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Method for recording and/or reproducing data on/from  
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medium, method for recognizing recording/recorded medium, and  
method for recording and/or reproducing data for apparatus  
using recording/recorded medium

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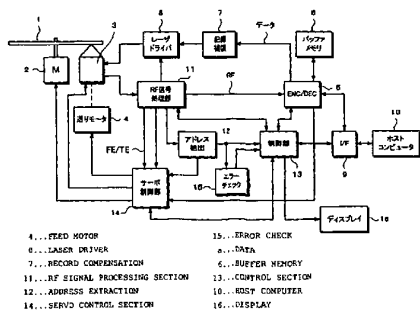
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(54) Title: METHOD FOR RECORDING AND/OR REPRODUCING DATA ON/FROM RECORDING/RECORDED MEDIUM, REPRODUCING APPARATUS, RECORDING MEDIUM, METHOD FOR RECOGNIZING RECORDING/RECORDED MEDIUM, AND METHOD FOR RECORDING AND/OR REPRODUCING DATA FOR APPARATUS USING RECORDING/RECORDED MEDIUM

(54) 発明の名称: 記録媒体の記録及び/又は再生方法、再生装置、記録媒体、記録媒体の判別方法、並びに、記録媒体を用いる装置の記録及び/又は再生方法



(57) Abstract: A method for recording and/or reproducing data on/from a recording/recorded medium, wherein from a recording medium having at least a data recording area and a second area before a first area where data can be recorded, address information representing the position of the second area is read; an error or errors, if any, are detected by using an error detecting code added to the address information read from the recording medium; if an error or errors are detected in the address information, a message to the effect that an error or error are detected is shown or reported at least to the user.

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DESCRIPTION

RECORDING AND/OR REPRODUCING METHOD FOR RECORD MEDIUM,  
REPRODUCING APPARATUS, RECORD MEDIUM, RECORD MEDIUM  
DISTINGUISHING METHOD, AND RECORDING AND/OR REPRODUCING  
5 METHOD FOR APPARATUS USING RECORD MEDIUM

Technical Field

The present invention relates to a recording  
and/or reproducing method for a record medium, a  
reproducing apparatus, a record medium, a record medium  
10 distinguishing method, and a recording and/or  
reproducing method for an apparatus using a record  
medium suitable for a data record medium on which  
address information that represents the positions of a  
lead-in area and so forth are recorded.

15 Background Art

In recent years, optical discs as large  
capacity record mediums have been developed. For  
examples, CD (Compact Disc) for music information, CD-  
ROM for computer data, and DVD (Digital Versatile Disc  
20 or Digital Video Disc) for video information are known.  
These discs are read-only discs. More recently,  
optical discs such as CD-R (CD-Recordable) disc and CD-  
RW (CD-Rewritable) disc that allow data to be recorded  
and rewritten have been commercially used.

25 On the above-described disc shaped record  
mediums such as CD, CD-ROM disc, CD-R disc, and CD-RW  
disc, a data management area referred to as lead-in

area is formed on an inner periphery side of a program area in which data is recorded on. In addition, another area referred to as lead-out area is formed on an outer periphery of the program area. Addresses of time information as disc position information are assigned to those areas.

For example, on CD-R disc or CD-RW disc, a guide groove for a laser beam (hereinafter referred to as groove) is wobbled so as to successively pre-format address information. Position information or time information as wobble information is successively recorded. In CD-R disc/CD-RW disc, with reference to address information that is obtained by decoding wobble information, data is written to the disc. In CD-R disc/CD-RW disc, address information is obtained in such a manner that wobble information is extracted from a signal that is read from a disc with a signal that is frequency-modulated with a carrier of 22.05 kHz and then the extracted wobble information is demodulated. The address information is referred to as ATIP (Absolute Time In Pre-groove). An absolute addresses of a disc are represented by absolute time information.

An absolute address is composed of time information of minutes, seconds, and frames (namely, MSF format). In the MSF format, a decimal numeral of each of minutes, seconds, and frames is represented by BCD (Binary Coded Decimal). One second is equivalent

to 75 frames. Addresses from 00 minute, 00 second, 00  
frame to 99 seconds, 59 seconds, 74 frames can be  
represented. In BCD, one digit in decimal notation is  
represented by four bits in binary notation. In ATIP,  
5 24 bits are required.

On CD-R disc or CD-RW disc, control signals  
other than time information are recorded by ATIP in the  
lead-in area. The control signals include the start  
address-of the lead-in area (referred to as lead-in  
10 start time) and the maximum start address of the lead-  
out area (referred to as lead-out start time). The  
lead-in start time and the lead-out start time are  
information that is read by a drive when a CD-R/CD-RW  
is loaded to a recording and reproducing apparatus.  
15 They are important to use the loaded CD-R disc/CD-RW  
disc.

With error detection code (CRC) for each  
frame of ATIP, an error of address information of lead-  
in start time and lead-out start time can be detected.  
20 However, it is impossible to perfectly detect such an  
error. To improve the reliability of address  
information, error detection/correction encoding with  
higher performance may be used. To do that, the amount  
of redundant code such as parity is increased. As a  
25 result, the redundancy deteriorates. As with CD-R disc  
whose disc format has been already standardized, it is  
difficult to change error detection/correction code.

In addition, depending on the application for use, even if a medium such as CD-R disc satisfies the standard, it may be required to use a medium with as small amount of eccentricity as possible. However, as long as a medium satisfies the standard, it is not necessary to distinguish such a disc. Thus, there is no way to distinguish discs.

Thus, an object of the present invention is to provide a recording and/or reproducing method for a record medium, a reproducing apparatus, a record medium, a record medium distinguishing method, and a recording and/or reproducing method for an apparatus using a record medium that allow an error of address information such as lead-in start time or lead-out start time that represents the position of an area to be detected with the address information itself and a disc to be distinguished with the address information.

#### Summary of Invention

According to one aspect of the present invention there is provided a recording and/or reproducing method for a record medium, comprising the steps of:

reading address information from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area, the address information representing the position of the second area;

detecting an error corresponding to error detection code encoded for the address information that has been read from the record medium; and

when the result of the detecting step represents that an error has been detected in the address information

that has been read from the record medium, notifying at least a user that the error has been detected.

According to another aspect of the present invention there is provided a recording and/or reproducing method for a record medium, comprising the steps of:

5 reading address information from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area, the address information representing the position of the second area;

10 detecting an error corresponding to error detection code encoded for the address information that has been read from the record medium; and

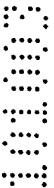
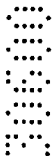
15 when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, prohibiting data from being recorded to at least the first area of the record medium.

20 According to another aspect of the present invention there is provided a recording and/or reproducing method for a record medium, comprising the steps of:

25 reading address information from a record medium, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being followed by the third area, the address information being at least one of first address information and second address information, the first address information representing the position of the

30 second area, the second address information representing the position of the third area;

detecting an error corresponding to error detection code encoded for the address information of at



least one of the first address information and the second address information that have been read from the record medium; and

5 when the result of the detecting step represents that an error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium, notifying at least a user that the error has been detected.

10 According to another aspect of the present invention there is provided a recording and/or reproducing apparatus for a record medium, comprising:

15 a head for reading or reproducing data to/from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area;

20 an error checking portion for detecting an error corresponding to error detection code encoded for address information that has been read from the record medium by said head, the address information representing the position of the second area; and

25 a controlling portion for notifying at least a user that an error has been detected, when the result of error detection of said error checking portion represents that the error has been detected in the address information that has been read from the record medium.

According to another aspect of the present invention there is provided a recording and/or reproducing apparatus for a record medium, comprising:

30 a head for reading or reproducing data to/from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area;

an error checking portion for detecting an error corresponding to error detection code encoded for address information that has been read from the record medium by said head, the address information representing the position of the second area; and

a controlling portion for prohibiting data from being recorded to at least the first area of the record medium, when the result of error detection of said error checking portion represents that the error has been detected in the address information that has been read from the record medium.

According to another aspect of the present invention there is provided a recording and/or reproducing apparatus for a record medium, comprising:

a head for reading or reproducing data to/from a record medium, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being followed by the third area;

an error checking portion for detecting an error corresponding to error detection code encoded for address information of at least one of first address information and second address information that have been read from the record medium by said head; and

a controlling portion for notifying at least a user that the error has been detected, when the result of error detection of said error checking portion represents that the error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium.

According to another aspect of the present invention there is provided a record medium having:  
a first area on which data is recordable;  
a second area followed by the first area; and  
5 a third area preceded by the first area,  
wherein address information that represents at least the position of the second area is recorded by an error detection process with error detection code, and  
wherein the address information is a value that  
10 satisfies a predetermined calculation expression.

According to another aspect of the present invention there is provided a record medium having:  
a first area on which data is recordable;  
a second area followed by the first area; and  
15 a third area preceded by the first area,  
wherein address information that represents at least the position of the second area is recorded by an error detection process with error detection code, and  
wherein a low order portion of the address  
20 information is selected corresponding to data that represents a manufacturer.

According to yet another aspect of the present invention there is provided a record medium determining method, comprising the steps of:  
25 reading address information from a record medium loaded to an apparatus, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being  
30 followed by the third area, the address information being at least one of first address information and second address information, the first address information representing the position of the second area, the second

address information representing the position of the third area;

5 detecting an error corresponding to error detection code encoded for the address information of at least one of the first address information and the second address information that have been read from the record medium; and

10 determining whether or not the loaded record medium is suitable for the apparatus corresponding to the result of the detecting step.

According to another aspect of the present invention there is provided a recording and/or reproducing method for an apparatus that uses a record medium, comprising the steps of:

15 reading address information from a record medium loaded to an apparatus, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being  
20 followed by the third area, the address information being at least one of first address information and second address information, the first address information representing the position of the second area, the second address information representing the position of the third  
25 area;

30 detecting an error corresponding to error detection code encoded for the address information of at least one of the first address information and the second address information that have been read from the record medium; and

determining whether or not the loaded record medium is suitable for the apparatus corresponding to the result of the detecting step.

Brief Description of Drawings

Fig. 1 is a block diagram showing the overall structure of a disc drive according to an embodiment of the present invention; Fig. 2 is a schematic diagram for explaining areas of an optical disc according to an embodiment of the present invention; Fig. 3 is an enlarged sectional view showing the structure of an optical disc according to an embodiment of the present invention; Fig. 4 is a schematic diagram showing a wobbling groove according to an embodiment of the present invention; Fig. 5 is an enlarged schematic diagram showing a wobbling groove according to an embodiment of the present invention; Fig. 6 is a schematic diagram showing an address format according to an embodiment of the present invention; Fig. 7 is a schematic diagram showing the contents of information represented by the most significant bit of the address format; Fig. 8 is a schematic diagram showing the contents of successive frames of a lead-in area of the address format; Fig. 9 is a schematic diagram for explaining the margin of a lead-in area; and Fig. 10 is a schematic diagram showing an example of distinguishing a manufacturer using lead-in start time.

Best Modes for Carrying out the Invention

With reference to Fig. 1, an example of a disc recording and reproducing apparatus (hereinafter simply referred to as drive) according to the preferred embodiment of the present invention will be described. In Fig. 1, reference numeral 1 represents a recordable optical disc, for example, CD-R disc. The optical disc 1 is rotation-driven at constant linear velocity or constant angular velocity by a spindle motor 2. An optical pickup

3 is disposed to record data to the optical disc 1 and read data from the optical disc 1. The optical pickup 3 is moved in the radius direction of the disc 1 by a feed motor 4.

5           As shown in Fig. 2, the optical disc 1 according to the embodiment has a center hole and a clamping area. The center hole is formed at the center of the optical disc 1. The clamping area is formed around the center hole. In the direction from the inner periphery to the  
10 outer periphery of the disc, area PCA (Power Calibration Area), area PMA (Program Memory Area), lead-in area LI, program Area PA, and lead-out area LO are formed. The area PCA is an area for adjusting laser power radiated from the optical pickup to the optical disc 1. The area  
15 PMA is an area



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for temporarily storing address information necessary  
for a rewriting operation (namely, allowing new data to  
be written after the former record end position). The  
diameter of the optical disc 1 is 120 mm that is the  
5 same as that of CD. However, as with CD single that is  
CD having a diameter of 8 cm, the diameter of the  
optical disc 1 may be 80 mm.

Fig. 3 shows the structure of the optical  
disc 1. Fig. 3 shows a CD-R disc as an example of the  
10 optical disc 1. Assuming that the side on which laser  
light is radiated from the optical pickup 3 is the  
lower side, a protection film 21, a reflection film 22,  
a record layer 23, and a substrate 24 are successively  
formed toward the lower side. The reflection film 22  
15 is composed of a metal material such as Au or Ag. The  
record layer 23 is composed of an organic coloring  
matter. The substrate 24 is composed of a synthetic  
resin having light permeability. An example of the  
substrate 24 is polycarbonate having a pre-groove 25.  
20 Examples of the organic coloring matter used for the  
record layer 23 are cyanine type coloring matter and  
phthalocyanine type coloring matter. As was described  
in the "Related Art" section, the pre-groove 25 is  
wobbled in the radius direction of the disc 1 so as to  
25 record address information (position information).  
When light energy of laser light radiated from the  
optical pickup 3 is focused on the pre-groove 25 (in

other words, when the laser light is focused by an object lens of the optical pickup 3), a deformed portion (pits) is formed at the interface between a part of a heated and solved organic coloring matter of the record layer 23 and the substrate 24 that is softened by the heat of the radiated laser light. As a result, data is recorded in the pre-groove 25 of the optical disc 1. When laser light that is lower than laser light in the record mode is radiated from the optical pickup 3 to the optical disc 1 and the difference between the amount of light radiated by the optical pickup 3 and the amount of light reflected by the optical disc 1 is detected by the optical pickup 3, data can be reproduced. The optical disc 1 can be reproduced by a CD player and a CD-ROM reproducing apparatus as well as a CD-R recording and reproducing apparatus.

As shown in Figs. 4 and 5, the pre-groove 25 is spirally and successively formed from the area PCA to the lead-out area LO (on the entire disc surface from the inner periphery to the outer periphery). The pre-groove 25 is wobbled for controlling the rotation of the disc and as a record reference signal. As was described above, data is recorded in the pre-groove 25 or between the pre-groove 25 and a land thereof. As wobble information of the pre-groove 25, address information is successively recorded. With reference

to address information obtained by the wobble information, the optical pickup 3 is moved to a desired write position of the optical disc 1. Data is written to the desired position of the optical disc 1.

5           Returning to Fig. 1, data is supplied from a host computer 10 as an external device to the drive through an interface 9 (for example, SCSI (Small Computer System Interface)). An encoder/decoder 5 is connected to the interface 9. A buffer memory 6 is  
10 connected to the encoder/decoder 5. The buffer memory 6 stores write data or read data.

          Write data is supplied to the encoder/decoder 5 through the interface 9. In the record mode, the encoder/decoder 5 generates data in the CD-ROM format.  
15           Thereafter, data in the CD format is EFM-modulated and encoded by an error correction code encoding process. In the reproduction mode, the encoder/decoder 5 performs a decoding process for an RF signal supplied from an RF signal processing portion 11 (that will be  
20 described later). Digital data as the result of the decoding process is output to the host computer 10 through the interface 9. Besides ATIP, the encoder/decoder 5 adds address data as sub code to the record data. In addition, the encoder/decoder 5 adds  
25 address data to the header of data generated in the CD-ROM format. Such address data represent addresses as with ATIP.

Record data is supplied from the encoder/decoder 5 to a laser driver 8 through a record compensator (record equalizer) 7. The record compensator 7 performs a nonlinear process for record data so that recorded pits become the same as those of CD. The compensation amount of the record compensator 7 is adjusted depending on the characteristic of the record layer of the optical disc 1, the shape of the record laser beam, and so forth. Information that represents the optimum power of the optical disc 1 is recorded in ATIP. In addition, to obtain the real optimum writing power of the optical disc 1 (namely, the output level of laser light radiated from the optical pickup 3), using the PCA area, a test write operation is performed. As a result of the test write operation, the optimum write power can be obtained. After the optimum power has been set, data is written to the optical disc 1.

The laser driver 8 drives a semiconductor laser device as a light source of the optical pickup 3 corresponding to an output signal of the record compensator 7 so as to generate a drive signal having a predetermined level necessary for recording record data to the optical disc 1. The drive signal is supplied from the laser driver 8 to the semiconductor laser device of the optical pickup 3. Laser light corresponding to the record data is radiated from the

semiconductor laser device. Thus, the data is recorded  
to the optical disc 1. As was described above, APC  
(Automatic Power Control) of the RF signal processing  
portion 11 controls the laser driver 8 so that the  
5 output level of the laser light that is output from the  
semiconductor laser device becomes an optimum value.  
An output signal of which the reflected light of the  
optical disc 1 is detected by the optical pickup 3 is  
supplied to the RF signal processing portion 11. A  
10 wobble signal obtained as a push-pull signal generated  
corresponding to the output signal of the optical  
pickup 3 is supplied from the RF signal processing  
portion 11 to an address extracting portion 12.

The RF signal processing portion 11 has a  
15 matrix amplifier. The matrix amplifier calculates a  
detected signal of a photo-detector of the optical  
pickup 3. As a result, besides the above-described  
push-pull signal, the RF signal processing portion 11  
generates tracking error signal TE and focus error  
20 signal FE. The tracking error signal TE and the focus  
error signal FE are supplied to a servo controlling  
portion 14.

The address extracting portion 12 supplies a  
wobble signal as the push-pull signal supplied from the  
25 RF signal processing portion 11 to an FM demodulator  
through a band pass filter that passes only a frequency  
band close to a carrier frequency (at 22.05 kHz) so as

to obtain a bi-phase signal. In addition, the address  
extracting portion 12 uses a clock obtained from the  
bi-phase signal to control the spindle motor 2. In  
addition, the address extracting portion 12 extracts  
5 address data and control signal from the bi-phase  
signal with the clock. The address data and the  
control signal extracted by the address extracting  
portion 12 are supplied to a controlling portion 13  
composed of a microcomputer.

10           The controlling portion 13 controls the seek  
operation using address data supplied from the address  
extracting portion 12. In addition, the controlling  
portion 13 controls the laser power of laser light  
radiated from the optical pickup 3 using the supplied  
15 control signal. The controlling portion 13 controls  
all the portions of the drive such as the interface 9,  
the encoder/decoder 5, the RF signal processing portion  
11, and the servo controlling portion 14.

          An output signal of the address extracting  
20 portion 12 is supplied to the controlling portion 13.  
In addition, the output signal of the address  
extracting portion 12 is supplied to an error checking  
circuit 15. As will be described later, the error  
checking circuit 15 detects the presence/absence of an  
25 error using lead-in start time data and/or lead-out  
start time data of the control signal and outputs the  
error detected result to the controlling portion 13.

According to the embodiment, since the optical disc 1 is a CD-R disc, various recording methods such as disc-at-once, track-at-once, packet-at-once, and multi-session can be used. In the disc-at-once method, once data recording operation for the optical disc 1 is started, until it is completed, the recording operation cannot be stopped. In the method, data is recorded in the order of the lead-in area LI, the program area PA, and the lead-out area LO of the optical disc 1. In the track-at-once method, at first, data is recorded to the program area. Thereafter, data is recorded to the lead-out area. Finally, data is recorded to the lead-in area. In the track-at-once method, as wobble information recorded in the pre-groove 25, each track number, start time data, and end time data that are read from ATIP are recorded. After all data is recorded to tracks, lead-out area is recorded. In addition, corresponding to information that is read from the PMA area, TOC information is created. The TOC information is recorded to the lead-in area. In the packet-at-once method, a small amount of data is repeatedly rewritten. In the multi-session method, data is recorded in such a manner that a plurality of sessions are formed in the radius direction of the optical disc 1. Data is recorded in such a manner that each session has a lead-in area and a lead-out area.

In addition, when the optical disc 1 is reproduced, the RF signal processing portion 11 outputs an RF signal. The RF signal is supplied to the encoder/decoder 5. The encoder/decoder 5 performs an EFM-demodulating process and a decoding process in CD format such as error correction code decoding process. Thereafter, the encoder/decoder 5 performs a decoding process in CD-ROM format. Reproduced data that is output from the encoder/decoder 5 is stored to the buffer memory 6. When the encoder/decoder 5 receives a read command from the host computer 10, the encoder/decoder 5 transfers the reproduced data stored in the buffer memory 6 to the host computer 10 through the interface 9.

A frame synchronous signal, tracking error signal TE, and focus error signal FE that are output from the RF signal processing portion 11 and clock that is output from the address extracting portion 12 are supplied to the servo controlling portion 14. The servo controlling portion 14 performs a tracking servo and a focus servo for the optical pickup 3, a spindle servo for the spindle motor 2, and a thread servo for the feed motor 4.

As was described above, on the optical disc 1, the pre-groove 25 is wobbled by FM (FSK) modulation with a carrier of  $22.05 \text{ kHz} \pm 1 \text{ kHz}$ . When the FM-modulated wobbling of the pre-groove 25 is demodulated

from the generated push-pull signal corresponding to the output signal of the optical pickup 3, a bi-phase signal with a clock of 6.3 kHz is obtained. When the obtained bi-phase signal is demodulated, data of 3150 bits/sec can be obtained. As was described above, since one second is equivalent to 75 frames, one frame of ATIP data as address data is composed of 42 bits.

Fig. 6 shows the structure of data of one frame of ATIP data as address data of the optical disc 1. The first four bits are a synchronous signal. The next 24 bits are an address description portion. The last 14 bits are CRC (Cyclic Redundancy Code). The synchronous signal has a special pattern that does not take place in a bi-phase mark. The decimal numerals of minutes, seconds, and frames of address data (time information) are denoted by eight bits each in BCD. Thus, addresses of up to 99 minutes, 59 seconds, 74 frames can be represented. Assuming that the data amount of one frame is 2 kbytes, the address data is equivalent to around 900 Mbytes.

In the format of the optical disc 1 (CD-R), in a combination of high order four bits of each of M for "minutes", S for "seconds", and F for "frames" (actually, those bits are not used (namely, all 0s), information other than addresses is represented (the information is referred to as extra information). With respect to the most significant bit of M for "minutes",

when M is "99 minutes", the most significant bit thereof becomes "1". However, actually, so far, the record durations of discs that are commercially available are up to 80 minutes. Thus, the most significant bit of M for "minutes" does not become "1". Extra information other than addresses is recorded to the lead-in area LI. In the program area PA and the lead-out area LO, only address data is recorded.

Fig. 7 shows contents of information in combinations of three bits M1, S1, and F1 that are the most significant bits of M for minutes, S for seconds, and F for frames. In other words, (M1, S1, F1 = 000) represents the addresses of the program area PA and the lead-out area LO. The most significant bits M1, S1, and F1 and the addresses (M, S, F) of the program area PA and the lead-out area LO are combined. (M1, S1, F1 = 100) represents the addresses of the area PCA, the area PMA, and the lead-in area. (M1, S1, F1 = 101) represents special information 1 (record power at reference speed, application code, and disc type ID). (M1, S1, F1 = 110) represents special information 2 (lead-in start time). (M1, S1, F1 = 111) represents special information 3 (lead-out start time). In addition, as shown in Fig. 7, although additional information 1, additional information 2, and additional information 3 have been reserved, they have been not yet defined. Special information is represented by M1

= "1", whereas additional information 1 to 3 are represented by extra information other than addresses.

In the optical disc 1 (CD-R), the sequence of successive frames of the lead-in area LI is defined as shown in Fig. 8. As is clear from Fig. 8, a sequence of 30 frames is defined. At frame numbers N, N + 10, N + 20, ... (at intervals of 10 frames), special information 1, special information 2, and special information 3 are placed. At other frame numbers, regular addresses are placed.

Next, addresses represented by time information of minutes, seconds, and frames will be described in reality. Time information of each of the program area PA and the lead-out area LO starts at 00 minute, 00 second, 00 frame and increments. In the lead-in area LI, time information exceeding 90 minutes is recorded. After 99 minutes, 59 seconds, 74 frames, time information becomes 00 minute, 00 second, 00 frame at which the program area PA starts.

The standard of CD-R disc as an example of the optical disc 1 is defined in "Orange Book" that is a standard document. In the range that satisfies the standard of the Orange Book, the start position of the lead-in area has a margin to some extent. Fig. 9 shows the margin of the start position of the lead-in area LI. In the format of which the disc reproduction duration or disc record duration of the optical disc 1 is 64

minutes (linear velocity = 1.4 m/sec constant), as was described above, the minimum length of the lead-in area L1 is (02, 07, 48) and the maximum length of the lead-in area L1 is (02, 14, 06) in (M, S, F) notation. Thus, 5 the lead-in start time can be selected from a value that satisfies the standard of the above-described Orange Book - namely, in the range from (97, 45, 69) to (97, 52, 27).

Likewise, in the format of which the disc 10 reproduction duration or disc record duration of the optical disc 1 is 74 minutes (linear velocity = 1.2 m/sec constant), the minimum length of the lead-in area LI is (02, 28, 68) and the maximum length of the lead-in area LI is (02, 36, 32) in (M, S, F) notation. Thus, 15 the lead-in start time can be selected from a value that satisfies the standard of the above-described Orange Book - namely, in the range from (97, 23, 43) to (97, 31, 07).

According to the embodiment of the present 20 invention, using the margin of the lead-in start time, it is encoded so that an error thereof can be detected by itself. The error checking circuit 15 (see Fig. 1) detects whether or not there is an error of lead-in start time. For example, error detection encoding 25 using CRCC (Cyclic Redundancy Check Code) is used. In this case, assuming that with generation polynomial  $g(x) = x^4 + x + 1$  and time information of lead-in start

time  $T(x) = [M, S, F]$  (24 bits, polynomial of 23-rd order of  $x$ ), the low order four bits of the frame  $F$  are selected so that  $T(x)$  is can be exactly divided by  $g(x)$  (remainder = "0").

5                   When the above-described error detectable encoding is performed, the error checking circuit 15 divides the lead-in start time by generation polynomial  $g(x)$  and determines whether or not the remainder is 0 so as to detect an error of lead-in start time. In the  
10                   example of  $g(x)$ , values of which the remainder is 0 are 0 to F (in hexadecimal notation). However, BCD notation does not represent values A to F. Thus, the selection of the low order four bits of the frame  $F$  is restricted. To solve the problem, a rule of which when  
15                   the value becomes one of A to F, "6" is added to the value is pre-adopted. As a result, values A to F in hexadecimal notation can be converted into values 0 to 5, respectively.

                  As another method, besides the above-  
20                   described generation polynomial, with generation polynomial  $g(x) = x^3 + x + 1$ , the low order three bits of the frame  $F$  are selected so that the remainder of which the lead-in start time is divided by  $g(x)$  becomes 0. Thus, values A to F in hexadecimal notation  
25                   can be selected from values 0 to 7.

                  As a second example of which the error detectable encoding by the error checking circuit 15,

the digits (8 bits) of the frame F are selected so that when each digit of M, S, and F of the lead-in start time is added with (modulo 75), the added result becomes "0". (modulo 75) is used because the digits of the frames range from values 00 to 74. In reality, now assume that lead-in start time is 97 minutes, 24 seconds, Q frames where Q is a symbol that represents an undetermined value. In the example, the following formula is satisfied.

10                     $97 + 24 + Q = 0 \text{ (modulo 75) } \dots (1)$

The value that satisfies the formula (1) is (Q = 29). Thus, the digits of the frames become (29 frames). The error checking circuit 15 performs an addition of the above-described formula with (modulo 75) and determines whether or not the added result is "0" so as to check whether or not there is an error in the lead-in start time.

As a third example of the error detectable encoding by the error checking circuit 15, the low order four bit of the frame F are selected so that when each digit of M, S, and F of the lead-in start time is added with (modulo 10), the added result becomes 0. In reality, assuming that the lead-in start time is 97 minutes, 24 seconds, 10 frames, the value of the low order four bits is decided using the following formula.

25                     $9 + 7 + 2 + 4 + 1 + Q = 0 \text{ (modulo 10) } \dots (2)$

The value that satisfies the formula (2) is

(Q = 7). Thus, the digits of the frames become (17 frames). The error checking circuit 15 performs the addition of the above formula with (modulo 10) and determines whether or not the added result is 0 so as to check whether or not there is an error in the lead-in start time.

Since (modulo 10) is used, as a value of the low order four bits of the digits of the frames, one of 0 to 9 can be selected. This is well harmonized with code assignments for distinguishing disc manufacturers of OSJ (Orange book study of Japan) for CD-R discs. Fig. 10 shows an example of lead-in start time code assignments for manufactures (A, B, C, D, E, F, ..., G, H, ..., I) according to OSJ. "1st code" of Fig. 10 is applied to a format of which the disc reproduction duration is 74 minutes, whereas "2nd code" is applied to a format of which the disc reproduction duration is 64 minutes. The manufacturer distinguished result is used to control the output level of a laser beam in the record mode of a CD-R disc as the optical disc 1.

In Fig. 10, as 1st code, (97 minutes, 24 seconds, 10 frames to 97 minutes, 24 seconds, 19 frames) are assigned to for example manufacturer E. Likewise, a value in the range of (0 to 9) as the low order four bits of the frames is assigned to each manufacturer. Thus, in the error detection encoding by the addition with (modulo 10), one of values (0 to 9)

is selected. Consequently, the error detection encoding is well harmonized with the code assignments shown in Fig. 10.

In addition, in the code assignments of OSJ, (00 to 04) are assigned cyanine as organic coloring matter used in the record layer 23, whereas (05 to 09) are assigned phthalocyanine as organic coloring matter used in the record layer 23. To satisfy the code assignments of OSJ, instead of an adding expression with (modulo 75) or an adding expression with (modulo 10), an adding expression with (modulo 5).

As a fourth example of the error detectable encoding by the error checking circuit 15, error detecting encoding is performed for lead-out start time recorded in the lead-in area LI as special information 3. When the lead-out start time is 17 minutes, 50 seconds, Q frames, as with the second example, the value Q of the frames is selected so that the added result of the following formula with (modulo 75) becomes "0".

$$17 + 50 + Q = 0 \text{ (modulo 75) ... (3)}$$

The value of the frames that satisfies the formula (3) is (Q = 08). Thus, time information of 17 minutes, 50 seconds, 08 frames is recorded as the lead-out start time. Of course, the lead-out start time is a value that cannot exceed a value defined in the CD-R physical standard or the like. The program error PA

depends on the value of the lead-out start time. As a result, the record capacity may slightly decrease depending on the value of the lead-out start time. However, since the lead-out start time is not affected  
5 by manufacturer code of OSJ and category code of organic coloring matter used for the record layer 23, it can be said that the flexibility of the lead-out start time is high.

As a fifth example of the error detectable  
10 encoding by the error checking circuit 15, both lead-in start time and lead-out start time are used. When the lead-in start time is 97 minutes, 24 seconds, 10 frames and the lead-out start time is 17 minutes, 50 seconds, Q frames, the value Q of the frames is selected so that  
15 the added result of the following formula with (modulo 75) becomes "0".

$$97 + 24 + 10 + 17 + 50 + Q = 0 \text{ (modulo 75) } \dots$$

(4)

The value of the frames of the lead-out start  
20 time that satisfies the formula (4) is (Q = 27). To detect an error, it is determined whether or not the added result of both the lead-in start time and the lead-out start time that are read from the optical disc with (modulo 75) is "0".

25 Next, a sixth example of the error detection encoding by the error checking circuit 15 will be described. In the sixth example, in addition to lead-

in start time and/or lead-out start time, constant K  
that the drive (recorder or player) side has is used.  
Assuming that the lead-in start time is 97 minutes, 24  
seconds, 10 frames, the lead-out end time is 20 minutes,  
5 15 seconds, 34 frames, and  $K = 25$ , the added result of  
the following expression becomes 225.

$$97 + 24 + 10 + 20 + 15 + 34 + 25 = 225$$

In other words, the value of the digits of  
the frames of the lead-out start time is selected. If  
10 the added result does not become 225 with only the  
value of digits of the frames, the value of digits of  
the seconds are used. When the lead-out start time is  
read, it is determined whether or not the added result  
is 225 so as to detect whether there is an error in the  
15 lead-out start time. The value "255" as the added  
result becomes 0 in an addition with (modulo 75). As  
with the above-described example, the addition with  
(modulo 75) can be used. (modulo 75) represents that  
the added result can be exactly divided. Thus, it is  
20 different from the case that the added result is "225".

Alternatively, two or more types of error  
detection encoding for address information such as  
lead-in start time can be used instead of one type of  
error detection encoding. For example, with an adding  
25 expression with (modulo 10) and an adding expression  
with (modulo 75), two types of address information of  
which the added result becomes "0" can be generated.

As constant K that the drive side has, with two types of constants K1 and K2, two types of address information can be generated.

Moreover, in the above-described examples, all digits or bits of address information such as lead-in start time are used. However, error detection encoding can be performed by omitting a part of address information (namely, the value of a lower digit of the frames of time information). In reality, in an example using lead-in start time and lead-out start time, assuming that the value of a lower digit of the frames of the lead-in start time is always "0", the error detection encoding can be performed.

Next, a seventh example of the error detection encoding by the error checking circuit will be described. In the seventh example, each digit of M, S, and F of lead-in start time is independently handled. Each digit is multiplied by a predetermined coefficient. In other words, lead-in start time is represented by two digits in BCD notation. The minutes (M) of the lead-in start time are represented by numerals ( $M_{1_1}$ ,  $M_{2_1}$ ) of two digits. The minutes (S) of the lead-in start time are represented by numerals ( $S_{1_1}$ ,  $S_{2_1}$ ) of two digits. The frames (F) of the lead-in start time are represented by numerals ( $F_{1_1}$ ,  $F_{2_1}$ ) of two digits. As expressed by the following formula, each digit of M, S, and F of the lead-in start time is

independently handled. Each digit is multiplied by a predetermined coefficient and then added each other.  $F2_1$  is decided so that the calculated result with modulo  $z$  becomes "0".

5                     $a \times M1_1 + b \times M2_1 + c \times S1_1 + d \times S2_1 + e \times$   
 $F1_1 + f \times F2_1 = 0 \text{ (modulo } z) \dots (6)$

In this case, coefficients  $a$  to  $f$  may be the same or different from each other. Alternatively, some of coefficients  $a$  to  $f$  may be the same. It may be  
10 considered that the second and third examples are special examples of expressions by the above-described formulas (1) and (2). In other words, it can be considered that the second example is an example of which in the formula (6), the coefficient  $a$  is "10",  
15 the coefficient  $b$  is "1", the coefficient  $c$  is "10", the coefficient  $d$  is "1", the coefficient  $e$  is "10", the coefficient  $f$  is "1", and the coefficient  $z$  is "75". Likewise, it can be considered that the third example is an example of which all the coefficients  $a$  to  $f$  are  
20 "1" and the coefficient  $z$  is "10".

An eighth example of the error detection encoding by the error checking circuit 15 is an example of which each digit of  $M$ ,  $S$ , and  $F$  of the lead-out start time is independently handled and each digit is  
25 multiplied by a predetermined coefficient. In other words, the lead-out start time is represented by two digits in BCD notation. The minutes of the lead-out

start time are represented by numerals ( $M_{1_0}$ ,  $M_{2_0}$ ) of two digits. The seconds of the lead-out start time are represented by numerals ( $S_{1_0}$ ,  $S_{2_0}$ ) of two digits. The frames of the lead-out start time are represented by numerals ( $F_{1_0}$ ,  $F_{2_0}$ ) of two digits. As expressed by the following formula, each digit of M, S, and F of the lead-out start time is independently handled. Each digit is multiplied by a predetermined coefficient.  $F_{2_0}$  is decided so that the added result with modulo  $z$  becomes "0".

$$g \times M_{1_0} + h \times M_{2_0} + i \times S_{1_0} + j \times S_{2_0} + k \times F_{1_0} + l \times F_{2_0} = 0 \pmod{z} \dots (7)$$

Both lead-in start time and lead-out start time may be used. In this case, the minutes of the lead-in start time are represented by numerals ( $M_{1_1}$ ,  $M_{2_1}$ ) of two digits. The seconds of the lead-in start time are represented by numerals ( $S_{1_1}$ ,  $S_{2_1}$ ) of two digits. The frames of the lead-in start time are represented by numerals ( $F_{1_1}$ ,  $F_{2_1}$ ) of two digits. The minutes of the lead-out start time are represented by numerals ( $M_{1_0}$ ,  $M_{2_0}$ ) of two digits. The seconds of the lead-out start time are represented by numerals ( $S_{1_0}$ ,  $S_{2_0}$ ) of two digits. The frames of the lead-out start time are represented by numerals ( $F_{1_0}$ ,  $F_{2_0}$ ) of two digits. As expressed by the following formula, each digit of M, S, and F of the lead-in start time and each digit of M, S, and F of the lead-out start time are

independently handled. Each digit is multiplied by a predetermined coefficient and then added each other.  $F_{2_1}$  and  $F_{2_0}$  are decided so that the added result with modulo  $z$  becomes "0".

$$\begin{aligned} & a \times M_{1_1} + b \times M_{2_1} + c \times S_{1_1} + d \times S_{2_1} + \\ & e \times F_{1_1} + f \times F_{2_1} + g \times M_{1_0} + h \times M_{2_0} \\ & + i \times S_{1_0} + j \times S_{2_0} + k \times F_{1_0} + l \times F_{2_0} = 0 \\ & \text{(modulo } z) \dots (8) \end{aligned}$$

According to the embodiment of the present invention, the detected result of the error checking circuit 15 is supplied to the controlling portion 13. The controlling portion 13 controls the recording operation or the reproducing operation of the drive corresponding to the detected result of the error checking circuit 15. The controlling portion 13 can control such operations in several manners.

In the record mode, the optical pickup 3 reads the lead-in area LI of the loaded optical disc 1. In addition to the regular operation of the CD-R drive, the error checking circuit 15 checks an error using address information or using both address information and constant  $K$ . When the determined result of the error checking circuit 15 represents that the address information has an error, the controlling portion 13 prohibits data from being recorded to the program area PA of the optical disc 1. In contrast, when the determined result of the error checking circuit 15

represents that the address information does not have  
an error, the controlling portion 13 permits data to be  
recorded to the program area PA of the optical disc 1.  
When the controlling portion 13 prohibits data from  
5 being recorded to the program area PA of the optical  
disc 1, the controlling portion 13 causes a display 16  
of the drive to display a message that represents that  
data cannot be recorded because an error has been  
detected. In other words, only when the address  
10 information does not have an error, data can be  
recorded to the optical disc 1.

Likewise, in the reproduction mode, an error  
of the loaded disc 1 is checked in the same manner as  
the record mode. When the determined result of the  
15 error checking circuit 15 represents that address  
information that is read from the lead-in area LI of  
the loaded optical disc has an error, the error  
checking circuit 15 prohibits data recorded on the  
optical disc 1 from being reproduced therefrom. In  
20 contrast, when the determined result of the error  
checking circuit 15 represents that the address  
information does not have an error, the controlling  
portion 13 controls the optical pickup 3 so as to  
permit data recorded on the optical disc 1 to be  
25 reproduced. In other words, only when the address  
information that is read from the optical disc 1 does  
not have an error, data recorded in the program area PA

of the optical disc 1 can be reproduced. When the reproduction of the optical disc 1 is prohibited because an error has been detected from the address information that has been read from the optical disc 1, an error message is displayed on the display 16 of the drive. As was described above, when an error has been detected in address information, in addition to the record/reproduction prohibiting process of the loaded optical disc 1, the loaded optical disc 1 may be forcedly unloaded from the drive. At that point, an error message may be displayed on the display 16.

As the optical disc 1, a recordable optical disc (for example, CD-R disc) may be recorded and reproduced by different recording and/or reproducing apparatuses. Knowing that cheap CD-R discs that are commercially available tend to have a problem, some users may want to use such discs. From this point of view, a recording and reproducing apparatus that can record and reproduce data to/from a CD-R disc may have different operations against an error in the record mode and the reproduction mode.

As an example of the operations in the record and reproduction modes, when an error is detected in lead-in start time or the like (for example, address information of lead-in start time, address information of lead-out start time, address information of lead-in start time and lead-out start time, or address

information of address information that represents the position of particular data recorded in the program area PA), although data is prohibited from being recorded to the loaded optical disc, data is permitted to be reproduced from the loaded optical disc. In other words, there is a situation that although an error has taken place in address information that has been read, data has been recorded on the loaded optical disc by another apparatus. When an error is detected in the above-described manner, if data is prohibited from being reproduced from the loaded optical disc, although the data has been recorded on the disc, the data cannot be reproduced at all. To solve such a problem, when an error is detected in address information such as lead-in start time, data is prohibited from being recorded to the loaded optical disc. However, data is permitted to be reproduced from the loaded optical disc. Those recording and reproducing operations are controlled by the controlling portion that controls the operations of the recording and reproducing apparatus. In the following examples, the operations of the recording and reproducing apparatus are controlled by the controlling portion of the apparatus.

As another example of the operations in the record and reproduction modes, when an error is detected in address information such as lead-in start

time of a loaded optical disc, data is prohibited from  
being recorded to the loaded optical disc. In addition,  
when data is reproduced from the loaded optical disc,  
an error message is displayed on the display of the  
5 apparatus so as to alarm the user for a high  
possibility of an occurrence of an error. However,  
data is permitted to be reproduced from the loaded  
optical disc. For example, when data is recorded to  
the loaded optical disc, if an error is detected in  
10 address information such as lead-in start time, an  
error message "This disc has a risk of an occurrence of  
an error." may be displayed on the display of the  
apparatus. An alarm sound may be generated. A lamp or  
the like may be lit. In such a manner, the user is  
15 alarmed of an occurrence of an error. In addition,  
data is prohibited from being recorded to the loaded  
optical disc. When an error message is displayed on  
the display or the like in such a manner, the user can  
know why data cannot be recorded to the optical disc.

20 As another example of the operations in the  
record and reproduction modes, if an error is detected  
in address information such as lead-in start time of a  
loaded optical disc, when data is recorded and  
reproduced to/from the loaded optical disc, the user is  
25 alarmed of the error. However, data is permitted to be  
recorded and reproduced to/from the loaded optical disc.  
For example, knowing that cheap optical discs that are

commercially available tend to have an error in the  
record mode and reproduction mode, some users may want  
to use such discs. For such users, when an error is  
detected in address information of the loaded optical  
5 disc, an error message "This is not a recommended  
disc." may be displayed on the displaying portion of  
the apparatus such as display. Alternatively, an alarm  
sound may be generated. Alternatively, a lamp or the  
like may be lit. Thus, before the recording operation  
10 or the reproducing operation is performed after the  
optical disc has been loaded, the users are alarmed.  
However, data is permitted to be recorded and  
reproduced. Thus, such users can use cheap discs that  
are commercially available even if they have a risk of  
15 an occurrence of an error.

As another example of the operations in the  
record and reproduction modes, when an error is  
detected in address information such as lead-in start  
time that is read from a loaded optical disc, in the  
20 record mode, the user is alarmed in such a manner.  
However, data is permitted to be recorded to the loaded  
optical disc. In addition, data is permitted to be  
reproduced from the loaded optical disc. In this case,  
knowing that cheap discs that are commercially  
25 available tend to have a problem of an error in the  
record mode or the reproduction mode, users can use  
them. In this example, when data is reproduced from

the loaded disc, since an error message is not displayed on the displaying portion such as the display of the apparatus, the users can be prevented from unnecessary getting confused.

5                   In addition to the detection of an error of address information such as lead-in start time that is read from the optical disc 1, the loaded optical disc 1 can be distinguished. In other words, even if address information can be correctly read from the loaded  
10 optical disc 1, when the error detected result corresponding to the error detection code of the address information that is read from the loaded optical disc 1 does not satisfy a non-error condition, it is determined that the address information that is  
15 read from the loaded optical disc 1 has an error. In other words, it is determined that an optical disc whose address information has an error is not a desired disc. As a result, corresponding to the address information that is read, the loaded disc can be  
20 distinguished.

                  In other words, for an optical disc 1 suitable for the recording and reproducing apparatus, address information such as lead-in start time is pre-recorded on the optical disc 1 so that a value  
25 calculated corresponding to one of the formulas (1) to (8) becomes a predetermined value. After an optical disc is loaded to the recording and reproducing

apparatus, it reads address information such as lead-in  
start time from the loaded optical disc with the  
optical pickup 3, calculates the address information  
that has been read, and determines whether or not the  
5 loaded optical disc is a disc suitable for the  
apparatus corresponding to the calculated result  
(namely, depending on whether or not the address  
information has an error). When the determined result  
represents that the loaded optical disc is an optical  
10 disc suitable for the apparatus, data is permitted to  
be recorded to the program area PA of the loaded  
optical disc 1. In contrast, when the determined  
result represents that the loaded optical disc is not  
an optical disc suitable for the apparatus, data is  
15 prohibited from being recorded to the loaded optical  
disc. At that point, when the loaded optical disc is  
not an optical disc suitable for the apparatus, an  
alarm message such as "This is not a recommended disc.  
Carefully use it." may be displayed on the displaying  
20 portion such as the display 16 of the drive.  
Alternatively, an alarm sound may be generated.  
Alternatively, a lamp or the like may be lit. As a  
result, the user is alarmed.

Likewise, when an optical disc is loaded to  
25 the apparatus, address information such as lead-in  
start time is read from the loaded optical disc. The  
address information that has been read from the loaded

optical disc is calculated corresponding to one of the above-described formulas (1) to (8) so as to determine whether or not the loaded optical disc is a disc suitable for the apparatus. When the determined result represents that the loaded optical disc is an optical disc suitable for the apparatus, data is permitted to be reproduced from the loaded optical disc. In contrast, when the determined result represents that the loaded optical disc is not an optical disc suitable for the apparatus, data is prohibited from being reproduced from the loaded optical disc. At that point, when the determined result represents that the loaded optical disc is not an optical disc suitable for the apparatus, an alarm message such as "This is not a recommended disc. Carefully use it." may be displayed on the displaying portion such as the display 16 of the drive. Alternatively, an alarm sound may be generated. Alternatively, a lamp or the like may be lit. As a result, the user is alarmed.

As the optical disc 1, a recordable optical disc (for example, CD-R disc) may be recorded and reproduced by different recording and reproducing apparatuses. Knowing that cheap discs that are commercially available may not be suitable for the apparatus, some users may want to use them. From this point of view, when the determined result represents that the loaded optical disc is not a disc suitable for

the recording and reproducing apparatus that records and reproduces data to/from a CD-R disc, the apparatus may perform different operations in the record mode and the reproduction mode.

5                   As an example of the operations in the record mode and reproduction mode in the case that the determined result represents that the loaded optical disc is not a disc suitable for the apparatus, when the determined result corresponding to lead-in start time or the like (for example, address information of lead-  
10                   in start time, address information of lead-out start time, address information of lead-in start time and lead-out start time, or address information of address information that represents the position of particular  
15                   data recorded in the program area) represents that the loaded optical disc is not an optical disc suitable for the apparatus, data is prohibited from being recorded to the program area of the loaded optical disc.  
                  However, data is permitted to be reproduced from the  
20                   loaded optical disc. In other words, even if the loaded optical disc is not an optical disc suitable for the apparatus, data may have been recorded thereto by another apparatus. Thus, if data is prohibited from being recorded to the optical disc that is not suitable  
25                   for a desired apparatus, the data should be reproduced by the original apparatus. Thus, the operability deteriorates. Thus, when the determined result

corresponding to address information such as lead-in  
start time represents that the loaded optical disc is  
not an optical disc that is suitable for the apparatus,  
new data is prohibited from being recorded to the  
5 loaded optical disc. Instead, data is permitted to be  
reproduced from the loaded optical disc.

As another example in the case that the  
determined result represents that the loaded optical  
disc is not an optical disc suitable for the apparatus,  
10 when the determined result corresponding to address  
information such as lead-in start time read from the  
loaded optical disc represents that the loaded optical  
disc is not an optical disc suitable for the apparatus,  
data is prohibited from being recorded to the loaded  
15 optical disc. In addition, when data is reproduced  
from the loaded optical disc, an error message is  
displayed on the displaying portion or the like of the  
apparatus. The user is alarmed of a message that  
represents that the loaded optical disc is likely not  
20 to be used. However, data is permitted to be  
reproduced. For example, in the record mode, when the  
determined result corresponding to address information  
of lead-in start time or the like that is read from the  
loaded optical disc represents that the loaded optical  
25 disc is not a disc that is suitable for the apparatus,  
an alarm message such as "This is not a recommended  
disc. Carefully use it." may be displayed on the

displaying portion or the like of the apparatus.

Alternatively, an alarm sound may be generated.

Alternatively, a lamp or the like may be lit. As a

result, the user is alarmed. In addition, data is

5 prohibited from being recoded to the loaded optical

disc. When such an error message is displayed, the

user can know the reason why data cannot be recorded to

the loaded disc.

As another example in the case that the

10 determined result represents that the loaded optical

disc is not an optical disc suitable for the apparatus,

when the determined result corresponding to address

information such as lead-in start time or the like

represents that the loaded optical disc is not an

15 optical disc suitable for the apparatus, both in the

record mode and the reproduction mode, the user is

alarmed. However, data is permitted to be recorded to

the loaded optical disc and reproduced therefrom. For

example, knowing that cheap discs that are commercially

20 available tend to have a problem of an error in the

record mode and the reproduction mode, some users may

want to use them. In this case, when an optical disc

that is not suitable for the apparatus is loaded

thereto, corresponding to address information that is

25 read from the loaded optical disc, an alarm message

such as "This is not a recommended disc. Carefully use

it." may be displayed on the displaying portion or the

like of the apparatus. Alternatively, an alarm sound  
may be generated. Alternatively, a lamp or the like  
may be lit. As a result, the user is alarmed. However,  
data is permitted to be record to the loaded optical  
5 disc and reproduced therefrom. Thus, such users can  
use cheap discs with knowing such a risk.

As another example in the case that the  
determined result represents that the loaded optical  
unit is not an optical disc suitable for the apparatus,  
10 when the determined result corresponding to address  
information such as lead-in start time or the like that  
is read from the loaded optical disc represents that  
the loaded optical disc is not a disc suitable for the  
apparatus, in the record mode, the user is alarmed in  
15 the above-described manner. However, data is permitted  
to be recorded to the loaded optical disc. In addition,  
data is permitted to be reproduced from the loaded  
optical disc. In this case, knowing that cheap discs  
that are commercially available have a problem of an  
20 error, some users may use them. When data is  
reproduced from the loaded optical disc, since an error  
message is not displayed, the user is prevented from  
unnecessarily getting confused.

In addition, depending on the type of the  
25 optical disc loaded to the apparatus, electric  
characteristics such as servo characteristic,  
mechanical characteristics, or optical characteristics

may be varied and optimized. As was described above,  
the detection of an error of address information  
according to embodiments of the present invention can  
be used for distinguishing one of a plurality of types  
5 of discs. With the distinguished result of the disc  
corresponding to an error detected from the address  
information, if the disc has a problem, the electric  
characteristics of the servo mechanism, mechanical  
characteristics, or optical characteristics of the  
10 apparatus can be varied so as to handle the loaded  
optical disc.

Generally, in addition to base  
specifications, the above-described standard for CD-R  
disc and so forth defines some tolerances for various  
15 reference values such as amount of eccentricity and  
track pitch so as to absorb manufacturing errors and so  
forth of discs. On the other hand, a particular  
application for CD-R disc requires specifications that  
are stricter than the tolerances for amount of  
20 eccentricity and track pitch. For example, a portable  
audio recording and reproducing apparatus and a  
portable video photographing, recording, and  
reproducing apparatus should consider the influence of  
vibrations and so forth. Thus, in this case, a  
25 recordable optical disc as a record medium (namely, a  
CD-R disc) may require specifications closer to the  
reference values. The error detection of address  
information according to embodiments of the present  
invention can be applied for distinguishing an optical  
30 disc that satisfies the requirements of a portable  
audio recording and reproducing apparatus and a





additions in the form and detail thereof may be made therein without departing from the spirit and scope of the embodiments of the present invention. For example, instead of addresses of start positions of lead-in area and lead-out area, addresses of end positions and address information that define their lengths (widths) can be used. In addition, as well as addresses that define positions of lead-in and lead-out, addresses that define positions of particular data recorded in the program area may be used. For example, in lead-in area of CD or CD-ROM, as TOC (Table Of Contents), absolute times at which individual movements start are recorded. Thus, as was described above, error detection encoding can be performed for an absolute time at which the first movement starts (namely, the position two or three seconds after the start position of the program area).

As well as the above-described CD-R disc, embodiments of the present invention can be applied to CD-RW disc on which almost the same information as CD-R is recorded corresponding to ATIP. In addition, as well as recordable discs, embodiments of the present invention can be applied to read-only discs such as CD disc and CD-ROM disc. In addition, in the case of CD-R disc and CD-RW disc, the embodiments of the present invention can be applied to recorded address data without pre-recorded address information such as ATIP.

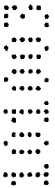
In addition, embodiments of the present invention can be applied to address information in binary notation rather than time information in BCD notation (minutes, seconds, frames). For example, the



CD-RW disc, a data reproducing method and apparatus,  
and a data recoding and reproducing method and  
apparatus.

5 In the claims which follow and in the preceding  
description of the invention, except where the context  
requires otherwise due to express language or necessary  
implication, the word "comprise" or variations such as  
"comprises" or "comprising" is used in an inclusive  
10 sense, i.e. to specify the presence of the stated  
features but not to preclude the presence or addition  
of further features in various embodiments of the  
invention.

15 It is to be understood that, if any prior art  
publication is referred to herein, such reference does  
not constitute an admission that the publication forms  
a part of the common general knowledge in the art, in  
Australia or any other country.



CLAIMS

1. A recording and/or reproducing method for a record medium, comprising the steps of:

5 reading address information from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area, the address information representing the position of the second area;

10 detecting an error corresponding to error detection code encoded for the address information that has been read from the record medium; and

15 when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, notifying at least a user that the error has been detected.

2. The recording and/or reproducing method for the record medium as set forth in claim 1, further comprising the step of:

20 when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, prohibiting data from being recoded to the first area of the record medium.

3. The recording and/or reproducing method for the record medium as set forth in claim 2, further

comprising the step of:

when the result of the detecting step represents that an error has not been detected in the address information that has been read from the record medium, permitting data to be recorded to the first area of the record medium.

5

4. The recording and/or reproducing method for the record medium as set forth in claim 1, further comprising the step of:

10

when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, prohibiting data recorded in the first area of the record medium from being reproduced.

15

5. The recording and/or reproducing method for the record medium as set forth in claim 1, further comprising the step of:

20

when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, permitting data recorded in the first area of the record medium to be reproduced.

25

6. The recording and/or reproducing method for the record medium as set forth in claim 1, further comprising the step of:

when the result of the detecting step represents that an error has been detected in the

address information that has been read from the record medium, prohibiting data from being recorded to the first area of the record medium and permitting data recorded in the first area to be reproduced.

5 7. The recording and/or reproducing method for the record medium as set forth in claim 1, further comprising the step of:

when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, permitting data to be recorded to the first area of the record medium and data recorded in the first area to be reproduced.

10 8. The recording and/or reproducing method for the record medium as set forth in claim 1,

15 wherein the notifying step is performed by displaying an alarm message, when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium.

20 9. The recording and/or reproducing method for the record medium as set forth in claim 1,

25 wherein the notifying step is performed by generating an alarm sound, when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium.

10. The recording and/or reproducing method for the record medium as set forth in claim 1, wherein the detecting step is performed by calculating address information that has been read from the record medium and detecting whether or not the address information that has been read from the record medium has an error depending on whether or not the calculated result is a predetermined value.
- 5
11. The recording and/or reproducing method for the record medium as set forth in claim 10, wherein the address information is information that represents at least the start position of the second area.
- 10
12. The recording and/or reproducing method for the record medium as set forth in claim 11, wherein the address information represents at least minutes, seconds, and frames.
- 15
13. The recording and/or reproducing method for the record medium as set forth in claim 12, wherein a data portion that represents at least the frames of the address information is varied corresponding to data that represents a manufacturer of the record medium.
- 20
14. A recording and/or reproducing method for a record medium, comprising the steps of: reading address information from a record medium, the record medium having at least a first area
- 25

and a second area, data being recordable to the first area, the second area being followed by the first area, the address information representing the position of the second area;

5           detecting an error corresponding to error detection code encoded for the address information that has been read from the record medium; and

          when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, prohibiting data from being recorded to at least the first area of the record medium.

10           15.       The recording and/or reproducing method for the record medium as set forth in claim 14, further comprising the step of:

          when the result of the detecting step represents that an error has not been detected in the address information that has been read from the record medium, permitting data to be recorded to the first area of the record medium.

20           16.       The recording and/or reproducing method for the record medium as set forth in claim 14, further comprising the step of:

          when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, permitting data recorded in the first area of

the record medium to be reproduced.

17. The recording and/or reproducing method for the record medium as set forth in claim 14, further comprising the step of:

5 when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, prohibiting data recorded in the first area of the record medium from being reproduced.

10 18. The recording and/or reproducing method for the record medium as set forth in claim 14, further comprising the step of:

15 when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium, notifying at least a user that the error has been detected.

19. The recording and/or reproducing method for the record medium as set forth in claim 18,

20 wherein the notifying step is performed by displaying an alarm message, when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium.

25 20. The recording and/or reproducing method for the record medium as set forth in claim 18,

wherein the notifying step is performed by

generating an alarm sound, when the result of the detecting step represents that an error has been detected in the address information that has been read from the record medium.

5 21. The recording and/or reproducing method for the record medium as set forth in claim 14,

wherein the detecting step is performed by calculating address information that has been read from the record medium and detecting whether or not the address information that has been read from the record medium has an error depending on whether or not the calculated result is a predetermined value.

10 22. The recording and/or reproducing method for the record medium as set forth in claim 21,

15 wherein the address information is information that represents at least the start position of the second area.

23. The recording and/or reproducing method for the record medium as set forth in claim 22,

20 wherein the address information represents at least minutes, seconds, and frames.

24. The recording and/or reproducing method for the record medium as set forth in claim 23,

25 wherein a data portion that represents at least the frames of the address information is varied corresponding to data that represents a manufacturer of the record medium.

25. A recording and/or reproducing method for a record medium, comprising the steps of:

reading address information from a record medium, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being followed by the third area, the address information being at least one of first address information and second address information, the first address information representing the position of the second area, the second address information representing the position of the third area;

detecting an error corresponding to error detection code encoded for the address information of at least one of the first address information and the second address information that have been read from the record medium; and

when the result of the detecting step represents that an error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium, notifying at least a user that the error has been detected.

26. The recording and/or reproducing method for the record medium as set forth in claim 25, further comprising the step of:

when the result of the detecting step  
represents that an error has been detected in the  
address information of at least one of the first  
address information and the second address information  
5 that have been read from the record medium, prohibiting  
data from being recoded to the first area of the record  
medium.

27. The recording and/or reproducing method for  
the record medium as set forth in claim 26, further  
10 comprising the step of:

when the result of the detecting step  
represents that an error has not been detected in the  
address information of at least one of the first  
address information and the second address information  
15 that have been read from the record medium, permitting  
data to be recorded to the first area of the record  
medium.

28. The recording and/or reproducing method for  
the record medium as set forth in claim 25, further  
20 comprising the step of:

when the result of the detecting step  
represents that an error has been detected in the  
address information of at least one of the first  
address information and the second address information  
25 that have been read from the record medium, prohibiting  
data recorded in the first area of the record medium  
from being reproduced.

29. The recording and/or reproducing method for the record medium as set forth in claim 25, further comprising the step of:

5 when the result of the detecting step represents that an error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium, permitting data recorded in the first area of the record medium to  
10 be reproduced.

30. The recording and/or reproducing method for the record medium as set forth in claim 25, further comprising the step of:

15 when the result of the detecting step represents that an error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium, prohibiting data from being recorded to the first area of the  
20 record medium and permitting data recorded in the first area to be reproduced.

31. The recording and/or reproducing method for the record medium as set forth in claim 25, further comprising the step of:

25 when the result of the detecting step represents that an error has been detected in the address information of at least one of the first

address information and the second address information  
that have been read from the record medium, permitting  
data to be recorded to the first area of the record  
medium and data recorded in the first area to be  
5 reproduced.

32. The recording and/or reproducing method for  
the record medium as set forth in claim 25,

wherein the notifying step is performed by  
displaying an alarm message, when the result of the  
10 detecting step represents that an error has been  
detected in the address information of at least one of  
the first address information and the second address  
information that have been read from the record medium.

33. The recording and/or reproducing method for  
15 the record medium as set forth in claim 25,

wherein the notifying step is performed by  
generating an alarm sound, when the result of the  
detecting step represents that an error has been  
detected in the address information of at least one of  
20 the first address information and the second address  
information that have been read from the record medium.

34. The recording and/or reproducing method for  
the record medium as set forth in claim 25,

wherein the detecting step is performed by  
25 calculating address information of at least one of the  
first address information and the second address  
information that have been read from the record medium

and detecting whether or not the address information that has been read from the record medium has an error depending on whether or not the calculated result is a predetermined value.

5 35. The recording and/or reproducing method for the record medium as set forth in claim 34,  
wherein the first address information is information that represents at least the start position of the second area.

10 36. The recording and/or reproducing method for the record medium as set forth in claim 35,  
wherein the first address information represents at least minutes, seconds, and frames.

15 37. The recording and/or reproducing method for the record medium as set forth in claim 36,  
wherein a data portion that represents at least the frames of the first address information is varied corresponding to data that represents a manufacturer of the record medium.

20 38. The recording and/or reproducing method for the record medium as set forth in claim 34,  
wherein the second address information is information that represents at least the start position of the third area.

25 39. The recording and/or reproducing method for the record medium as set forth in claim 38,  
wherein the second address information

represents at least minutes, seconds, and frames.

40. The recording and/or reproducing method for the record medium as set forth in claim 25,

5 wherein the detecting step is performed by calculating address information of both of the first address information and the second address information that have been read from the record medium and detecting whether or not the first address information and the second address information that have been read  
10 from the record medium have an error depending on whether or not the calculated result is a predetermined value.

41. The recording and/or reproducing method for the record medium as set forth in claim 40,

15 wherein the first address information is information that represents at least the start position of the second area.

42. The recording and/or reproducing method for the record medium as set forth in claim 41,

20 wherein the first address information represents at least minutes, seconds, and frames.

43. The recording and/or reproducing method for the record medium as set forth in claim 42,

25 wherein a data portion that represents at least the frames of the first address information is varied corresponding to data that represents a manufacturer of the record medium.

44. The recording and/or reproducing method for the record medium as set forth in claim 42, wherein the second address information is information that represents at least the start position of the third area.

5

45. The recording and/or reproducing method for the record medium as set forth in claim 44, wherein the second address information represents at least minutes, seconds, and frames.

10

46. The recording and/or reproducing method for the record medium as set forth in claim 45, wherein a data portion that represents at least the frames of the second address information is varied corresponding to data that represents a manufacturer of the record medium.

15

47. A recording and/or reproducing apparatus for a record medium, comprising:

20

a head for reading or reproducing data to/from a record medium, the record medium having at least a first area and a second area, data being recordable to the first area, the second area being followed by the first area;

25

an error checking portion for detecting an error corresponding to error detection code encoded for address information that has been read from the record medium by said head, the address information representing the position of the second area; and

a controlling portion for notifying at least  
a user that an error has been detected, when the result  
of error detection of said error checking portion  
represents that the error has been detected in the  
5 address information that has been read from the record  
medium.

48. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 47,  
wherein said controlling portion prohibits  
10 data from being recoded to the first area of the record  
medium, when the result of error detection of said  
error checking portion represents that an error has  
been detected in the address information that has been  
read from the record medium.

15 49. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 48,  
wherein said controlling portion permits data  
to be recorded to the first area of the record medium,  
when the result of error detection of said error  
20 checking portion represents that an error has not been  
detected in the address information that has been read  
from the record medium.

50. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 47,  
25 wherein said controlling portion prohibits  
data recorded in the first area of the record medium  
from being reproduced, when the result of error

detection of said error checking portion represents that an error has been detected in the address information that has been read from the record medium.

51. The recording and/or reproducing apparatus  
5 for the record medium as set forth in claim 47,

wherein said controlling portion permits data recorded in the first area of the record medium to be reproduced, when the result of error detection of said error checking portion represents that an error has  
10 been detected in the address information that has been read from the record medium.

52. The recording and/or reproducing apparatus for the record medium as set forth in claim 47,

wherein said controlling portion prohibits  
15 data from being recorded to the first area of the record medium and permits data recorded in the first area to be reproduced, when the result of error detection of said error checking portion represents that an error has been detected in the address  
20 information that has been read from the record medium.

53. The recording and/or reproducing apparatus for the record medium as set forth in claim 47,

wherein said controlling portion permits data to be recorded to the first area of the record medium  
25 and data recorded in the first area to be reproduced, when the result of error detection of said error checking portion represents that an error has been

detected in the address information that has been read from the record medium.

54. The recording and/or reproducing apparatus for the record medium as set forth in claim 47, further comprising:

5 a displaying portion,  
wherein said controlling portion causes said displaying portion to display an alarm message, when the result of error detection of said error checking portion represents that an error has been detected in the address information that has been read from the record medium.

55. The recording and/or reproducing apparatus for the record medium as set forth in claim 47,  
15 wherein said controlling portion generates an alarm sound, when the result of error detection of said error checking portion represents that an error has been detected in the address information that has been read from the record medium.

20 56. The recording and/or reproducing apparatus for the record medium as set forth in claim 47,  
wherein said controlling portion calculates address information that has been read from the record medium and detects whether or not the address information that has been read from the record medium has an error depending on whether or not the calculated result is a predetermined value.

57. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 56,  
wherein the address information is  
information that represents at least the start position  
5 of the second area.

58. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 57,  
wherein the address information represents at  
least minutes, seconds, and frames.

10 59. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 58,  
wherein a data portion that represents at  
least the frames of the address information is varied  
corresponding to data that represents a manufacturer of  
15 the record medium.

60. A recording and/or reproducing apparatus for  
a record medium, comprising:  
a head for reading or reproducing data  
to/from a record medium, the record medium having at  
20 least a first area and a second area, data being  
recordable to the first area, the second area being  
followed by the first area;

an error checking portion for detecting an  
error corresponding to error detection code encoded for  
25 address information that has been read from the record  
medium by said head, the address information  
representing the position of the second area; and

a controlling portion for prohibiting data  
from being recorded to at least the first area of the  
record medium, when the result of error detection of  
said error checking portion represents that the error  
5 has been detected in the address information that has  
been read from the record medium.

61. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 60,

10 wherein said controlling portion permits data  
to be recorded to the first area of the record medium,  
when the result of error detection of said error  
checking portion represents that an error has not been  
detected in the address information that has been read  
from the record medium.

15 62. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 60,

20 wherein said controlling portion prohibits  
data recoded in the first area of the record medium  
from being reproduced, when the result of error  
detection of said error checking portion represents  
that an error has been detected in the address  
information that has been read from the record medium.

63. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 60,

25 wherein said controlling portion permits data  
recorded in the first area of the record medium to be  
reproduced, when the result of error detection of said

error checking portion represents that an error has been detected in the address information that has been read from the record medium.

5 64. The recording and/or reproducing apparatus for the record medium as set forth in claim 60, wherein said controlling portion prohibits data from being recorded to the first area of the record medium and permits data recorded in the first area to be reproduced, when the result of error  
10 detection of said error checking portion represents that an error has been detected in the address information that has been read from the record medium.

15 65. The recording and/or reproducing apparatus for the record medium as set forth in claim 60, wherein said controlling portion permits data to be recorded to the first area of the record medium and data recorded in the first area to be reproduced, when the result of error detection of said error  
20 checking portion represents that an error has been detected in the address information that has been read from the record medium.

25 66. The recording and/or reproducing apparatus for the record medium as set forth in claim 60, further comprising:  
a displaying portion,  
wherein said controlling portion causes said displaying portion to display an alarm message, when

the result of error detection of said error checking portion represents that an error has been detected in the address information that has been read from the record medium.

5 67. The recording and/or reproducing apparatus for the record medium as set forth in claim 60,  
wherein said controlling portion generates an alarm sound, when the result of error detection of said error checking portion represents that an error has  
10 been detected in the address information that has been read from the record medium.

68. The recording and/or reproducing apparatus for the record medium as set forth in claim 60,  
wherein said controlling portion calculates  
15 address information that has been read from the record medium and detects whether or not the address information that has been read from the record medium has an error depending on whether or not the calculated result is a predetermined value.

20 69. The recording and/or reproducing apparatus for the record medium as set forth in claim 60,  
wherein the address information is information that represents at least the start position of the second area.

25 70. The recording and/or reproducing apparatus for the record medium as set forth in claim 69,  
wherein the address information represents at



73. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 72,

5 wherein said controlling portion prohibits  
data from being recorded to the first area of the  
record medium, when the result of error detection of  
said error checking portion represents that an error  
has been detected in the address information of at  
least one of the first address information and the  
second address information that have been read from the  
10 record medium.

74. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 73,

15 wherein said controlling portion permits data  
to be recorded to the first area of the record medium,  
when the result of error detection of said error  
checking portion represents that an error has not been  
detected in the address information of at least one of  
the first address information and the second address  
information that have been read from the record medium.

20 75. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 72,

25 wherein said controlling portion prohibits  
data recoded in the first area of the record medium  
from being reproduced, when the result of error  
detection of said error checking portion represents  
that an error has been detected in the address  
information of at least one of the first address

information and the second address information that have been read from the record medium.

76. The recording and/or reproducing apparatus for the record medium as set forth in claim 72,

5            wherein said controlling portion permits data recorded in the first area of the record medium to be reproduced, when the result of error detection of said error checking portion represents that an error has been detected in the address information of at least  
10 one of the first address information and the second address information that have been read from the record medium.

77. The recording and/or reproducing apparatus for the record medium as set forth in claim 72,

15            wherein said controlling portion prohibits data from being recorded to the first area of the record medium and permits data recorded in the first area to be reproduced, when the result of error detection of said error checking portion represents  
20 that an error has been detected in the address information of at least one of the first address information and the second address information that have been read from the record medium.

78. The recording and/or reproducing apparatus for the record medium as set forth in claim 72,

25            wherein said controlling portion permits data to be recorded to the first area of the record medium

and data recorded in the first area to be reproduced,  
when the result of error detection of said error  
checking portion represents that an error has been  
detected in the address information of at least one of  
5 the first address information and the second address  
information that have been read from the record medium.

79. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 72, further  
comprising:

10 a displaying portion,  
wherein said controlling portion causes said  
displaying portion to display an alarm message, when  
the result of error detection of said error checking  
portion represents that an error has been detected in  
15 the address information of at least one of the first  
address information and the second address information  
that have been read from the record medium.

80. The recording and/or reproducing apparatus  
for the record medium as set forth in claim 72,

20 wherein said controlling portion generates an  
alarm sound, when the result of error detection of said  
error checking portion represents that an error has  
been detected in the address information of at least  
one of the first address information and the second  
25 address information that have been read from the record  
medium.

81. The recording and/or reproducing apparatus

for the record medium as set forth in claim 72,

          wherein said controlling portion calculates  
address information of at least one of the first  
address information and the second address information  
5 that have been read from the record medium and detects  
whether or not the address information of at least one  
of the first address information and the second address  
information that have been read from the record medium  
has an error depending on whether or not the calculated  
10 result is a predetermined value.

82.       The recording and/or reproducing apparatus  
for the record medium as set forth in claim 81,

          wherein the first address information is  
information that represents at least the start position  
15 of the second area.

83.       The recording and/or reproducing apparatus  
for the record medium as set forth in claim 82,

          wherein the first address information  
represents at least minutes, seconds, and frames.

20 84.       The recording and/or reproducing apparatus  
for the record medium as set forth in claim 83,

          wherein a data portion that represents at  
least the frames of the first address information is  
varied corresponding to data that represents a  
25 manufacturer of the record medium.

85.       The recording and/or reproducing apparatus  
for the record medium as set forth in claim 81,

wherein the second address information is information that represents at least the start position of the third area.

86. The recording and/or reproducing apparatus  
5 for the record medium as set forth in claim 83,

wherein the second address information represents at least minutes, seconds, and frames.

87. A record medium having:  
10 a first area on which data is recordable;  
a second area followed by the first area; and  
a third area preceded by the first area,  
wherein address information that represents  
at least the position of the second area is recorded by  
an error detection process with error detection code,  
15 and

wherein the address information is a value that satisfies a predetermined calculation expression.

88. The record medium as set forth in claim 87,  
20 wherein the address information is information that represents at least the start position of the second area.

89. The record medium as set forth in claim 88,  
wherein the address information represents at least minutes, seconds, and frames.

25 90. The record medium as set forth in claim 89,  
wherein a data portion that represents at least the frames of the address information is varied

corresponding to data that represents a manufacturer of the record medium.

91. The record medium as set forth in claim 87,  
wherein further address information that  
5 represents the position of the third area is recorded  
by an error detection process with error detection code,  
and

wherein the address information is a value  
that satisfies a predetermined calculation expression.

10 92. The record medium as set forth in claim 91,  
wherein the further address information is  
information that represents at least the start position  
of the third area.

93. The record medium as set forth in claim 92,  
15 wherein the further address information  
represents at least minutes, seconds, and frames.

94. The record medium as set forth in claim 87,  
wherein the record medium is a recordable  
optical disc.

20 95. A record medium having:  
a first area on which data is recordable;  
a second area followed by the first area; and  
a third area preceded by the first area,  
wherein address information that represents  
25 at least the position of the second area is recorded by  
an error detection process with error detection code,  
and

wherein a low order portion of the address information is selected corresponding to data that represents a manufacturer.

5 96. The record medium as set forth in claim 95, wherein the address information is information that represents at least the start position of the second area.

10 97. The record medium as set forth in claim 96, wherein the address information represents at least minutes, seconds, and frames.

98. The record medium as set forth in claim 95, wherein the address information is a value that satisfies a predetermined calculation expression.

15 99. The record medium as set forth in claim 95, wherein further address information that represents the position of the third area is recorded by an error detection process with error detection code, and

20 wherein the address information is a value that satisfies a predetermined calculation expression.

100. The record medium as set forth in claim 99, wherein the further address information is information that represents at least the start position of the third area.

25 101. The record medium as set forth in claim 100, wherein the further address information represents at least minutes, seconds, and frames.

" " " "

102. The record medium as set forth in claim 95,  
wherein the record medium is a recordable  
optical disc.

5 103. A record medium determining method,  
comprising the steps of:  
reading address information from a record  
medium loaded to an apparatus, the record medium having  
at least a first area, a second area, and a third area,  
data being recordable to the first area, the second  
10 area being followed by the first area, the data record  
area being followed by the third area, the address  
information being at least one of first address  
information and second address information, the first  
address information representing the position of the  
15 second area, the second address information  
representing the position of the third area;

detecting an error corresponding to error  
detection code encoded for the address information of  
at least one of the first address information and the  
20 second address information that have been read from the  
record medium; and

determining whether or not the loaded record  
medium is suitable for the apparatus corresponding to  
the result of the detecting step.

25 104. The record medium determining method as set  
forth in claim 103,  
wherein the determining step is performed by

" v "  
" " "

determining that the loaded record medium is not  
suitable for the apparatus and notifying at least a  
user of it when the result of the detecting step  
represents that an error has been detected in the  
5 address information of at least one of the first  
address information and the second address information  
that have been read from the record medium.

105. The record medium determining method as set  
forth in claim 104,

10 wherein the determining step is performed by  
calculating address information of at least one of the  
first address information and the second address  
information that have been read from the record medium  
and determining whether or not the record medium loaded  
15 to the apparatus is suitable therefor depending on  
whether or not the calculated result is a predetermined  
value.

106. The record medium determining method as set  
forth in claim 105,

20 wherein the first address information is  
information that represents at least the start position  
of the second area.

107. The record medium determining method as set  
forth in claim 106,

25 wherein the first address information  
represents at least minutes, seconds, and frames.

108. The record medium determining method as set

forth in claim 107,

wherein a data portion that represents at least the frames of the first address information is varied corresponding to data that represents a manufacturer of the record medium.

5

109. The record medium determining method as set forth in claim 103,

wherein the determining step is performed by calculating address information of both of the first address information and the second address information that have been read from the record medium, detecting whether or not the first address information and the second address information that have been read from the record medium have an error depending on whether or not the calculated result is a predetermined value, and determining that the record medium loaded to the apparatus is not suitable therefor when the detected result represents that the first address information and the second address information have an error.

10

15

20

110. The record medium determining method as set forth in claim 109,

wherein the first address information is information that represents at least the start position of the second area.

25

111. The record medium determining method as set forth in claim 110,

wherein the first address information

represents at least minutes, seconds, and frames.

112. The record medium determining method as set forth in claim 111,

5 wherein a data portion that represents at least the frames of the first address information is varied corresponding to data that represents a manufacturer of the record medium.

113. The record medium determining method as set forth in claim 109,

10 wherein the second address information is information that represents at least the start position of the third area.

114. The record medium determining method as set forth in claim 113,

15 wherein the second address information represents at least minutes, seconds, and frames.

115. A recording and/or reproducing method for an apparatus that uses a record medium, comprising the steps of:

20 reading address information from a record medium loaded to an apparatus, the record medium having at least a first area, a second area, and a third area, data being recordable to the first area, the second area being followed by the first area, the data record area being followed by the third area, the address  
25 information being at least one of first address information and second address information, the first

address information representing the position of the second area, the second address information representing the position of the third area;

5 detecting an error corresponding to error detection code encoded for the address information of at least one of the first address information and the second address information that have been read from the record medium; and

10 determining whether or not the loaded record medium is suitable for the apparatus corresponding to the result of the detecting step.

116. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115,

15 wherein the determining step is performed by determining that the loaded record medium is not suitable for the apparatus when the result of the detecting step represents that an error has been detected in the address information of at least one of  
20 the first address information and the second address information that have been read from the record medium.

117. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 116, further comprising the step of:

25 displaying an alarm message that notifies a user that the loaded record medium is not suitable for the apparatus.

118. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 116, further comprising the step of:

5 generating an alarm sound that notifies a user that the loaded record medium is not suitable for the apparatus.

119. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115, further comprising the step of:

10 when the determined result of the determining step represents that the loaded record medium is not suitable for the apparatus, prohibiting data from being recorded to the first area of the record medium.

120. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 119, further comprising the step of:

15 when the determined result of the determining step represents that the loaded record medium is suitable for the apparatus, permitting data to be recorded to the first area of the record medium.

121. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115, further comprising the step of:

20 when the determined result of the determining step represents that the loaded record medium is not suitable for the apparatus, prohibiting data recorded in the first area of the record medium from being

reproduced.

122. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115, further comprising the step of:

5 when the determined result of the determining step represents that the loaded record medium is not suitable for the apparatus, permitting data recorded in the first area of the record medium to be reproduced.

123. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115, further comprising the step of:

10 when the determined result of the determining step represents that the loaded record medium is not suitable for the apparatus, prohibiting data from being recorded to the first area of the record medium and permitting data recorded in the first area to be reproduced.

124. The recording and/or reproducing method for the apparatus that uses the record medium as set forth in claim 115, further comprising the step of:

20 when the determined result of the determining step represents that the loaded record medium is not suitable for the apparatus, permitting data to be recorded to the first area of the record medium and data recorded in the first area to be reproduced.

125. A method as claimed in any one of claims 1 to 46, or 115 to 124, and substantially as herein described with reference to the accompanying drawings.

126. An apparatus as claimed in any one of claims 47 to 86, and substantially as herein described with reference to the accompanying drawings.

127. A record medium as claimed in any one of claims 87 to 102, and substantially as herein described with reference to the accompanying drawings.

128. A record medium determining method as claimed in  
5 any one of claims 103 to 114, and substantially as herein described with reference to the accompanying drawings.

Dated this 10th day of October 2003

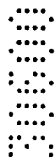
SONY CORPORATION

10 By their Patent Attorneys

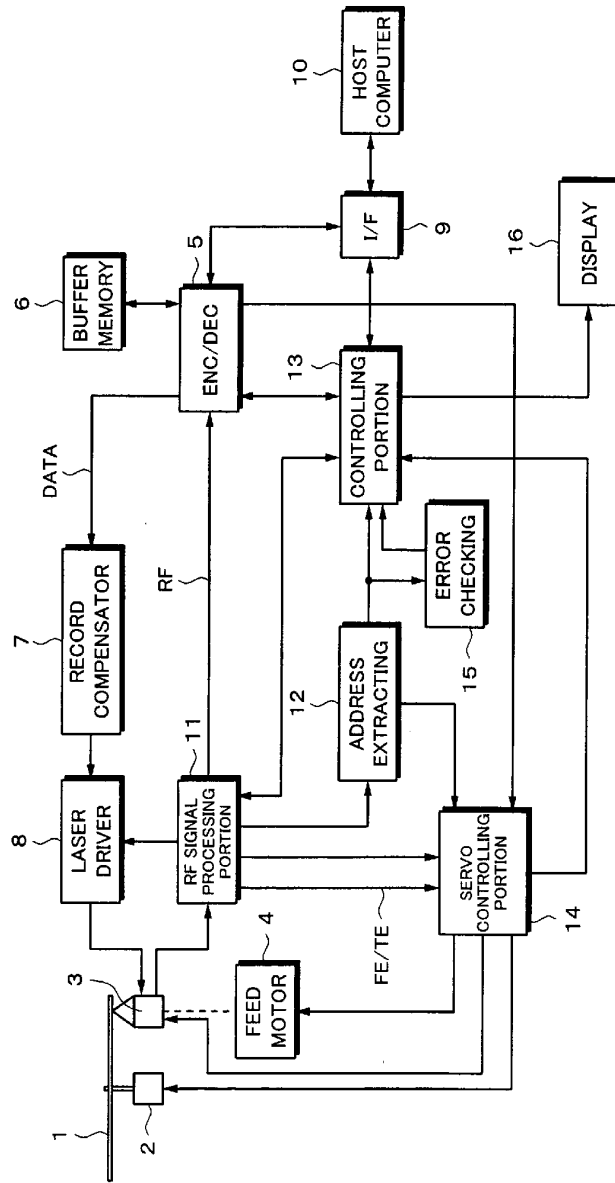
GRIFFITH HACK

Fellows Institute of Patent and  
Trade Mark Attorneys of Australia

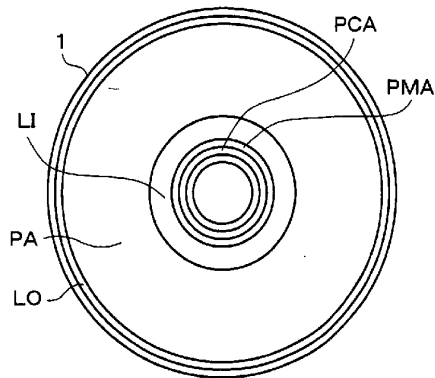
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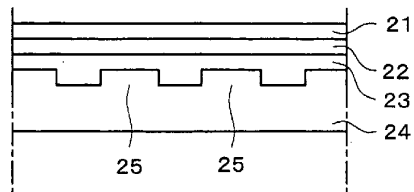
**Fig. 1**



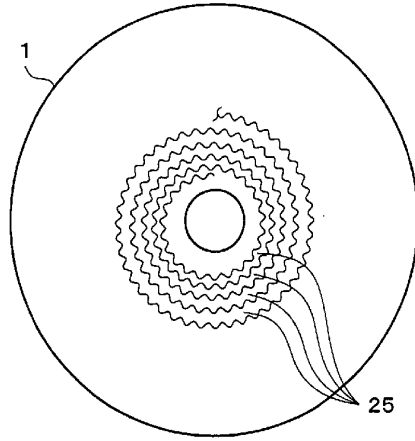
**Fig. 2**



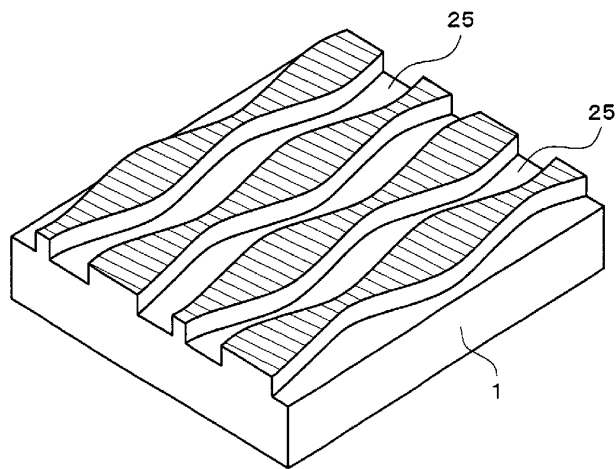
**Fig. 3**



**Fig. 4**

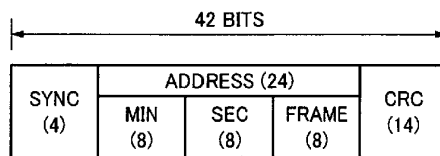


**Fig. 5**



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**Fig. 6**



**Fig. 7**

M1	S1	F1	CONTENTS OF INFORMATION
0	0	0	ADDRESSES OF PROGRAM AREA AND LEAD-OUT AREA
1	0	0	ADDRESSES OF PA, PMA, AND LEAD-IN AREA
1	0	1	SPECIAL INFORMATION 1: WRITE POWER AT REFERENCE SPEED
1	1	0	SPECIAL INFORMATION 2: START ADDRESS OF LEAD-IN AREA
1	1	1	SPECIAL INFORMATION 3: FINAL VALID START ADDRESS OF LEAD-OUT AREA
0	0	1	ADDITIONAL INFORMATION 1: NOT USED (RESERVED)
0	1	0	ADDITIONAL INFORMATION 2: NOT USED (RESERVED)
0	1	1	ADDITIONAL INFORMATION 3: NOT USED (RESERVED)

**Fig. 8**

FRAME NUMBER	CONTENTS OF FRAME
N	SPECIAL INFORMATION 1
N+1 : N+9	REGULAR ADDRESSES
N+10	SPECIAL INFORMATION 2
N+11 : N+19	REGULAR ADDRESSES
N+20	SPECIAL INFORMATION 3
N+21 : N+29	REGULAR ADDRESSES
N+30	SPECIAL INFORMATION 1
N+31 : N+39	REGULAR ADDRESSES
N+40	SPECIAL INFORMATION 2
N+41 : N+49	REGULAR ADDRESSES
N+50	SPECIAL INFORMATION 3
N+51 :	REGULAR ADDRESSES

**Fig. 9**

DISC REPRODUCTION DURATION	CLV	LEAD-IN POSITION	LEAD-IN LENGTH	LEAD-IN START TIME
64 MINUTES	1.4m/sec	23.0~24.9mm 22.9~24.9mm	02:07:48 (min) 02:14:06 (max)	97:52:27 97:45:69
74 MINUTES	1.2m/sec	23.0~24.9mm 22.9~24.9mm	02:28:68 (min) 02:36:32 (max)	97:31:07 97:23:43

**Fig. 10**

Manufacturer	1st CODE (74 MINUTES)	2nd CODE (64 MINUTES)
A	97m28s40f~97m28s49f	
B	97m23s60f~97m23s69f	
C	97m29s00f~97m29s09f	
D	97m26s10f~97m26s19f	97m47s40f~97m47s49f
E	97m24s10f~97m24s19f	
F	97m23s10f~97m23s19f	
		CHARACTERS CHARACTERS CHARACTERS CHARACTERS
G	97m24s00f~97m24s09f	97m46s00f~97m46s09f
H	97m32s00f~97m32s29f	97m49s00f~97m49s09f
CHARACTERS	CHARACTERS	CHARACTERS
CHARACTERS	CHARACTERS	CHARACTERS
CHARACTERS	CHARACTERS	CHARACTERS
CHARACTERS	CHARACTERS	CHARACTERS
I	97m26s00f~97m26s09f	97m28s40f~97m28s49f

DESCRIPTION OF REFERENCE NUMERALS

- 1 OPTICAL DISC
- 3 OPTICAL PICKUP
- 8 LASER DRIVER
- 10 EXTERNAL HOST COMPUTER
- 11 RF SIGNAL PROCESSING PORTION
- 12 ADDRESS EXTRACTING PORTION
- 13 CONTROLLING PORTION