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barcoded information such as a serial number, etc. recorded in the non-information area, however, a separate reading device has been used.

In the above prior art optical disk, since information carrying a serial number and the like is not recorded in a pit area but recorded in a non-information area, as described above, a separate reading device has had to be provided in addition to the usual optical pickup, the resulting problem being increased complexity of the playback apparatus construction.

DISCLOSURE OF THE INVENTION

10 The present invention provides an optical disk on which data is recorded, wherein in a prescribed region of said disk, an identifier is provided for indicating whether a barcode-like mark is present or not on said optical disk, said identifier and said barcode-like mark are in respectively different locations on said disk, said barcode-like mark disposed in a circumferential direction and, said barcode-like mark having a plurality of
15 bars, each of said bars extending in a radial direction.

The present invention further provides an optical disk reproduction apparatus for use with a disk on which data is recorded, wherein in a prescribed region of said disk, an identifier is provided for indicating whether a barcode-like mark is present or not on said optical disk, said identifier and said barcode-like mark are in respectively different
20 locations on said disk, said barcode-like mark disposed in a circumferential direction, and said barcode-like mark having a plurality of bars, each of said bars extending in a radial direction, said apparatus comprising:

reproduction means for reproducing said barcode-like mark on said optical disk;
identifier detection means for detecting said identifier on said optical disk, and
25 control means for controlling a prescribed operation based on said identifier detected by said identifier detection means.

A first embodiment of the invention relates to an optical disk on which data is recorded with CLV, wherein, in a prescribed region of a pre-pit signal area on said disk, all or part of a barcode is written in overwriting fashion by selectively removing a reflective
30 film in said prescribed region.

A second embodiment of the invention relates to an optical disk according to the



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first embodiment wherein a control data area is provided for holding therein physical feature information concerning said optical disk, and an identifier for indicating the presence or absence of said barcode is recorded in said control data area.

A third embodiment of the invention relates to an optical disk according to the
5 second embodiment, wherein a guard-band area where no data is recorded is provided between said control data area and said prescribed region of said pre-pit signal area.

A fourth embodiment of the invention relates to an optical disk according to the first embodiment, wherein said barcode is formed in such a manner that two or more barcode signals cannot occur within one prescribed time slot.

10 A fifth embodiment of the invention relates to an optical disk according to the first embodiment, wherein said barcode contains data at least including ID information uniquely given to said optical disk.

A sixth embodiment of the invention relates to an optical disk according to the fifth
15 embodiment, wherein said barcode contains data including, in addition to said ID information, a public key of a public key encryption function corresponding to said ID information, said public key is used to encrypt prescribed data, and the encrypted prescribed data is transmitted to an external party in order to obtain from said external party a password required to reproduce said optical disk.

A seventh embodiment of the invention relates to an optical disk according to the
20 fifth embodiment, wherein said ID information is encrypted or applied a digital signature to.

An eighth embodiment of the invention relates to an optical disk according to the seventh embodiment, wherein a secret key of a public key encryption function is used when applying encryption or a digital signature to said ID information.

25 A ninth embodiment of the invention relates to an optical disk according to any one of the first to eighth embodiments, wherein said optical disk is constructed from two disk-substrates laminated together.

A tenth embodiment of the invention relates to an optical disk barcode forming
30 method wherein pulsed laser light from a light source is made into a rectangular beam pattern by using a rectangular mask and said rectangular beam pattern is focused on a reflective film in pre-pit signal region in a prescribed radius portion of an optical disk on

which data is recorded, and at the same time, said optical disk is rotated, thereby forming a plurality of rectangular reflective-film-removed regions as a barcode in the same radius portion on said reflective film.

An eleventh embodiment of the invention relates to an optical disk barcode forming
5 method according to the tenth embodiment, wherein said optical disk includes a control data area for holding therein physical feature information concerning said optical disk, and an identifier for indicating the presence or absence of said barcode is recorded in said control data area.

A twelfth embodiment of the invention relates to an optical disk barcode forming
10 method according to the eleventh embodiment, wherein said barcode is formed in such a manner that two or more barcode signals cannot occur within one prescribed time slot.

A thirteenth embodiment of the invention relates to an optical disk barcode forming method according to any one of the tenth to twelfth embodiments, wherein said optical disk is constructed from two disk-substrates laminated together.

15 A fourteenth embodiment of the invention relates to an optical disk reproduction apparatus wherein recorded contents of a recording area, recorded by forming pits on an optical disk, are reproduced by using a rotational phase control for a motor, while recorded contents of a different recording area other than said recording area, recorded by selectively forming low-reflectivity portions on a reflective film in said different recording
20 area, are reproduced by using rotational speed control for said motor, and

the recorded contents of said recording area and the recorded contents of said different recording area both reproduced by using the same optical pickup.

A fifteenth embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein tracking control is not
25 performed in said different recording area.

A sixteenth embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein tracking control is, in effect, performed in said different recording area.

A seventeenth embodiment of the invention relates to an optical disk reproduction
30 apparatus according to the sixteenth embodiment, wherein a rotational speed is the rotational speed that would be achieved in said different recording area if said rotational

phase control were applied.

An eighteenth embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein the rotational speed of said motor in said rotational speed control is maintained at a prescribed value based on a result
5 obtained by measuring a minimum length pit in said different recording area.

A nineteenth embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein said low-reflectivity portions are a barcode formed by selectively removing said reflective film.

A twentieth embodiment of the invention relates to an optical disk reproduction
10 apparatus according to the fourteenth embodiment wherein

said low reflectivity portions are a barcode, said different recording area is also such area to which contents are recorded with pits, and

when reproducing the recorded contents of said different recording area, a high-frequency-component signal generated during reproduction of said pits which are formed
15 in said different recording area is reduced or eliminated by a low-pass filter, thereby making it possible to separate a signal which is reproduced from said barcode.

A twenty first embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein

said low reflectivity portions are a barcode, and

20 when reproducing the recorded contents of said different recording area, the width of a signal obtained by reading said barcode is increased to a prescribed width and then measured with sampling pulses from a control section.

A twenty second embodiment of the invention relates to an optical disk reproduction apparatus according to any one of the fourteenth to twenty first embodiments,
25 wherein said optical disk is constructed from two disk-substrates laminated together.

A twenty third embodiment of the invention relates to an optical disk reproduction apparatus according to the fourteenth embodiment, wherein said optical disk includes a control data area for holding therein physical feature information concerning said optical disk, and an identifier for indicating the presence or absence of said barcode is recorded in
30 said control data area.

A twenty fourth embodiment of the invention relates to an optical disk reproduction

apparatus according to the twenty third embodiment, wherein, after reading recorded contents of said control data area and judging the presence or absence of said barcode, it is determined whether an optical pickup should be moved to an inner portion or an outer portion of said optical disk.

5 A twenty fifth embodiment of the invention relates to a marking forming apparatus which comprises:

marking forming means for applying a marking on a reflective film formed on a disk;

marking position detecting means for detecting a position of said marking; and

10 position information writing means for converting at least said detected position information or information concerning said position information into a barcode, and for selectively removing said reflective film to write said barcode to an optical disk on which data is recorded with CLV,

 wherein all or part of said barcode is written in overwriting fashion to a prescribed
15 region of a pre-pit signal area on said optical disk.

 The twenty sixth embodiment of the invention relates to a marking forming apparatus according to the twenty fifth embodiment, wherein said disk is constructed from two disk-substrates laminated together.

 A twenty seventh embodiment of the invention relates to a marking forming means
20 according to the twenty fifth embodiment, wherein said position information writing means includes encrypting means for encrypting at least said detected position information or information concerning said position information, and writes contents thus encrypted to said disk.

 A twenty eighth embodiment of the invention relates to a marking forming
25 apparatus according to the twenty fifth embodiment, wherein said position information writing means includes digital signature means for applying a digital signature to at least said detected position information or information concerning said position information,

 and the writing at least said detected position information or information concerning said position information means writing information concerning a result of said
30 digital signature application to said disk.

 A twenty ninth embodiment of the invention relates to a reproduction apparatus

which comprises:

position information reading means for reading position information of a marking or information concerning said position information, said position information or said information being formed by (1) applying a marking on a reflective film formed on a disk,
5 (2) detecting position of the marking, (3) converting detected said position information or said information into a barcode, and (4) writing the barcode with selectively removing said reflective film on said optical disk on which data is recorded with CLV;

marking reading means for reading information concerning a physical position of said marking;

10 comparing/judging means for performing comparison and judgement by using a result of reading by said position information reading means and a result of reading by said marking reading means; and

reproducing means for reproducing data recorded on said optical disk in accordance with a result of the comparison and judgement performed by said comparing/judging
15 means,

wherein all or part of said barcode is written in overwriting fashion to a prescribed region of a pre-pit signal area on said optical disk.

A thirtieth embodiment of the invention relates to a reproduction apparatus according to the twenty ninth embodiment, wherein at least said detected position
20 information or information concerning said position information is written to said disk by position information writing means.

A thirty first embodiment of the invention relates to a reproduction apparatus according to the thirtieth embodiment, wherein

said position information writing means includes encrypting means for encrypting
25 at least said detected position information or information concerning said position information, and

said position information reading means includes decrypting means corresponding to said encrypting means, and by using said decrypting means, decrypts said encrypted position information or information concerning said position information.

30 A thirty second embodiment of the invention relates to a reproduction apparatus according to the thirtieth embodiment, wherein

said position information writing means includes digital signature means for applying a digital signature to at least said detected position information or information concerning said position information, and writes information concerning a result of said digital signature application to said disk,

5 and said position information reading means includes
 authenticating means corresponding to said digital signature means, and
 position information extracting means for obtaining said position information from an authentication process performed by said authenticating means and/or from said information concerning the result of said digital signature application,

10 when an output indicating correctness of said authentication result is produced from said authenticating means, said comparing/judging means performs the comparison and judgement by using the position information obtained by said position information extracting means and the result of reading by said marking reading means, and when said output indicating correctness is not produced, the reproduction is not performed.

15 A thirty third embodiment of the invention relates to a method of manufacturing a disk, which comprises the steps of:

 forming at least one disk;
 forming a reflective film to said formed disk;
 applying at least one marking to said reflective film;
20 detecting at least one position of said marking; and
 encrypting said detected position information and writing said encrypted information onto said disk,

 wherein, when encrypting and writing, at least said encrypted information is converted into a barcode, and said barcode is written by selectively removing said
25 reflective film on said disk on which data is recorded with CLV, and all or part of said barcode is written in overwriting fashion to a prescribed region of a pre-pit signal area on said disk.

 A thirty fourth embodiment of the invention relates to a method of manufacturing a disk, which comprises the steps of:

30 forming at least one disk;
 forming a reflective film to said formed disk;

applying at least one marking to said reflective film;
detecting at least one position of said marking; and
applying a digital signature to said detected position information and writing onto
said disk,

5 wherein, when applying said digital signature and writing, at least a result of said
digital signature is converted into a barcode, and said barcode is written by selectively
removing said reflective film on said disk on which data is recorded with CLV, all or part
of said barcode being written in overwriting fashion to a prescribed region of a pre-pit
signal area on said disk.

10 A thirty fifth embodiment of the invention relates to a disk wherein a marking is
formed by a laser to a reflective film of said disk holding data written thereon, at least
position information of said marking or information concerning said position information
is encrypted or applied a digital signature, at least said encrypted information or digital
signature-appended information is converted into a barcode, and said barcode is written by
15 selectively removing said reflective film on said disk on which data is recorded with CLV,
all or part of said barcode being written in overwriting fashion to a prescribed region of a
pre-pit signal area on said disk.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Figure 1 is a diagram showing a disk manufacturing process and a secondary
recording process;

Figure 2(a) is a top plan view of a disk, (b) is a top plan view of the disk, (c) is a
top plan view of the disk, (d) is a transverse sectional view of the disk, and (e) is a
waveform diagram of a reproduced signal;

25 Figure 3 is a flowchart illustrating a process of recording encrypted position
information on a disk in the form of a barcode;

Figure 4 is a diagram showing a disk fabrication process and a secondary recording
process (part 1);

Figure 5 is a diagram showing a disk fabrication process and a secondary recording
30 process (part 2);

Figure 6 is a diagram showing a two-layer disk fabrication process (part1);

Figure 7 is a diagram showing the two-layer disk fabrication process (part 2);

Figure 8(a) is an enlarged view of a non-reflective portion of a laminated type, and (b) is an enlarged view of a non-reflective portion of a single-plate type;

Figure 9(a) is a reproduced-waveform diagram for a non-reflective portion, (b) is a reproduced-waveform diagram for a nonreflective portion, (c) is a reproduced-waveform diagram for a nonreflective portion, and (d) is a plan view of a master disk produced by a master disk method;

Figure 10 is a cross-sectional view of a non-reflective portion of the laminated type, and (b) is a cross-sectional view of a non-reflective portion of the single-plate type;

Figure 11 is a schematic diagram, based on an observation through a transmission electron microscope, illustrating a cross section of the nonreflective portion;

Figure 12(a) is a cross-sectional view of a disk, and (b) is a cross-sectional view of the nonreflective portion of the disk;

Figure 13(a) is a diagram showing a physical arrangement of addresses on a legitimate CD, and (b) is a physical arrangement of addresses on an illegally duplicated CD;

Figure 14(a) is a diagram showing part (b) of Figure 33 in further detail, (b) is a diagram showing an equivalent data structure for ECC encoding/decoding, (c) is a diagram showing mathematical equation for ECC computation, and (d) is a diagram showing a mathematical equation for ECC computation;

Figure 15 is a block diagram of a low-reflectivity position detector;

Figure 16 is a diagram illustrating the principle of detecting address/clock positions of a low-reflectivity portion;

Figure 17 is a diagram showing a comparison of low-reflectivity portion address tables for a legitimate disk and a duplicated disk;

Figure 18A is a flowchart illustrating a procedure for encryption, etc. using an RSA function;

Figure 18B is a flowchart illustrating a position information check process;

Figure 19 is a flowchart illustrating a low-reflectivity position detecting program;

Figure 20 is a diagram showing a detected waveform of a first-layer marking signal;

Figure 21 is a diagram showing a detected waveform of a second-layer marking signal;

Figure 22 is a flowchart illustrating the function of a scramble identifier and the switching between drive ID and disk ID in a program installation process;

5 Figure 23 is a block diagram of a stripe recording apparatus;

Figure 24 is a diagram showing a signal waveform and a trimming pattern in RZ recording;

Figure 25 is a diagram showing a signal waveform and a trimming pattern in NRZ recording;

10 Figure 26 is a diagram showing a signal waveform and a trimming pattern in PE-RZ recording;

Figure 27 is a diagram showing a top plan view of disk stripes, along with signal waveforms;

15 Figure 28(a) is a perspective view of a converging unit, and (b) is a diagram showing a stripe arrangement and an emitting-pulse signal;

Figure 29(a) is a perspective view of the converging unit, with a beam deflector appended thereto, and (b) is a diagram showing a stripe arrangement and an emitting-pulse signal;

20 Figure 30 is a diagram showing the arrangement of stripes on a disk and the contents of control data;

Figure 31 is a flowchart illustrating how control mode is switched between CAV and CLV when playing back stripes;

Figure 32 is a diagram showing a stripe area and an address area on a disk;

25 Figure 33(a) is a diagram showing a data structure after ECC encoding, (b) is a diagram showing a data structure after ECC encoding (when $n = 1$), and (c) is a diagram showing an ECC error-correction capability;

Figure 34 is a diagram showing the data structure of a synchronisation code;

Figure 35(a) is a diagram showing the configuration of an LPF, and (b) is a diagram showing a waveform filtered through the LPF;

30 Figure 36(a) is a diagram showing a reproduced signal waveform, and (b) is a diagram for explaining a dimensional accuracy of a stripe;

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Figure 37 is a diagram showing a synchronization code and a laser emitting pulse signal waveform;

Figure 38 is a diagram showing a procedure for reading control data for playback;

Figure 39 is a diagram showing a top plan view of a disk having a pinhole-like
5 optical marking as a physical feature;

Figure 40 is a diagram showing a procedure for playing back a PCA area in a tracking ON condition;

Figure 41 is a block diagram of a playback apparatus implementing rotational speed control;

10 Figure 42 is a block diagram of a playback apparatus implementing rotational speed control;

Figure 43 is a block diagram of a playback apparatus implementing rotational speed control;

Figure 44 is a diagram illustrating a piracy prevention algorithm;

15 Figure 45 is a diagram for explaining barcode encryption;

Figure 46 is a diagram showing another application example of the barcode;

Figure 47 is a perspective view showing a nonreflective portion formed in a two-layer disk; and

Figure 48 is a diagram showing a comparison of address coordinate positions on
20 different master disks.

Description of the Reference Numerals

584. LOW-REFLECTIVITY PORTION, 586. LOW REFLECTIVITY LIGHT AMOUNT
DETECTOR, 587. LIGHT AMOUNT LEVEL COMPARATOR, 588. LIGHT AMOUNT
REFERENCE VALUE, 599. LOW REFLECTIVITY PORTION START/END POSITION
25 DETECTOR, 600. LOW REFLECTIVITY PORTION POSITION DETECTOR, 601.
LOW-REFLECTIVITY PORTION ANGULAR POSITION SIGNAL OUTPUT
SECTION, 602. LOW-REFLECTIVITY PORTION ANGULAR POSITION
DETECTOR, 605. LOW REFLECTIVITY PORTION START POINT, 606. LOW
REFLECTIVITY PORTION END POINT, 607. TIME DELAY CORRECTOR, 816.
30 DISK MANUFACTURING PROCESS, 817. SECONDARY RECORDING PROCESS,
818. DISK

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disk, all or part of a barcode is written in overwriting fashion by selectively removing a reflective film in said prescribed region, and when playing back the disk by a reproduction apparatus, the barcode data can be played back using the same optical pickup.

- 5 Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

WHAT IS CLAIMED:-

1. An optical disk on which data is recorded, wherein in a prescribed region of said disk, an identifier is provided for indicating whether a barcode-like mark is present or not
5 on said optical disk, said identifier and said barcode-like mark are in respectively different locations on said disk, said barcode-like mark disposed in a circumferential direction and, said barcode-like mark having a plurality of bars, each of said bars extending in a radial direction.
2. An optical disk according to claim 1, wherein one of said bars has a lower
10 reflectivity than an average reflectivity of an area between said one of said bars and another of said bars.
3. An optical disk reproduction apparatus for use with a disk on which data is recorded, wherein in a prescribed region of said disk, an identifier is provided for indicating whether a barcode-like mark is present or not on said optical disk, said identifier
15 and said barcode-like mark are in respectively different locations on said disk, said barcode-like mark disposed in a circumferential direction, and said barcode-like mark having a plurality of bars, each of said bars extending in a radial direction, said apparatus comprising:
reproduction means for reproducing said barcode-like mark on said optical disk;
20 identifier detection means for detecting said identifier on said optical disk, and
control means for controlling a prescribed operation based on said identifier detected by said identifier detection means.
4. An optical disk reproduction apparatus according to claim 3, wherein said reproduction means includes an optical head for performing reproduction.
- 25 5. An optical disk reproduction apparatus according to claim 3, wherein an indication of absence of said mark is output.