphering information for anti-duplication of the disc is recorded in the form of a BCA code.

As shown in Fig. 4, the BCA code recorded on the BCA has a data structure in which a plurality of data units are successively recorded. Each data unit consists of data of 4 rows including a sync field of 1 byte and an information field of 4 bytes, and parity of 4 rows including a sync field of 1 byte and a carrier field of 4 bytes.

Meanwhile, diverse additional information corresponding to sector information, as used in DVDs and described with reference to Fig. 2, may be recorded in an optional information field in each data unit, for example, a first information field of each data unit, $I_{0,0}$, $I_{0,1}$, $I_{0,2}$, or $I_{0,3}$. For example, recorded in the first information field $I_{0,0}$, of each data unit written on the BCA of a BD-ROM may be number-of-layers information of 2 bits (b7b6 = Number of Layers), disc reflectivity information of 2 bits (b5b4 = Reflectivity), reserved information of 1 bit (b3 = reserved), application indicator information of 1 bit (b2 = Application Indicator), and data unit sequence number information of 2 bits

(b1b0 = Data Unit Sequence Number), as shown in Fig. 5.

In this case, where the 2-bit number-of-layers information 'b7b6' corresponds to '00b', it represents that the associated optical disc has a structure consisting of one layer, that is, a single layer structure. Also, the number-of-layers information 'b7b6' corresponding to '01b' represents that the associated optical disc has a dual layer structure. On the other hand, where the number-of-layers information 'b7b6' corresponds to '10b' or '11b', it represents that the associated optical disc has a triple layer structure having a third layer Layer 2 or a quadruple layer structure having a fourth layer Layer 3.

Where the 2-bit reflectivity information 'b5b4' corresponds to '00b', it represents that the optical disc has a low reflectivity lower than a first predetermined reference value. Also, the reflectivity information 'b5b4' corresponding to '01b' represents that the optical disc has a middle reflectivity being higher than the first predetermined reference value and lower than a second predetermined reference value, whereas the reflectivity information 'b5b4' corresponding to '11b' represents that the optical disc has a high reflectivity higher than the second predetermined reference value.

For reference, the recording density of a BD-RE or BD-ROM is about 5 times as high as that of general DVDs. By virtue of such a high recording density, it is possible to allocate 2 bits to reflectivity information in the case of the BD-RE or BD-ROM, so that the reflectivity information can be more finely defined. Accordingly, more appropriate OPC (Optical Power Control) and AGC (Automatic Gain Control) can be carried out during data recording and reproducing operations.

Where the 1-bit application indicator information 'b2' corresponds to '0b', it represents nonuse of an anti-duplication system. On the other hand, the application indicator information 'b2' corresponding to '1b' represents use of the anti-duplication

system.

Also, where the 2-bit data unit sequence number information 'b1b0' corresponds to '00b', it represents that the number of the associated data unit is 'Data Unit 0'. The data unit sequence number information 'b1b0' corresponding to '01b' represents 'Data Unit 1', whereas the data unit sequence number information 'b1b0' corresponding to '10b' represents 'Data Unit 2'. On the other hand, the data unit sequence number information 'b1b0' corresponding to '11b' represents 'Data Unit 3'.

In addition to the above-described information, regional playback control information (not shown) may be recorded. Optical discs recorded with such regional playback control information cannot be played back in a particular optical recording/reproducing apparatus.

Meanwhile, the 2-bit layer information may be substituted with disc type information, as shown in Fig. 6. For example, where the disc type information 'b7b6' corresponds to '00b', it represents a BD-ROM type. Also, the disc type information 'b7b6' corresponding to '01b' represents a BD-R (Blu-ray Disc Recordable), whereas the disc type information 'b7b6' corresponding to '10b' represents a BD-RE.

Also, diverse additional information corresponding to sector information, as used in DVDs, may be repeatedly recorded in the remaining information fields $I_{n,1}$ to $I_{n,15}$ (n = 0, 1, 2, 3) of each data unit, in order to stably read the additional information.

In accordance with a second embodiment of the present invention, diverse additional information required to enable a normal data recording or reproducing operation may also be recorded in an address unit written on the high-density optical disc.

As shown in Fig. 7, an address unit having a size of 16 addresses x 9 bytes (rows) is recorded on the high-density optical

disc. Meanwhile, diverse additional information corresponding to sector information, as used in a DVD and described above in conjunction with Fig. 2, is recorded in a particular 1-byte address field of the address unit, for example, an address field corresponding to a row number of '4' and an address number of 'S', $AF_{4,S}$ (S = 0, 1,..., 15).

As shown in Fig. 8, the additional information recorded in the address field $AF_{4,S}$ may be disc reflectivity information, zone type information, data type information, and disc type information, each of which has a size of 2 bits. Here, the disc reflectivity information and disc type information are the same as those described above.

Where the zone type information corresponds to '00b', it represents that the current position corresponds to a data zone. The zone type information corresponding to '01b' represents an inner zone, whereas the zone type information corresponding to '10b' represents an outer zone. The zone type information is linked to the layer number information recorded in a state of being included in a physical ADIP address.

For example, where the zone type information corresponds to '01b' representing an inner zone under the condition in which the current layer is determined to be the first layer of a dual layer structure, based on the layer number information, the current position corresponds to the lead-in zone of the first layer. On the other hand, where the zone type information corresponds to '01b' representing an inner zone under the condition in which the current layer is determined to be the second layer of a dual layer structure, the current position corresponds to the lead-out zone of the second layer.

Meanwhile, where the data type information corresponds to '00b', it represents that the associated main A/V data is read-only data. Also, the data type information corresponding to '01b' represents recordable data, whereas the data type

information corresponding to '10b' represents rewritable data.

Also, where the disc type information corresponds to '00b', it represents that the associated optical disc is a BD-ROM. On the other hand, the disc type information corresponding to '01b' represents a BD-R, whereas the disc type information corresponding to '10b' represents a BD-RE.

Meanwhile, layer information of 2 bits representing the current layer may be recorded in place of the data type information, in addition to the layer number information recorded in a state of being included in a physical ADIP address. Where the layer information corresponds to '00b', it represents that the current layer is a first layer Layer 0. Also, the layer information corresponding to '01b' represents a second layer Layer 1, whereas the layer information corresponding to '10b' represents a third layer Layer 2. On the other hand, the layer information corresponding to '11b' represents a fourth layer Layer 3. Alternatively, the layer information may represent the number of layers included in the associated disc.

It is also possible to perform desired control operations when a recording or reproducing operation is carried out, using the additional information according to the present invention in a state of being linked to the layer information. For example, although the layers of a high-density optical disc may be different from one another in terms of tracking control method, disc reflectivity, and data type, it is possible to carry out a stable recording or reproducing operation by performing a control operation by the unit of layers, based on the additional information.

When a BD-RE or BD-ROM according to the first embodiment of the present invention is loaded in an optical disc apparatus including an optical pickup 11, a VDR (Video Disc Recording) system 12, and an encoder 13, as shown in Fig. 10, the optical disc apparatus preferentially accesses the BCA of the optical disc,

and reads the reflectivity information recorded in the first information field of each data unit, thereby performing OPC and AGC operations. Also, the optical disc apparatus reads the layer information and disc type information recorded in the first information field of each data unit, so that it carries out a normal data recording or reproducing operation, based on the read information.

On the other hand, when a BD-RE or BD-ROM according to the second embodiment of the present invention is loaded in the optical disc apparatus, the optical disc apparatus reads the reflectivity information, zone type information, data type information and disc type information recorded in the address unit of the optical disc while performing a data recording or reproducing operation thereof, so that it normally carries out the data recording or reproducing operation, based on the read information.

Alternatively, the additional information according to the present invention may be recorded in a state of being included in file system data or navigation data recorded at the leading position of the data area on an optical disc. Where this method is combined with the method according to the first or second embodiment of the present invention, so as to record the additional information in both the leading position of the data area and the BCA or address unit, it is possible to perform a desired control operation using the information before and/or during the data recording or reproducing operation.

As apparent from the above description, the present invention provides a high-density optical disc and a recording/reproducing method thereof which enable optimal optical power control and automatic gain control or identification of a current position, while enabling a normal data recording or reproducing operation corresponding to the type of the optical disc.

Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

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THE CLAIMS AS DEFINED IN THE INVENTION ARE AS FOLLOWS:

1. A high-density recording medium, comprising:

a lead-in area including control information required to record or reproduce data on or from the recording medium; and

a burst cutting area located inwardly from the lead-in area, the burst cutting area including a plurality of data units;

wherein additional information is included in at least one data unit, the additional information including at least medium type information.

2. The high-density recording medium according to claim 1, wherein the medium type information indicates that the recording medium is a writable medium or read-only medium.

3. The high-density recording medium according to claim 1, wherein each data unit is preceded by synch information.

4. The high-density recording medium according to claim 3, wherein the additional information is recorded in a first data unit.

5. The high-density recording medium according to claim 1, wherein the additional information is repeatedly recorded in each data unit.

6. The high-density recording medium according to claim 1, wherein the control information in the lead-in area includes the additional information in the burst cutting area.

7. The high-density recording medium according to claim 6, further comprising:

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a lead-out area having the control information.

8. The high-density recording medium according to claim 1, wherein the additional information further includes layer information.

9. The high-density recording medium according to claim 8, wherein the additional information further includes a sequence number to identity one of the data units.

10. The high-density recording medium according to claim 8, wherein the layer information represents the number of layers included in the recording medium.

11. The high-density recording medium according to claim 10, wherein the control information in the lead-in area includes the additional information in the burst cutting area.

12. The high-density recording medium according to claim 9, wherein the additional information further includes an application indicator to indicate a use for a copy protection system.

13. The high-density recording medium according to claim 1, wherein the additional information further includes reflectivity information, the reflectivity information indicating the reflectivity of the recording medium.

14. The high-density recording medium according to claim 13, wherein the reflectivity information is required for optical power control or automatic gain control when a data recording or reproducing operation is carried out.

15. The high-density recording medium according to claim 1, wherein the medium type information represents a medium type of a

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BD-ROM (BD-Read Only Memory), a BD-R (BD-Recordable), or BD-RE (BD- Rewritable).

16. The high-density recording medium according to claim 1, wherein said at least one data unit comprises a plurality of information bytes, the medium type information being included in at least one of the information bytes.

17. The high-density recording medium according to claim 16, wherein the medium type information is included in the first information byte in each data unit.

18. A method for recording or reproducing data on or from a high-density recording medium, comprising the steps of:

identifying information included in at least one data unit of a burst cutting area of the recording medium, the information including at least medium type information; and

controlling a data recording or reproducing operation, based on the identified information.

19. The method according to claim 18, wherein the information further includes layer information to indicate the number of layers included in the recording medium, thereby identifying the number of layers of the recording medium.

20. The method according to claim 18, wherein the burst cutting area includes a plurality of data units, the information being included in at least one of the data units, wherein the identifying step identifies the information by processing the data unit.

21. The method according to claim 20, wherein the information is repeatedly included in each data unit.

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22. The method according to claim 18, wherein the medium type information represents a medium type of a BD-ROM (BD-Read Only Memory), a BD-R (BD-Recordable), or a BD-RE (BD-Rewritable).

23. The method according to claim 18, wherein the information includes reflectivity information of the recording medium for controlling optical power or automatic gain for the data recording or reproducing operation.

24. The method according to claim 18, wherein the identifying step identifies the information preferentially when the recording medium is loaded in a recording or reproducing apparatus.

25. The method according to claim 18, wherein the identifying step identifies the information in an early stage for recording or reproducing data on or from the recording medium.

26. The method according to claim 18, wherein the information includes a sequence number to identify a data unit, thereby identifying the data unit that includes the information.

27. The method according to claim 18, wherein the recording medium further comprises a lead-in area that follows the burst cutting area and includes information equal to the information of the burst cutting area, the method further comprising:

moving an optical pickup to read the information recorded on the burst cutting area, and then identifying the information in the burst cutting area.

28. The method according to claim 18, wherein the identifying step identifies the information in an early stage for recording or reproducing data on or from the recording medium.

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29. The method according to claim 18, wherein the identifying step identifies the information in an early stage of a drive start-up procedure.

30. A method for recording or reproducing data on or from a high-density recording medium, comprising the steps of:

reading information included in a burst cutting area of the recording medium, the burst cutting area being located inwardly from the lead-in area, and including a plurality of data units, the information being included in at least one data unit and including at least medium type information; and

controlling a data recording or reproducing operation, based on the read information.

31. The method according to claim 30, wherein each data unit comprises a plurality of information bytes, the information being included in at least one information byte of the data unit.

32. The method according to claim 30, wherein the information further includes layer information to indicate the number of layers included in the recording medium, thereby identifying the number of layers of the recording medium.

33. The method according to claim 32, further comprising:

processing the read information included in at least one data unit to identify the information.

34. The method according to claim 33, wherein the information is repeatedly included in each data unit, and wherein the processing step processes the read information included in each data unit to identify the information.

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35. The method according to claim 30, wherein the medium type information represents a medium type of a BD-ROM (BD-Read Only Memory), a BD-R (BD-Recordable), or a BD-RE (BD-Rewritable).

36. The method according to claim 30, wherein the information includes reflectivity information of the recording medium for controlling optical power or automatic gain for a recording or reproducing operation.

37. The method according to claim 30, wherein the information includes a sequence number to identify a data unit, thereby identifying the data unit that includes the information.

38. The method according to claim 30, wherein the reading step reads the information preferentially when the recording medium is loaded in a recording or reproducing apparatus.

39. The method according to claim 30, wherein the reading step reads the information in an early stage for recording or reproducing data on or from the recording medium.

40. The method according to claim 30, wherein the reading step reads the information at an early stage of a drive start-up procedure.

41. The method according to claim 30, wherein the lead-in area includes information equal to the information of the burst cutting area, the method further comprising:

moving an optical pickup to firstly read the information recorded on the burst cutting area.

FIG. 1

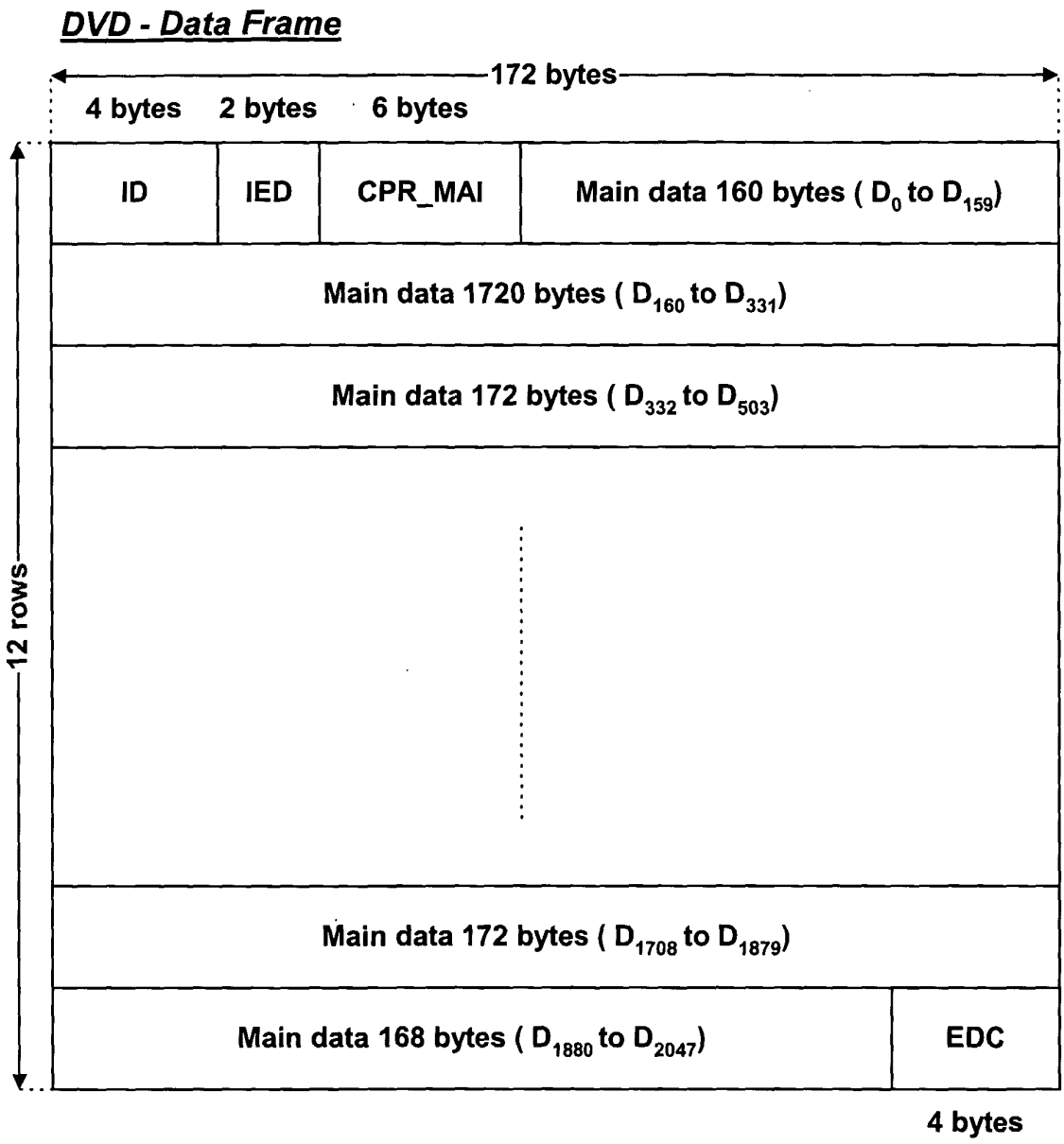

DVD - Data Frame
172 bytes
4 bytes
2 bytes
6 bytes
ID
IED
CPR_MAI
Main data 160 bytes (D0 to D159)
Main data 1720 bytes (D160 to D331)
Main data 172 bytes (D332 to D503)
Main data 172 bytes (D1708 to D1879)
Main data 168 bytes (D1880 to D2047)
EDC
12 rows
4 bytes

FIG. 2

DVD - Data Frame

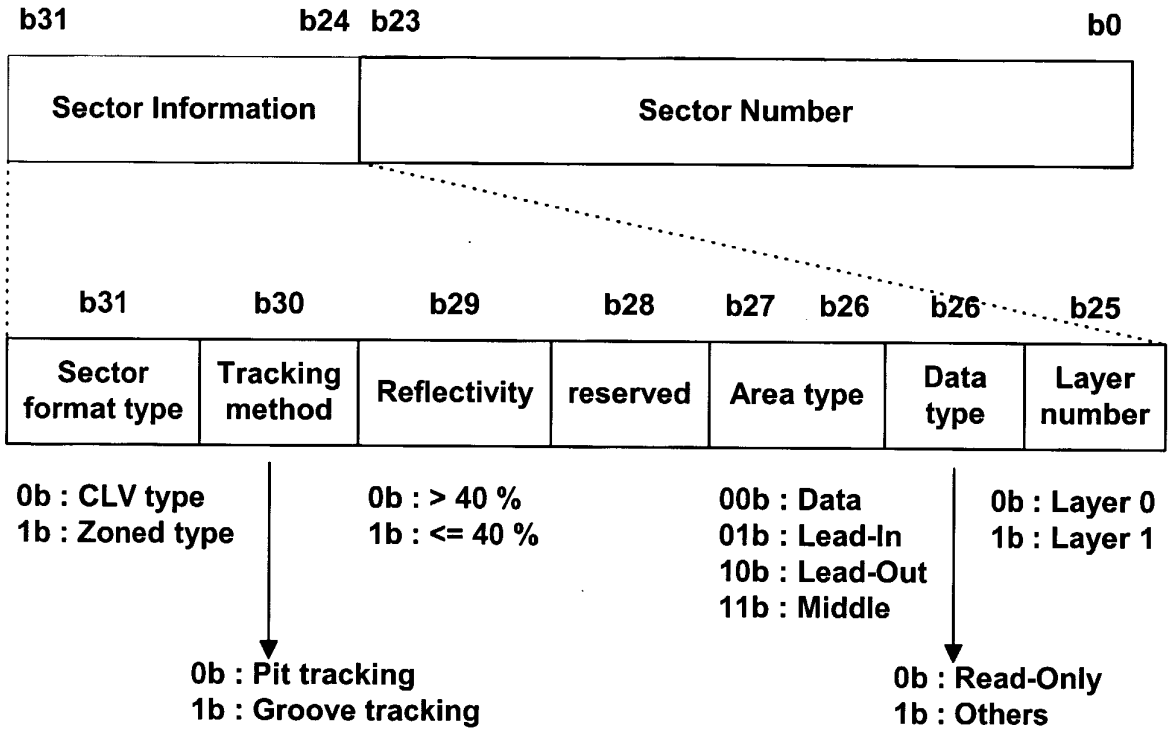


FIG. 3

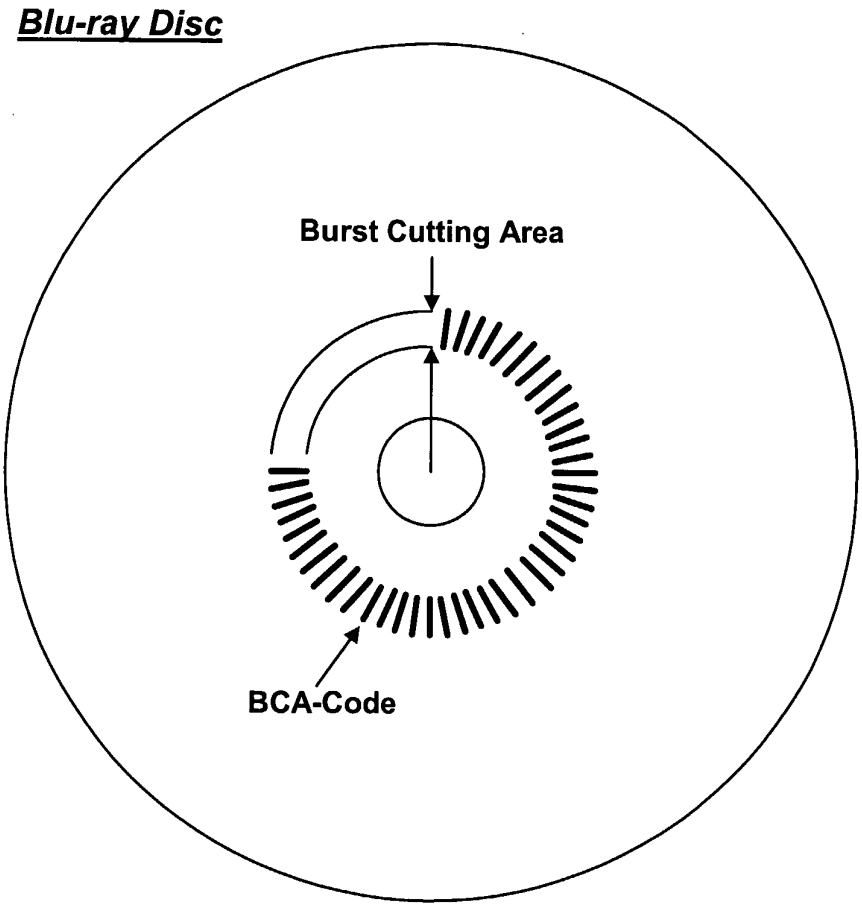


FIG. 4

Data structure of BCA-code

←1Bytes→	←4Bytes→				
$SB_{3,3}$	BCA pre-amble (all 00h)				1 row
$SB_{0,0}$	$I_{0,0}$	$I_{1,0}$	$I_{2,0}$	$I_{3,0}$	4 rows data
$SB_{0,0}$	$I_{4,0}$	$I_{5,0}$	$I_{6,0}$	$I_{7,0}$	
$SB_{0,0}$	$I_{8,0}$	$I_{9,0}$	$I_{10,0}$	$I_{11,0}$	
$SB_{0,0}$	$I_{12,0}$	$I_{13,0}$	$I_{14,0}$	$I_{15,0}$	1 data unit
$SB_{0,1}$	$C_{0,0}$	$C_{1,0}$	$C_{2,0}$	$C_{3,0}$	4 rows parity
$SB_{0,1}$	$C_{4,0}$	$C_{5,0}$	$C_{6,0}$	$C_{7,0}$	
$SB_{0,1}$	$C_{8,0}$	$C_{9,0}$	$C_{10,0}$	$C_{11,0}$	
$SB_{0,1}$	$C_{12,0}$	$C_{13,0}$	$C_{14,0}$	$C_{15,0}$	
$SB_{0,2}$	$I_{0,1}$	$I_{1,1}$	$I_{2,1}$	$I_{3,1}$	4 rows data
$SB_{0,2}$	$I_{4,1}$	$I_{5,1}$	$I_{6,1}$	$I_{7,1}$	
$SB_{0,2}$	$I_{8,1}$	$I_{9,1}$	$I_{10,1}$	$I_{11,1}$	
$SB_{0,2}$	$I_{12,1}$	$I_{13,1}$	$I_{14,1}$	$I_{15,1}$	1 data unit
$SB_{0,3}$	$C_{0,1}$	$C_{1,1}$	$C_{2,1}$	$C_{3,1}$	4 rows parity
$SB_{0,3}$	$C_{4,1}$	$C_{5,1}$	$C_{6,1}$	$C_{7,1}$	
$SB_{0,3}$	$C_{8,1}$	$C_{9,1}$	$C_{10,1}$	$C_{11,1}$	
$SB_{0,3}$	$C_{12,1}$	$C_{13,1}$	$C_{14,1}$	$C_{15,1}$	
$SB_{0,4}$	$I_{0,2}$	$I_{1,2}$	$I_{2,2}$	$I_{3,2}$	4 rows data
$SB_{0,4}$	$I_{4,2}$	$I_{5,2}$	$I_{6,2}$	$I_{7,2}$	
$SB_{0,4}$	$I_{8,2}$	$I_{9,2}$	$I_{10,2}$	$I_{11,2}$	
$SB_{0,4}$	$I_{12,2}$	$I_{13,2}$	$I_{14,2}$	$I_{15,2}$	1 data unit
$SB_{0,5}$	$C_{0,2}$	$C_{1,2}$	$C_{2,2}$	$C_{3,2}$	4 rows parity
$SB_{0,5}$	$C_{4,2}$	$C_{5,2}$	$C_{6,2}$	$C_{7,2}$	
$SB_{0,5}$	$C_{8,2}$	$C_{9,2}$	$C_{10,2}$	$C_{11,2}$	
$SB_{0,5}$	$C_{12,2}$	$C_{13,2}$	$C_{14,2}$	$C_{15,2}$	
$SB_{0,6}$	$I_{0,3}$	$I_{1,3}$	$I_{2,3}$	$I_{3,3}$	4 rows data
$SB_{0,6}$	$I_{4,3}$	$I_{5,3}$	$I_{6,3}$	$I_{7,3}$	
$SB_{0,6}$	$I_{8,3}$	$I_{9,3}$	$I_{10,3}$	$I_{11,3}$	
$SB_{0,6}$	$I_{12,3}$	$I_{13,3}$	$I_{14,3}$	$I_{15,3}$	1 data unit
$SB_{0,7}$	$C_{0,3}$	$C_{1,3}$	$C_{2,3}$	$C_{3,3}$	4 rows parity
$SB_{0,7}$	$C_{4,3}$	$C_{5,3}$	$C_{6,3}$	$C_{7,3}$	
$SB_{0,7}$	$C_{8,3}$	$C_{9,3}$	$C_{10,3}$	$C_{11,3}$	
$SB_{0,7}$	$C_{12,3}$	$C_{13,3}$	$C_{14,3}$	$C_{15,3}$	

FIG. 5

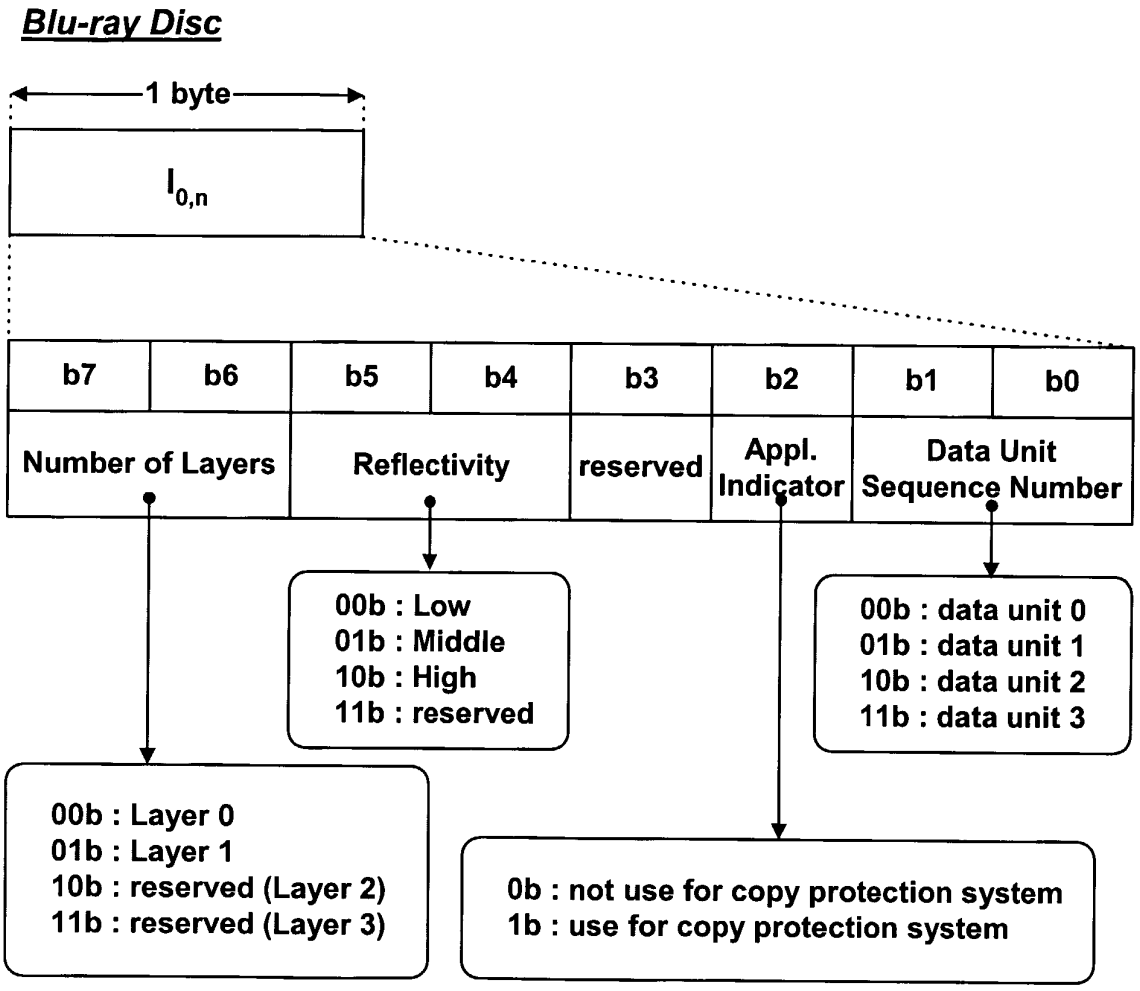

Blu-ray Disc
1 byte
$I_{0,n}$
b7
b6
b5
b4
b3
b2
b1
b0
Number of Layers
Reflectivity
reserved
Appl. Indicator
Data Unit Sequence Number
00b : Low
01b : Middle
10b : High
11b : reserved
00b : data unit 0
01b : data unit 1
10b : data unit 2
11b : data unit 3
00b : Layer 0
01b : Layer 1
10b : reserved (Layer 2)
11b : reserved (Layer 3)
0b : not use for copy protection system
1b : use for copy protection system

FIG. 6

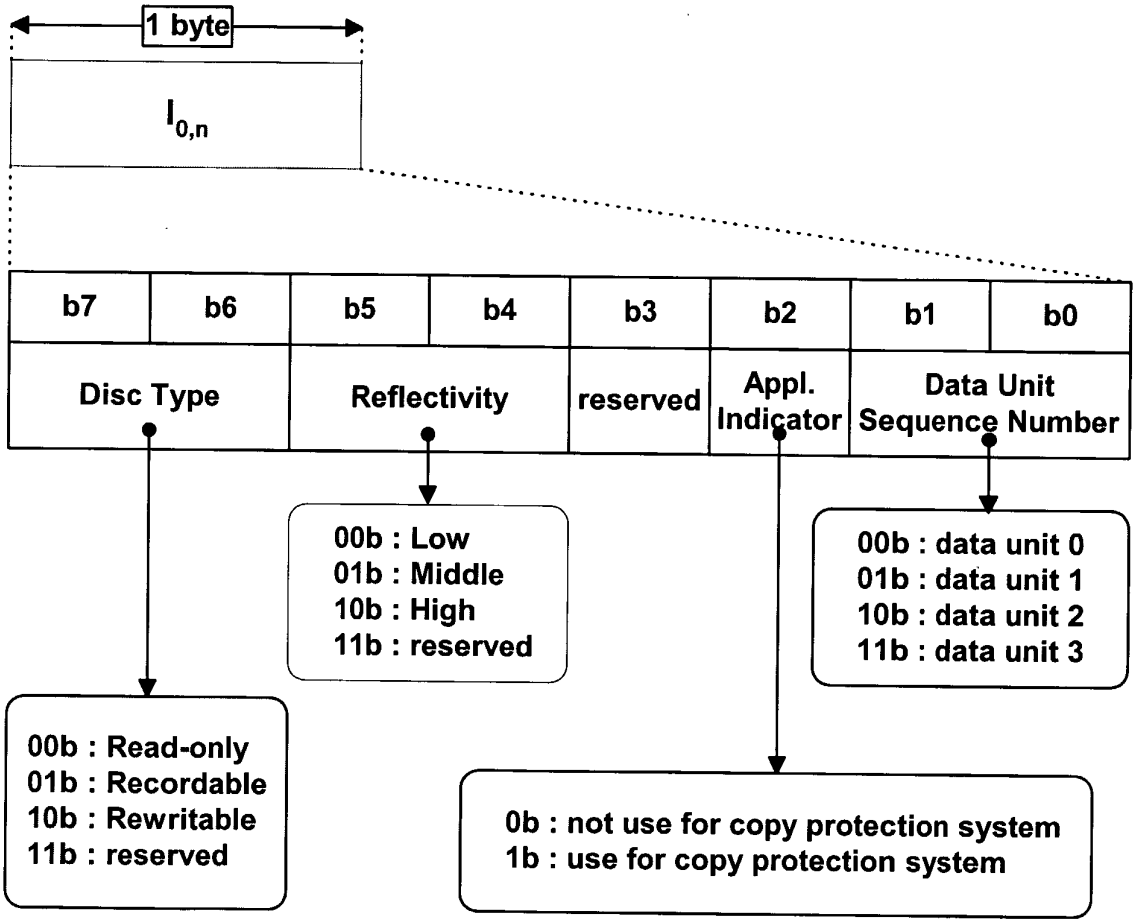

1 byte
$I_{0,n}$
b7
b6
b5
b4
b3
b2
b1
b0
Disc Type
Reflectivity
reserved
Appl. Indicator
Data Unit Sequence Number
00b : Low
01b : Middle
10b : High
11b : reserved
00b : data unit 0
01b : data unit 1
10b : data unit 2
11b : data unit 3
00b : Read-only
01b : Recordable
10b : Rewritable
11b : reserved
0b : not use for copy protection system
1b : use for copy protection system

FIG. 7

BD - Address Unit

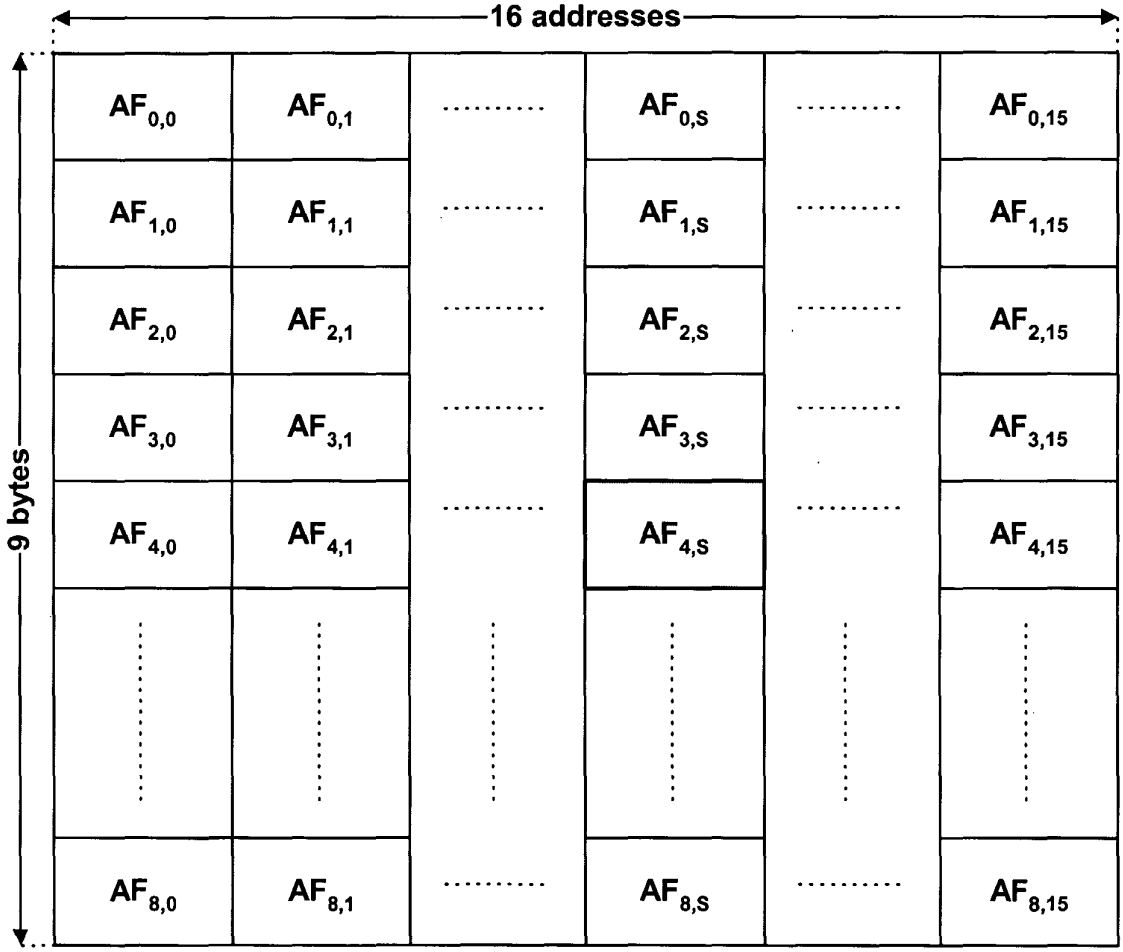


FIG. 8

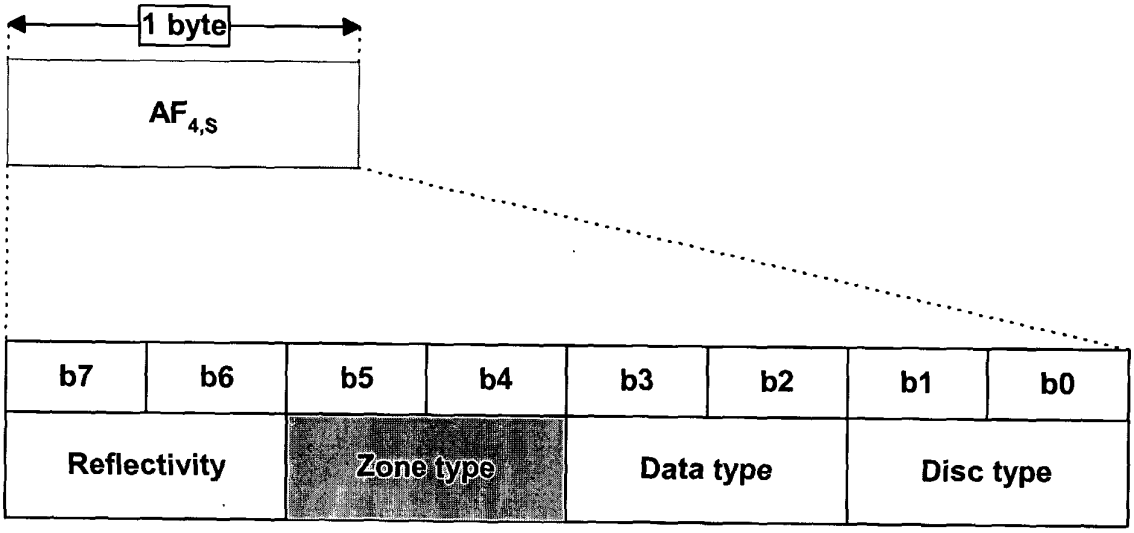

1 byte
$AF_{4,S}$
b7
b6
b5
b4
b3
b2
b1
b0
Reflectivity
Zone type
Data type
Disc type
00b : Low
01b : Middle
10b : High
11b : Reserved
00b : Data zone
01b : Inner zone
10b : Outer zone
11b : Reserved
00b : Read-only
01b : Recordable
10b : Rewritable
11b : Reserved
00b : Read-only
01b : Recordable
10b : Rewritable
11b : Reserved

FIG. 9

Physical ADIP Address

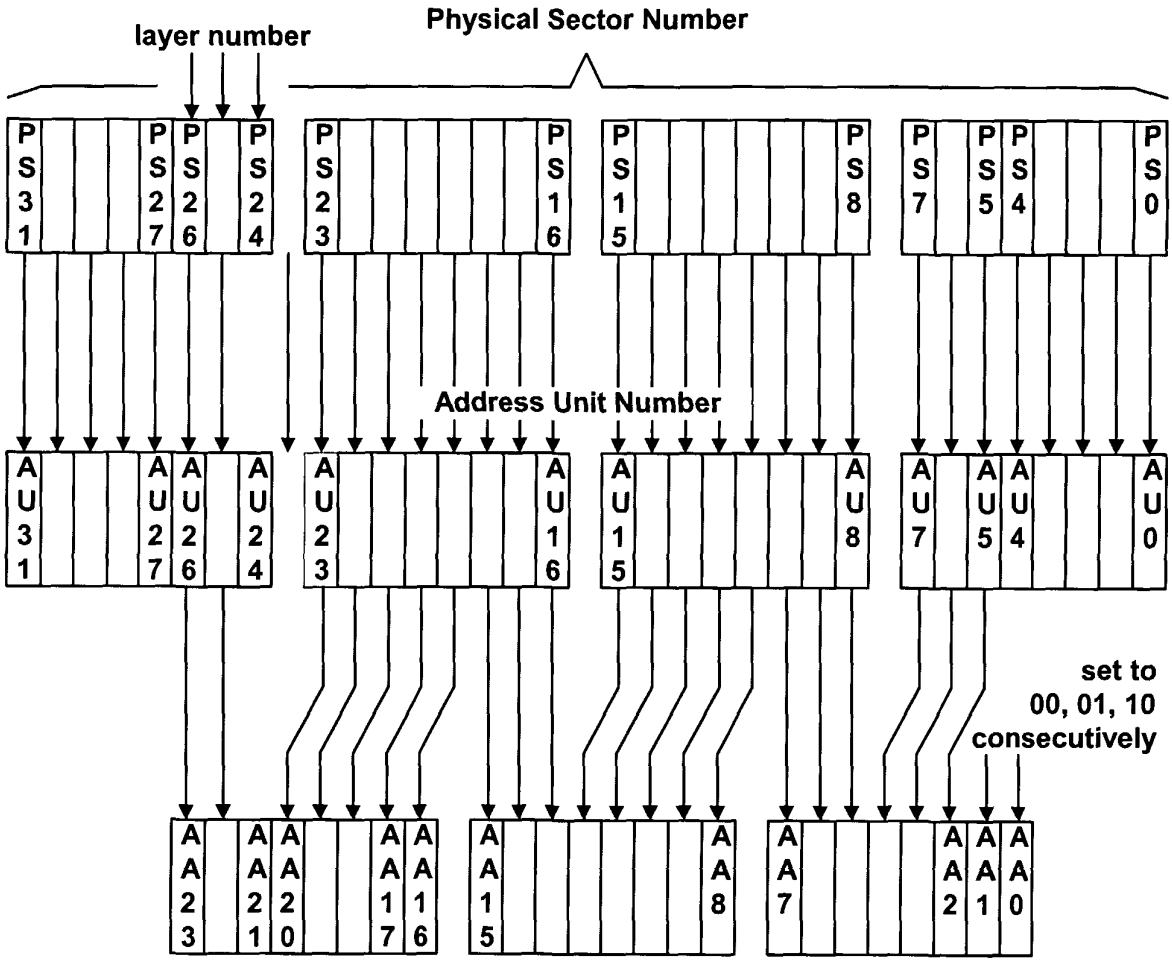
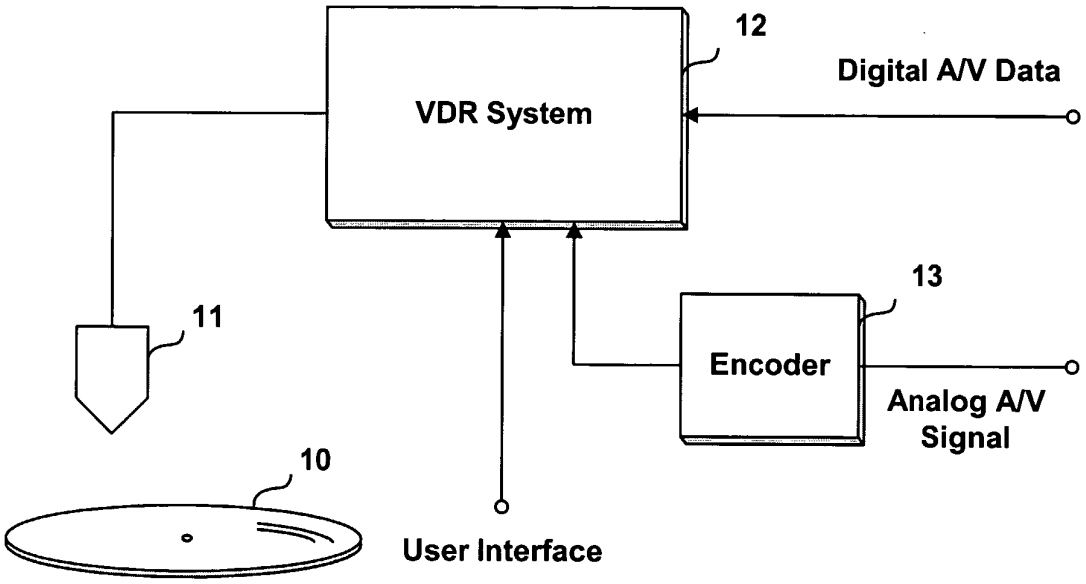


FIG. 10


12
Digital A/V Data
VDR System
13
11
Encoder
Analog A/V
Signal
10
User Interface