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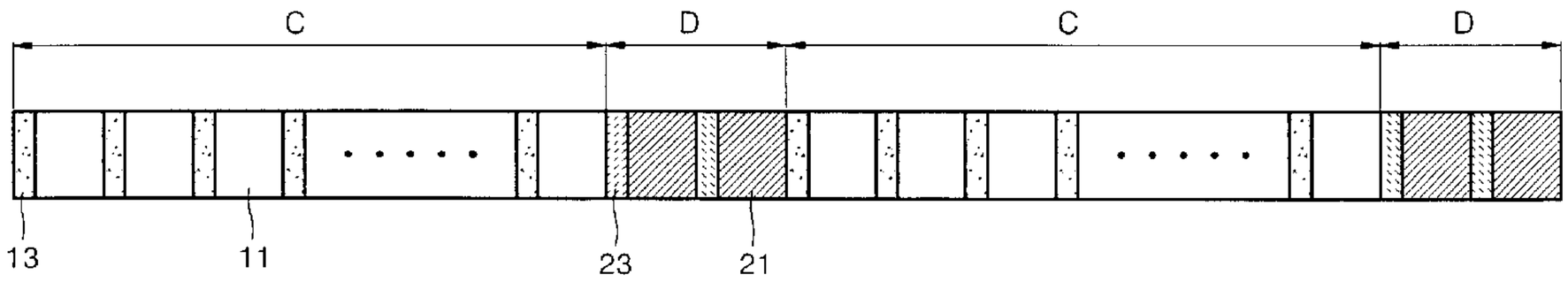
(54) Title: INFORMATION STORAGE MEDIUM AND METHOD OF RECORDING/REPRODUCING THE SAME



(57) Abrégé/Abstract:
An information storage medium has user data areas and additional data areas, and sync patterns to distinguish the additional data areas from the user data areas. The information storage medium includes a user data area in which user data is recorded and an additional data area located in at least one of areas before and after the user data area. Second sync patterns used in the additional data area are different from first sync patterns used in the user data area.

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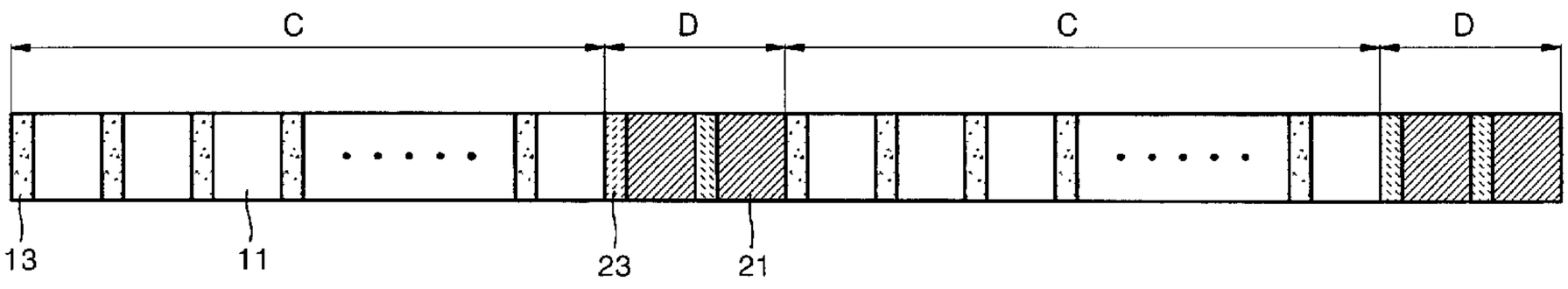
(54) Title: INFORMATION STORAGE MEDIUM AND METHOD OF RECORDING/REPRODUCING THE SAME



(57) Abstract: An information storage medium has user data areas and additional data areas, and sync patterns to distinguish the additional data areas from the user data areas. The information storage medium includes a user data area in which user data is recorded and an additional data area located in at least one of areas before and after the user data area. Second sync patterns used in the additional data area are different from first sync patterns used in the user data area.

INFORMATION STORAGE MEDIUM AND METHOD OF RECORDING/REPRODUCING THE SAME

Technical Field

The present invention relates to an information storage medium having user data areas and additional data areas and a method of reproducing information recorded on the information storage medium, and more particularly, to an information storage medium having an improved structure in which user data areas are distinguished from additional data areas and a method of recording information thereon and/or reproducing information from the information storage medium.

Background Art

Optical discs are generally used as information storage media of optical pickup devices which record information on and/or reproduce information from the optical discs without contacting the optical discs. Optical discs are classified as either compact discs (CDs) or digital versatile discs (DVDs) according to their information recording capacity. Optical discs can also be classified as either recordable discs or read-only discs according to their recording potential. Here, the recordable discs include 650MB CD-Rs, CD-RWs, 4.7GB DVD+R/RWs, DVD-random access memories (DVD-RAMs), DVD-R/rewritables (DVD-R/RWs), and so forth. The read-only discs include 650MB CDs, 4.7GB DVD-ROMs, and the like.

FIG. 1 illustrates the data structure of a recordable information storage medium such as a CD-R or a CD-RW. Referring to FIG. 1, the recordable information storage medium includes user data areas A and additional data areas B located before and after the user data areas A. Here, the user data areas A are physical clusters in which data is recorded. The additional data areas B are divided into run-in areas and run-out areas.

The additional data areas B serve as spare areas in which data can be recorded even when a recording position of the information storage medium is changed with a variation in the speed of a spindle motor during rotating of the information storage medium on a turntable.

In a case where a read-only information storage medium is manufactured according to the above-described format, the read-only information storage medium is required to have the same structure as the recordable information storage medium so as to have reproduction compatibility in a drive and a format consistent with the recordable information storage medium. In other words, the read-only information storage medium has a structure including user data areas A and additional data areas B. Here, the additional data areas B are located before and after the user data areas A and must have the same length as the run-in areas and the run-out areas described with reference to FIG. 1. In this case, the additional data areas B have to be separated from the user data areas A.

Disclosure of the Invention

Additional aspects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

The present invention provides an information storage medium having user data areas and additional data areas, and sync patterns to distinguish the additional data areas from the user data areas, and a method of recording information on and/or reproducing information from the same.

According to an aspect of the present invention, an information storage medium includes a user data area in which user data is recorded and an additional data area located in at least one of areas before and after the user data area, where second sync patterns used in the additional data area are different from first sync patterns used in the user data area.

According to another aspect of the present invention, a method of recording information on and/or reproducing information from an information storage medium includes preparing user data area in which user data is recorded and an additional data area located in at least one of areas before and after the user data area, where second sync patterns used in the additional data area are formed differently from first sync patterns used in the user data area.

Brief Description of the Drawings

FIG. 1 illustrates the data structure of a conventional recordable information storage medium such as a CD-R or a CD-RW.

FIG. 2 illustrates the data structure of a recording unit of an information storage medium according to an embodiment of the present invention.

FIG. 3 illustrates the data structure of the information storage medium.

FIG. 4 is a block diagram of a recording and/or reproducing apparatus according to an embodiment of the present invention.

Best mode for carrying out the Invention

Reference will now be made in detail to the present embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

Referring to FIGs. 2 and 3, an information storage medium according to an embodiment of the present invention includes user data areas C in which user data is recorded and additional data areas D located before and/or after the user data areas C. The information storage medium may be a recordable information storage medium or a read-only information storage medium.

Each of the user data areas C contains a plurality of user data 11 separated by a plurality of first sync patterns 13. According to an aspect

of the invention, the user data areas C include error correcting code (ECC) recording units.

Each of the additional data areas D contains a plurality of additional data 21 separated by a plurality of second sync patterns 23. Here, as will be explained later, the first sync patterns 13 have modulation codes corresponding to sync numbers shown in Tables 1 and 2 and are formed by combining predetermined selected sync numbers. The second sync patterns 23 are formed of predetermined type of patterns denoted by reference numerals 23a and 23b according to the same method as the plurality of first sync patterns 13.

According to an aspect of the invention, the second sync patterns 23 are different from the first sync patterns 13. In other words, the second sync patterns 23 are formed of patterns which are not used as the first sync patterns 13. By forming the second sync patterns 23 to be different from the first sync patterns 13, a reproducing system such as that shown in FIG. 4 can manage the additional data areas D by being able to differentiate the additional data areas D, with certainty, from the user data areas C.

The number of second sync patterns 23 depends on the length of the additional data areas D. It is preferable, but not required, that the second sync patterns 23 are arranged at equal intervals in order to increase an effective additional data efficiency of the additional data areas D. In addition, sync data can be easily restored during reproducing.

While not required, according to an aspect of the invention, the size of each of the plurality of user data 11 in the user data areas C is equal to a size of each of the plurality of additional data 21 in the additional data areas D. This structure can be realized by adjusting the positions of the second sync patterns 23.

It is preferable, but not required, that the entire size of additional data 21 in the additional data areas D be integer multiples of the size d_1 of user data 11 recorded between two adjacent first sync patterns 13a and 13b. In other words, referring to FIG. 2, the size d_2 of additional data 21 recorded between two adjacent second sync patterns 23a and 23b is

equal to the size d_1 of the user data 11 recorded between first sync patterns 13a, 13b, and the additional data 21 are recorded in two parts of each of the additional data areas D. Thus, the total size of the additional data 21 is an integer multiple of (i.e., is twice the size of) the size d_1 of the user data 11. As a result, since sync signals are detected at regular intervals in all areas during reproducing of data, it is advantageous to restore the sync signals.

The structure of the information storage medium using a run-length-limited (RLL) (d, k) code will be described below. The RLL code indicates how many bits of value “0” exist between two bits of value “1”. Thus, the RLL (d, k) code represents that the minimum number d and the maximum number k of bits of value “0” between two bits of value “1”, respectively.

In the structure using the RLL (d, K) code, the first sync patterns 13 generally include sync bodies that do not satisfy the RLL (d, k) code and sync identifications (IDs) that satisfy the RLL (d, k) code. In other words, the sync bodies have a run length k + i when i is an integer that is greater than or equal to “1”. The sync IDs contain different patterns to distinguish N different sync patterns.

The second sync patterns 23 include sync bodies that do not satisfy the RLL (d, k) code and sync IDs that satisfy the RLL (d, k) code. Here, the sync IDs contain different patterns to distinguish N different sync patterns.

FIG. 3 illustrates an embodiment of the data structure of an information storage medium including additional data areas D each having two additional data frames. Sync bodies and sync IDs of the information storage medium having the above data structure are shown in Tables 1 and 2 below.

As can be seen in Table 1, a RLL (1,7) code is used. Each sync body has 18 bits, and each sync ID has 6 bits. The user data area C includes 9 user data frames for sync data, and the additional data area D includes two user data frames for sync data.

Table 1

Sync No.	18-Bit Sync Body	6-Bit Sync ID	Remark
0	001 001 010 000 000 010	000 001	User Data Area Sync Data
1	001 001 010 000 000 010	010 010	
2	001 001 010 000 000 010	101 000	
3	001 001 010 000 000 010	100 001	
4	001 001 010 000 000 010	000 100	
5	001 001 010 000 000 010	001 001	
6	001 001 010 000 000 010	010 101	
7	001 001 010 000 000 010	010 000	
8	001 001 010 000 000 010	101 010	
9	001 001 010 000 000 010	100 101	Additional Data Area Sync Data
10	001 001 010 000 000 010	101 001	

As can be seen in Table 2, a RLL (2,10) code is used. Each sync body has 22 bits, and each sync ID has 10 bits. The user data area C includes 7 user data frames for sync data, and the additional data area D includes 2 user data frames for sync data.

Table 2

Sync No.	22-Bit Sync Body	10-Bit Sync ID	Remark
0	100 001 000 000 000 000 010 0	010 001 000 1	User Data Area Sync Data
1	100 001 000 000 000 000 010 0	000 100 100 1	
2	100 001 000 000 000 000 010 0	010 000 010 0	
3	100 001 000 000 000 000 010 0	001 000 000 0	
4	100 001 000 000 000 000 010 0	100 100 100 0	
5	100 001 000 000 000 000 010 0	010 000 100 0	
6	100 001 000 000 000 000 010 0	000 010 000 0	
7	100 001 000 000 000 000 010 0	010 001 000 1	

8	100 001 000 000 000 000 010 0	010 010 010 0	Additional Data Area Sync Data

As shown in Tables 1 and 2, the sync data in the additional data D area has different patterns as compared to the sync data in the user data area C. In other words, the sync IDs of the second sync patterns 23 have sync patterns not used as the first sync patterns 13. Therefore, the additional data areas D can be managed and can be distinctly differentiated from the user data areas C.

A method of recording information on and/or reproducing information from the information storage medium having the above-described structure will be described. As shown in FIG. 2, the user data areas C including basic ECC recording blocks and the additional data areas D located before and/or after the user data areas C are prepared in the information storage medium. Next, the second sync patterns 23 used in the additional data areas D are formed differently from the first sync patterns 13 used in the user data areas C.

Here, the second sync patterns 23 are plural and arranged at equal intervals. It is preferable, but not required, that the second sync patterns 23 are arranged in the additional data areas D so that the size of each of user data 11 in the user data areas C is equal to the size of each of additional data 21 in the additional data areas D.

Sync data in the additional data areas D contains sync bodies having second sync patterns that do not comply with the RLL (d, k) code and sync IDs having second sync patterns that comply with the RLL (d, k) code. The total size of additional data 21 in the additional data areas D is an integer multiple of the size of user data 11 recorded between two first sync patterns 13a and 13 b.

While not specifically so limited, it is understood that the information storage medium can include the CD-Rs, CD-RWs, DVD-RWs, DVD-RAMs, DVD+RWs, as well as next generation high definition DVDs,

such as Blu-ray discs, Advanced Optical Discs (AODs) and other optical storage media not listed above and/or to be developed.

FIG. 4 is a block diagram of a recording and/or reproducing apparatus according to an embodiment of the present invention. Referring to FIG. 4, the recording and/or reproducing apparatus includes a recording/reading unit 1001, a controller 1002, and a memory 1003. The recording/reading unit 1001 records data on a disc 1000, which is an embodiment of an information storage medium of the present invention, and reads the data from the disc 1000. The controller 1002 records and reproduces the user data 11 and the additional data 21 according to the present invention as set forth above in relation to FIGs. 2 and 3.

While not required in all aspects, it is understood that the controller 1002 can be a computer implementing the method using a computer program encoded on a computer readable medium. The computer can be implemented as a chip having firmware, or can be a general or special purpose computer programmable to perform the method.

In addition, it is understood that, in order to achieve a recording capacity of several dozen gigabytes, the recording/reading unit 1001 could include a low wavelength, high numerical aperture type unit usable to record dozens of gigabytes of data on the disc 1000. Examples of such units include, but are not limited to, those units using light wavelengths of 405 nm and having numerical apertures of 0.85, those units compatible with Blu-ray discs, and/or those units compatible with Advanced Optical Discs (AOD).

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

Industrial Applicability

As described above, an information storage medium and a method of recording information thereon and/or reproducing information therefrom according to the present invention can maintain consistency with the formats of different types of recordable information storage media and have reproduction compatibility in a drive.

Also, since sync patterns used in user data areas can be formed differently from sync patterns used in additional data areas, the additional data areas can be further efficiently separated from the user data areas.

Furthermore, by uniformly maintaining the length of data recorded in the user data areas and the additional data areas, sync signals can be detected at regular intervals in all areas during reproducing of data. Thus, it is advantageous to restore the sync signals.

What is claimed is:

1. An information storage medium for use with a recording and/or reproducing apparatus comprising:

a user data area in which user data is recorded and having first sync patterns; and

an additional data area located in at least one of areas before and after the user data area and having second sync patterns,

wherein the second sync patterns are different from first sync patterns such that the recording and/or reproducing apparatus distinguishes between the user area and the additional data area according to the first and second sync patterns.

2. The information storage medium of claim 1, wherein at least one of the first and second sync patterns are disposed in plural locations, and the one sync patterns are arranged such that adjacent pairs of the one sync patterns are separated by equal intervals.

3. The information storage medium of claim 2, wherein the second sync patterns are arranged in locations in the additional data area so that a size of each of the user data recorded in the user data area is equal to a size of each of the additional data recorded in the additional data area.

4. The information storage medium of claim 3, wherein the additional data area further comprises sync data that comprise:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

5. The information storage medium of claim 3, wherein the user data area comprises a plurality of the first sync patterns, and a total

size of the additional data recorded in the additional data area is an integer multiple of a size of the user data recorded between an adjacent pair of the first sync patterns.

6. The information storage medium of claim 2, wherein the user data area comprises a plurality of the first sync patterns, and a total size of the additional data recorded in the additional data area is an integer multiple of a size of the user data recorded between an adjacent pair of the first sync patterns.

7. The information storage medium of claim 6, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

8. The information storage medium of claim 2, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

9. The information storage medium of claim 1, wherein the second sync patterns are arranged in the additional data area so that a size of each of the user data recorded in the user data area is equal to a size of each of the additional data recorded in the additional data area.

10. The information storage medium of claim 1, wherein the user data area comprises a plurality of the first sync patterns, and a total

size of the additional data recorded in the additional data area is an integer multiple of a size of the user data recorded between two adjacent first sync patterns.

11. The information storage medium of claim 1, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

12. A method of recording information on and/or reproducing information from an information storage medium, the method comprising:

preparing a user data area in which user data is recorded and which has first sync patterns and an additional data area located in at least one of areas before and after the user data area; and

forming second sync patterns used in the additional data area which are different from the first sync patterns used in the user data area.

13. The method of claim 12, wherein one of the first and second the sync patterns are plural and arranged at equal intervals.

14. The method of claim 13, wherein the second sync patterns are arranged in the additional data area so that a size of each of the user data recorded in the user data area is equal to a size of each of the additional data recorded in the additional data area.

15. The method of claim 14, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

16. The method of claim 15, wherein the user data area comprises a plurality of the first sync patterns, and a total size of the additional data recorded in the additional data area is an integer multiple of a size of user data recorded between an adjacent pair of the first sync patterns.

17. The method of claim 13, wherein the user data area comprises a plurality of the first sync patterns, and a total size of the additional data recorded in the additional data area is an integer multiple of a size of the user data recorded between an adjacent pair of the first sync patterns.

18. The method of claim 17, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

19. The method of claim 13, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

20. The method of claim 12, wherein the second sync patterns are arranged in the additional data area so that a size of each of the user

data recorded in the user data area is equal to a size of each of the additional data recorded in the additional data area.

21. The method of claim 12, wherein the user data area comprises a plurality of the first sync patterns, and a total size of additional data recorded in the additional data area is an integer multiple of a size of the user data recorded between an adjacent pair of the first sync patterns.

22. The method of claim 12, wherein the additional data area further comprises sync data which comprises:

sync bodies including the second sync patterns that do not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

sync identifications including the second sync patterns that satisfy the RLL (d, k) code.

23. An information storage medium for use with a recording and/or reproducing apparatus comprising:

a user data area in which user data is recorded and having a first sync pattern; and

an additional data area located adjacent the user data area and having a second sync pattern,

wherein the second sync pattern is other than the first second pattern such that the recording and/or reproducing apparatus distinguishes between the user area and the additional data area according to the first and second sync patterns.

24. The information storage medium of claim 23, wherein:

the first sync pattern is disposed in a first location and a second location of the user data area so as to define a first size of the user data,

the second sync pattern is disposed in a first location and a second location of the additional data area so as to define a second size of the additional data, and

the first size is equal to the second size.

25. The information storage medium of claim 23, further comprising another user data area having the first sync pattern, the additional data area being disposed between the user data area and the another user data area.

26. The information storage medium of claim 23, wherein the user data area comprises error correcting code (ECC) recording units.

27. A recording and/or reproducing apparatus for use with an information storage medium, comprising:

a recording and/or reproducing unit to optically transfer data including user data and/or additional data between the apparatus and the information storage medium; and

a controller to control the recording and/or reproducing unit to determine a user data area of the information storage medium according to a first sync pattern recorded on the information storage medium, to determine an additional information area of the information storage medium according to a second sync pattern other than the first sync pattern recorded on the information storage medium, to transfer the user data with respect to the determined user data area, and to transfer the additional data with respect to the determined additional information area.

28. The recording and/or reproducing apparatus of claim 27, wherein:

the first sync pattern is disposed in a first location and a second location of the user data area so as to define a first size of the user data,

the second sync pattern is disposed in a first location and a second location of the additional data area so as to define a second size of the additional data,

wherein the first size is equal to the second size.

29. The recording and/or reproducing apparatus of claim 27, wherein the controller further determines another user data area having the first sync pattern such that the additional data area being disposed between the user data area and the another user data area, and transfers the user data with respect to the another user data area.

30. The recording and/or reproducing apparatus of claim 27, wherein the controller further detects in the first sync pattern:

a sync body including the first sync pattern that does not satisfy a run-length limited (RLL) (d, k) code having a minimum constraint of d and a maximum constraint of k; and

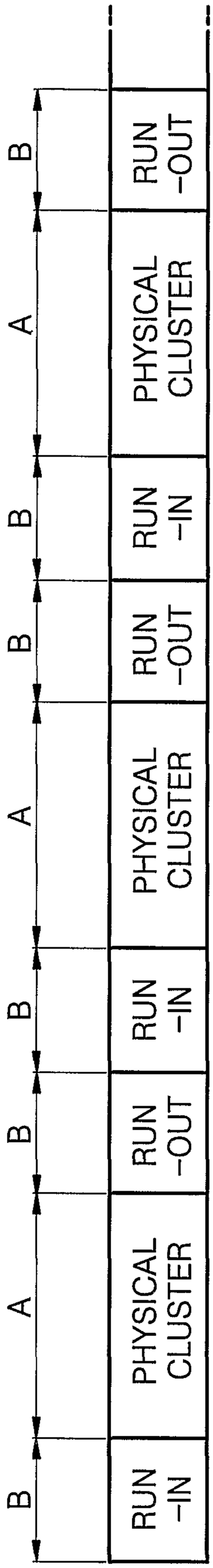
a sync identification including the first sync pattern that satisfies the RLL (d, k) code.

31. The recording and/or reproducing apparatus of claim 30, wherein the controller further detects in the second sync pattern:

a second sync body including the second sync pattern that does not satisfy the RLL (d, k) code; and

a second sync identification including the second sync pattern that satisfies the RLL (d, k) code.

FIG. 1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RUN -OUT
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PHYSICAL CLUSTER
B
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FIG. 2

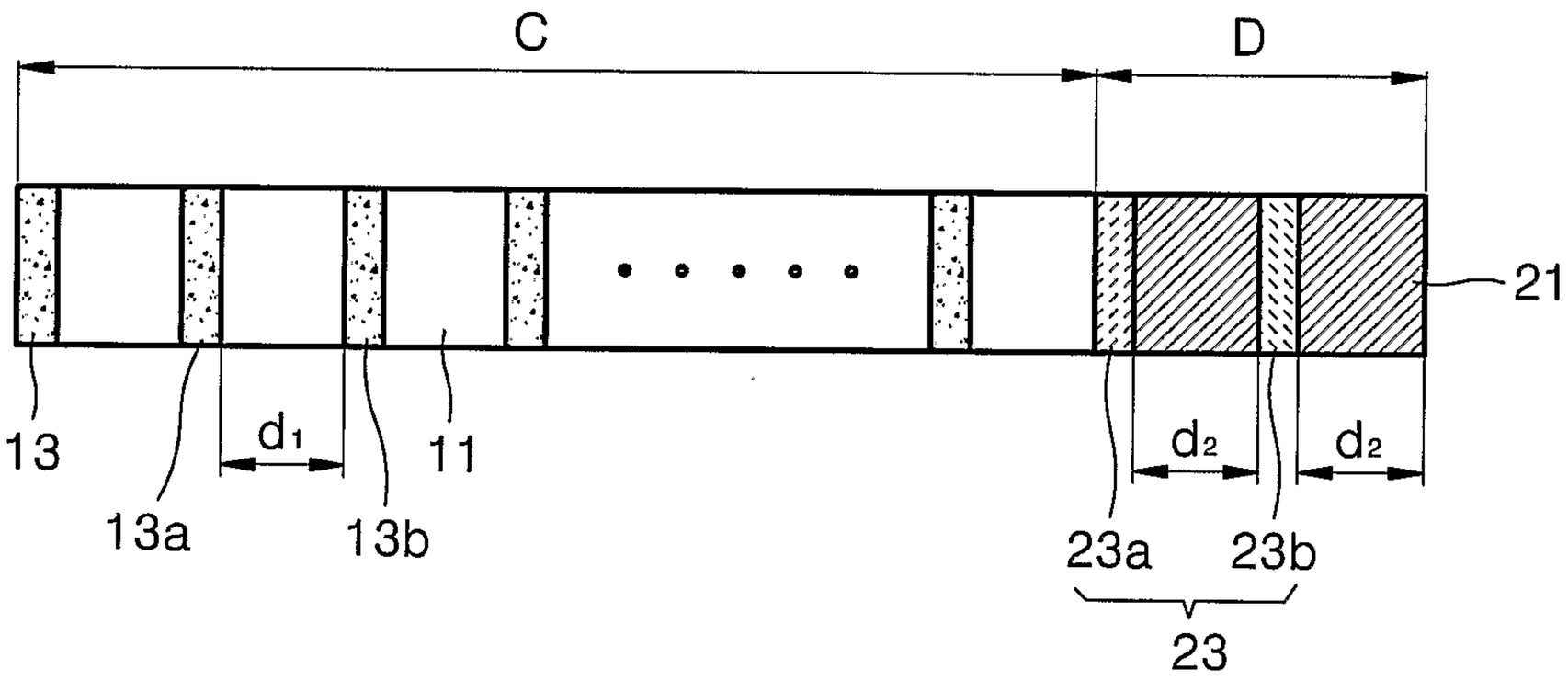


FIG. 3

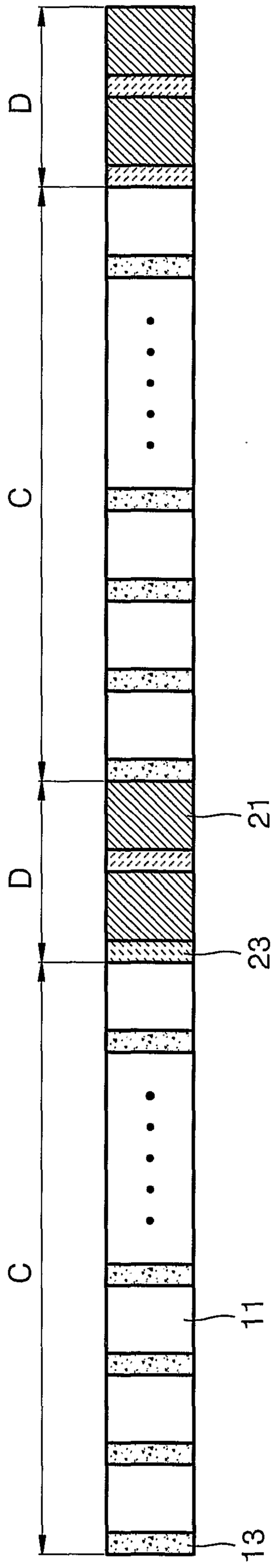
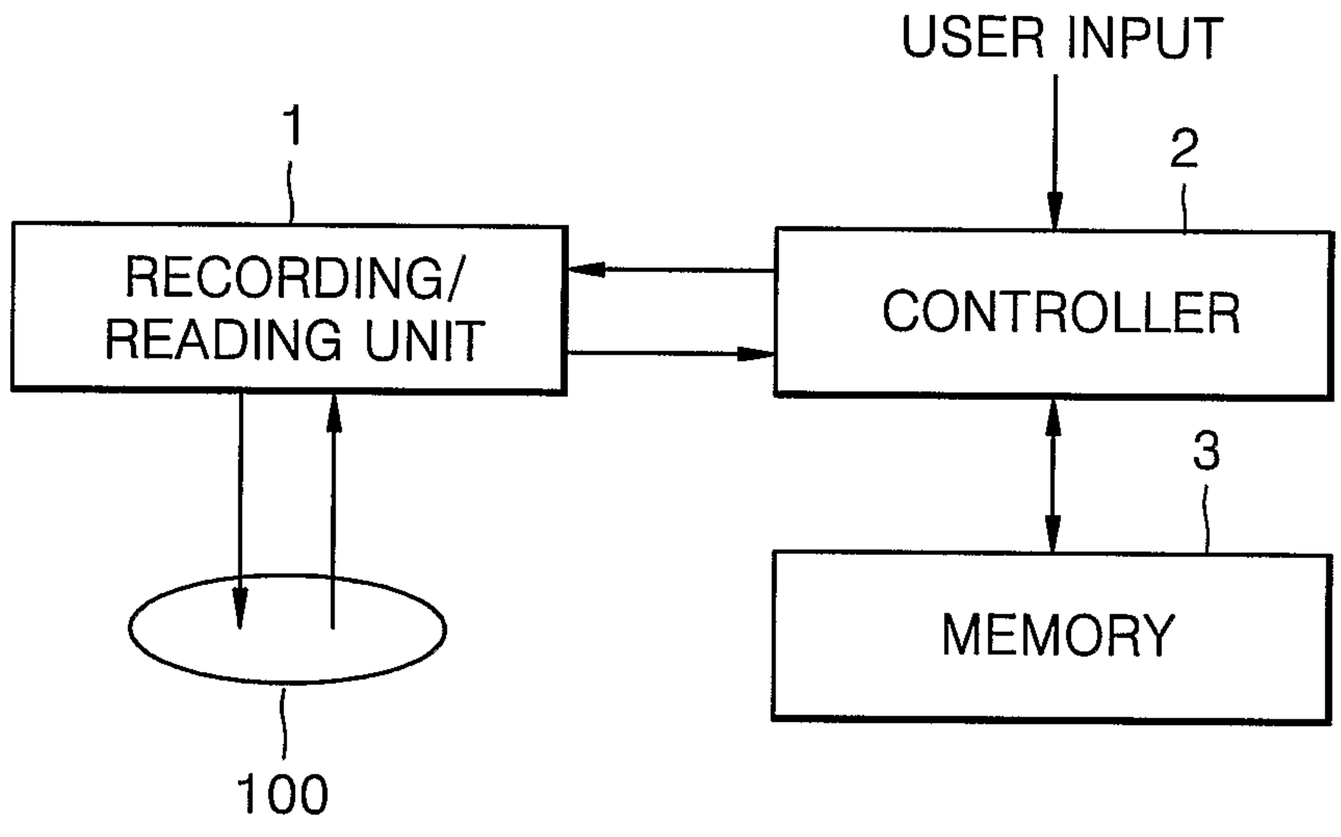
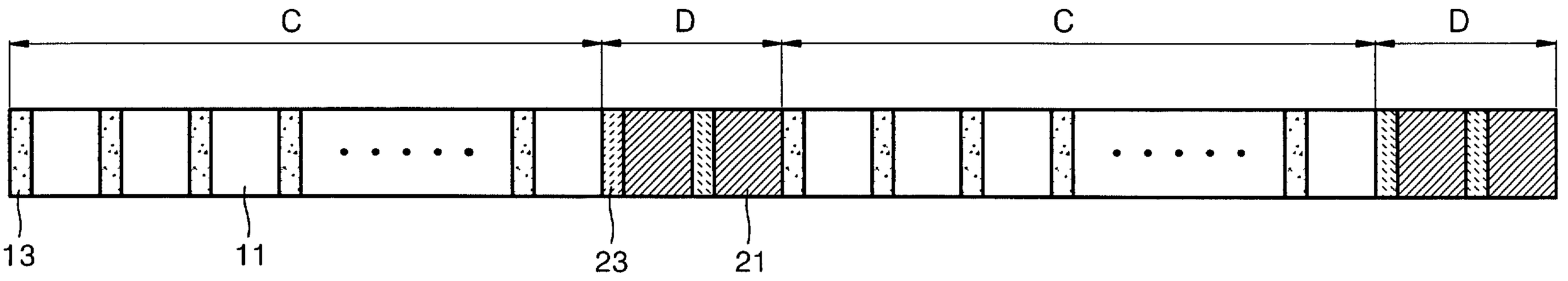


FIG. 4


USER INPUT
1
2
RECORDING/
READING UNIT
CONTROLLER
3
MEMORY
100


C
D
C
D
13
11
23
21