



(51) International Patent Classification:

G11B 7/005 (2006.01) *G11B 7/243* (2006.01)
G11B 7/24 (2006.01) *G11B 7/258* (2006.01)
G11B 7/241 (2006.01) *G11B 7/257* (2006.01)

(21) International Application Number:

PCT/EP2009/057416

(22) International Filing Date:

16 June 2009 (16.06.2009)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

08159337.8 30 June 2008 (30.06.2008) EP

(71) Applicant (for all designated States except US): **THOMSON LICENSING** [FR/FR]; 46 Quai A. Le Gallo, F-92100 Boulogne-Billancourt (FR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PILARD, Gael** [FR/DE]; Muehlenstrasse 51, 78087 Moenchweiler (DE). **VON RIEWEL, Larisa** [RO/DE]; Johann-Jacob-Riegger Str. 14, 78050 Villingen-Schwenningen (DE). **FERY, Christophe** [FR/DE]; Peter-Garten 3, 78078 Niedereschach (DE).

(74) Agent: **SCHMIDT-UHLIG, Thomas**; Deutsche Thomson OHG, European Patent Operations, Karl-Wiechert-Allee 74, 30625 Hannover (DE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: COMPATIBLE OPTICAL RECORDING MEDIUM

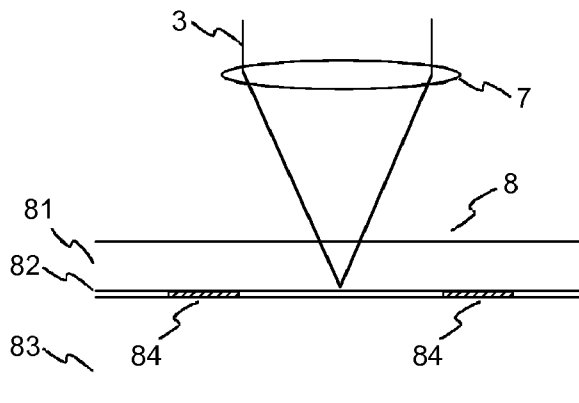


Fig. 3

(57) Abstract: The present invention relates to a format of a recordable optical recording medium (8), which is designed in such a way that it has the appearance of a read-only optical recording medium for most players and recorders, and to a method for manufacturing the recordable optical recording medium (8). The optical recording medium (8) has an essentially flat recording layer (82) having a first reflectivity at a wavelength specified for a reading and/or recording light beam (3), which has an alloyed guide track (84) formed of the material of the essentially flat recording layer (82) with a second reflectivity different from the first reflectivity at the specified wavelength.



Compatible optical recording medium

The present invention relates to a format of a recordable optical recording medium, which is designed in such a way that it can be read by any standard player and recorder, and to a method for manufacturing the recordable optical recording medium.

The distribution of digital data such as movies or software on optical recording media today is established as the main distribution channel. However, this means that stores need to stock a large amount of titles in order to be able to provide most requested titles immediately to their customers without having to order them.

In order to reduce this need for a large stock several solutions for a manufacturing on demand or a distribution via networks have been proposed. The optical recording medium, typically a DVD (digital versatile disk), is recorded as soon as a title is requested by a customer. Recording is done with a special recorder provided in a store, with a kiosk type recording terminal, or by a special consumer recorder connected to a network. These special recorders allow to write data to a recordable DVD in such a way that the DVD has the appearance of a CSS-encrypted DVD-Video (ROM) disk, even though it is a specially finalized recordable DVD. For recording the optical recording medium has a groove structure to guide an optical pickup unit relative to the optical recording medium.

In order to establish the above described solutions as further distribution channels, the recorded optical recording media have to be compatible with as many standard players and recorders as possible. While this is usually not a problem for players, the situation is different with recorders.

Several methods are known for detecting the position of the light spot on an optical recording medium. The two most popular are Differential Phase Detection (DPD, used for ROM formats) and differential Push-Pull (used for RE formats). However, those two methods require substrates having embossed features, i.e. pits for ROM formats or a groove/land structure for RE formats. A typical groove/land structure is depicted in Fig. 2. As a copy protection mechanism some optical pickups used in recorders do not allow to retrieve data from an optical recording medium indicated as a read-only medium when a push-pull signal originating from the land/groove structure is found, which is an indication of a recordable optical recording medium. Such incompatibilities have to be avoided.

Also, due to the constantly increasing data capacities, the formation of pits or grooves becomes more and more critical.

The document JP 07-311984 discloses the use of an amorphous formed track spiral used for the tracking signal. However, due to the erasability and the overall limited number of readout cycles, a phase change material is not suitable for a downloadable DVD, which needs to fulfill the DVD-ROM standards.

Similarly, the document US 4,737,947 discloses a recording medium having an optomagnetic recording layer and an optical recording layer. The optical layer includes guide tracks consisting of tracking bits, which are formed by thermal modification of the recording material upon laser irradiation. Write-once phase change materials are used for forming the guide tracks. In this document, the information bits and the tracking bits are recorded into two different layers. The optical recording layer, which carries the tracking bits, has to be isolated from the optomagnetic recording layer carrying the information bits, because the readout of the optomagnetic recording layer is done while the system is tracking using the tracking bits. It is then very important that the tracking bits

are not altered during the recording process of the information bits. In the case of a downloadable DVD application, the recording of the information bits is done using the tracking spiral, but the readout is done while the system is tracking with DPD using the information bits. In this case it does not matter if the tracking spiral is somehow altered during the recording process of the information bits. However, the read stability remains a very important item, which cannot be fulfilled using a phase change material.

EP 0 350 078 discloses an optical recording medium comprising a substrate, a recording layer, and a reflective metallic thin film layer provided on the recording layer. The recording layer consists of light transmissive portions and light screening portions. The light screening portions are formed by illuminating and developing a photosensitive layer. Image information derived from the light transmissive portions and the light screening portions of the recording layer acts as a tracking and a preformat in reading out information.

It is an object of the invention to propose a format for a recordable optical recording medium, which has the appearance of a read-only optical recording medium for most players and recorders.

According to the invention, this object is achieved by an optical recording medium with an essentially flat recording layer having a first reflectivity at a wavelength specified for a reading and/or recording light beam, which has an alloyed guide track formed of the material of the essentially flat recording layer with a second reflectivity different from the first reflectivity at the specified wavelength. The alloyed guide track preferably has the shape of a spiral or consists of concentric circles.

The optical recording medium according to the invention has the advantage that it enables tracking without the need for embossed features, e.g. pits or grooves. As a consequence the optical recording medium has the appearance of a read-only optical recording medium and is compatible with most players and recorders. At the same time the problems of erasability and the limited number of readout cycles do not occur when the guide track is formed using write-once materials. A further advantage is that during production of the optical recording medium the embossing step can be omitted.

The different reflectivities of the alloyed guide track and the non-alloyed areas allow to generate a tracking signal, e.g. by using a three-beam method. This is explained below with reference to Fig. 4. Of course, other methods making use of the change of reflectivity for tracking can also be used. It is not relevant whether the reflectivity of the guide track is higher or lower than the reflectivity of the non-alloyed areas.

Preferably, the recording layer is a Cu/Si recording layer. Such a recording layer can easily be alloyed using a intense light beam, e.g. a laser beam. Of course, other material compositions that can be alloyed and show different reflectivities in their alloyed state and their non-alloyed state can likewise be used. Examples of further material compositions are Pd/Te and PdO/Te. The designation X/Y is here used to indicate a layer containing a composition of the constituents X and Y. The ratio of the constituents does not necessarily need to be 1:1. In addition, the layer may include further constituents.

Favorably, the optical recording medium has the following layer stack:

cover layer
ZnS:SiO ₂
Cu/Si
ZnS:SiO ₂

reflective layer (Ag alloy)
substrate

The two dielectric ZnS:SiO₂ layers are used to adjust the reflectivity and the absorption of the optical stack, and thus also the sensitivity of the recording processes.

5

Advantageously, the optical recording medium is a DVD-like medium. The DVD today is a well established medium for transporting and providing audio-visual data such as movies. Many households are already equipped with DVD players or
10 recorders. Therefore, it is desirable to make use of the huge customer base also for manufacturing on demand and a distribution via networks.

A method for manufacturing an optical recording medium according
15 to the invention has the steps of:

- applying at least a recording layer on a substrate;
- applying at least a cover layer on the recording layer; and
- forming a guide track within the recording layer by alloying the material of the recording layer.

20

Similarly, a method for providing an optical recording medium having an essentially flat recording layer with a guide track has the step of forming a guide track within the essentially flat recording layer by alloying the material of the recording
25 layer.

Advantageously, an apparatus for manufacturing an optical recording medium according to the invention has:

- means for applying at least an essentially flat recording
30 layer on a substrate;
- means for applying at least a cover layer on the essentially flat recording layer; and
- means for forming a guide track within the essentially flat recording layer by alloying the material of the recording layer.

Similarly, an apparatus for providing an optical recording medium having an essentially flat recording layer with a guide track has means for forming a guide track within the essentially flat recording layer by alloying the material of the recording layer.

Advantageously, alloying is performed by irradiating the recording layer with an intense light beam along the desired guide track, e.g. a spiral track or concentric circles. Of course thermal processes, such as local heating, can likewise be used for alloying the material of the recording layer.

The alloyed guide track leads to a slightly reduced overall reflectivity with respect to the main spot. This generally is to be avoided in view of the high standard reflectivity value of the DVD-ROM. However, the reduction is comparable to the reduction induced by a normal groove/land structure and does not cause any additional difficulties.

For a better understanding the invention shall now be explained in more detail in the following description with reference to the figures. It is understood that the invention is not limited to this exemplary embodiment and that specified features can also expediently be combined and/or modified without departing from the scope of the present invention. In the figures:

Fig. 1 schematically shows a pickup for reading from an optical recording medium;

Fig. 2 shows a groove/land structure of a known recordable optical recording medium;

Fig. 3 depicts the structure of an optical recording medium according to the invention; and

Fig. 4 illustrates a tracking scheme suitable for the optical recording medium according to the invention.

In Fig. 1 a pickup 1 for reading from an optical recording medium 8 is shown schematically. A laser diode 2 emits a linearly polarized light beam 3, which is collimated by a collimator lens 4. The collimated light beam 3 passes a polarization beam splitter 5 and a quarter wave plate 6, which transforms the light beam 3 into a circular polarized light beam 3, before it is focused onto an optical recording medium 8 by an objective lens 7. The light beam 9 reflected by the optical recording medium 8 is collimated by the objective lens 7 and passes the quarter wave plate 6, which transforms the reflected light beam 9 into a linear polarized light beam 9. Due to the quarter wave plate 6, the direction of polarization of the reflected light beam 9 is perpendicular to the direction of polarization of the initial light beam 3. The reflected light beam 9 is thus deflected by the polarization beam splitter 5 towards a focusing lens 10, which focuses the reflected light beam 9 onto a detector 11. An evaluation circuitry 12 evaluates the signals obtained by the detector 11.

Fig. 2 shows a groove/land structure of a known recordable optical recording medium 8. As can be seen, a plurality of grooves 85 are arranged between the lands 86. The groove/land structure is used for tracking.

In the following the invention is explained with reference to a DVD-like optical recording medium, which is read with a wavelength around 650nm. Of course, the general idea of the invention is also applicable to other types of optical recording media.

The structure of an optical recording medium 8 according to the invention is shown schematically in Fig. 3. A polycarbonate cover-layer 81 protects an essentially flat recording layer 82.

The essentially flat recording layer 82 is arranged on a substrate 83 and consists of a material that can be alloyed. A guide track 84 is formed within the essentially flat recording layer 82. The guide track 84 is formed by alloying the material of the essentially flat recording layer 82. For simplicity a reflective layer beneath the recording layer 82 as well as additional spacer layers are omitted in the figure. Despite the guide track 84 the optical recording medium 8 essentially resembles a DVD-ROM.

A tracking scheme suitable for the optical recording medium 8 according to the invention is illustrated in Fig. 4. The tracking scheme is known as three-beam tracking. A main light beam 31 is located between two adjacent guide tracks 84. Two side beams 32, 32' are arranged relative to the main light beam 31 in such way that they fall onto the adjacent guide tracks 84 when the main light beam 31 is exactly located in the center between the two adjacent guide tracks 84. The reflected side beams 32, 32' are detected by separate detector elements of the photo detector 11. As the reflectivity of the guide tracks 84 is different from the reflectivity of the non-alloyed areas 87 between the guide tracks 84, any displacement of the side beams 32, 32' relative to the guide tracks 84 manifests itself as a change of the intensity detected by the separate detector elements of the photo detector 11. This change of intensity is used for tracking.

Claims

1. Optical recording medium (8) with an essentially flat recording layer (82) having a first reflectivity at a wavelength specified for a reading and/or recording light beam, which has a guide track (84) with a second reflectivity different from the first reflectivity at the specified wavelength, **characterized** in that the guide track (84) is an alloyed guide track formed of the material of the essentially flat recording layer (82).
2. Optical recording medium (8) according to claim 1, **wherein** the essentially flat recording layer (82) includes a Cu/Si composition, a Pd/Te composition, or a PdO/Te composition.
3. Optical recording medium (8) according to claim 1 or 2, **wherein** the guide track is formed by laser irradiation or a thermal process.
4. Optical recording medium according to one of claims 1 to 3, **wherein** it is a DVD-like medium.
5. Method for manufacturing an optical recording medium (8), having the steps of:
 - applying at least an essentially flat recording layer (82) on a substrate (83);
 - applying at least a cover layer (81) on the essentially flat recording layer (82); and
 - forming a guide track (84) within the essentially flat recording layer (82) by alloying the material of the recording layer (82).
6. Method for providing an optical recording medium (8) having an essentially flat recording layer (82) with a guide track (84), **having** the step of forming a guide track (84) within

the essentially flat recording layer (82) by alloying the material of the recording layer (82).

7. Method according to claim 5 or 6, **wherein** alloying is
5 performed by irradiating the essentially flat recording layer (82) with an intense light beam along the desired guide track (84), or by applying a thermal process to the area of the desired guide track (84).
- 10 8. Method according to one of claims 5 to 7, **wherein** the essentially flat recording layer (82) includes a Cu/Si composition, a Pd/Te composition, or a PdO/Te composition.
9. Method according to one of claims 5 to 8, **wherein** the
15 optical recording medium (8) is a DVD-like medium.
10. Apparatus for manufacturing an optical recording medium (8), having:
 - means for applying at least an essentially flat recording
20 layer (82) on a substrate (83);
 - means for applying at least a cover layer (81) on the essentially flat recording layer (82); and
 - means for forming a guide track (84) within the essentially flat recording layer (82) by alloying the
25 material of the recording layer (82).
11. Apparatus for providing an optical recording medium (8) having an essentially flat recording layer (82) with a guide track (84), **having** means for forming a guide track
30 (84) within the essentially flat recording layer (82) by alloying the material of the recording layer (82).
12. Apparatus according to claim 10 or 11, **wherein** the means for forming the guide track (84) is a light source for
35 irradiating the essentially flat recording layer (82) with an intense light beam along the desired guide track (84),

or a thermal processing means for applying a thermal process to the area of the desired guide track (84).

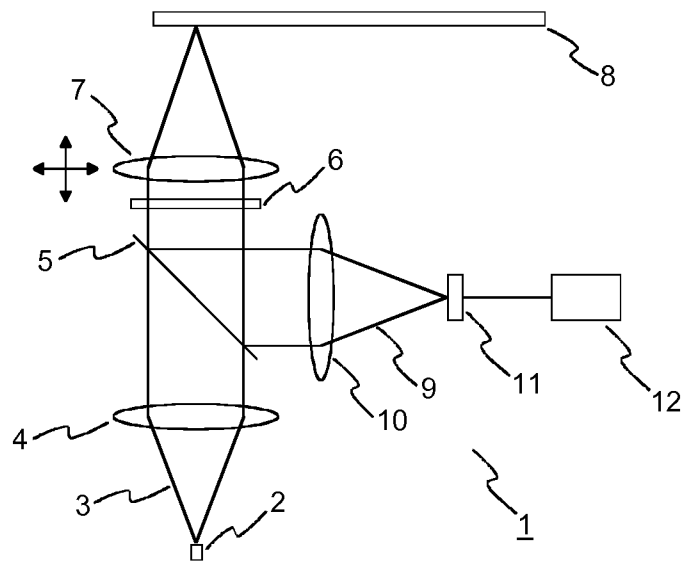


Fig. 1

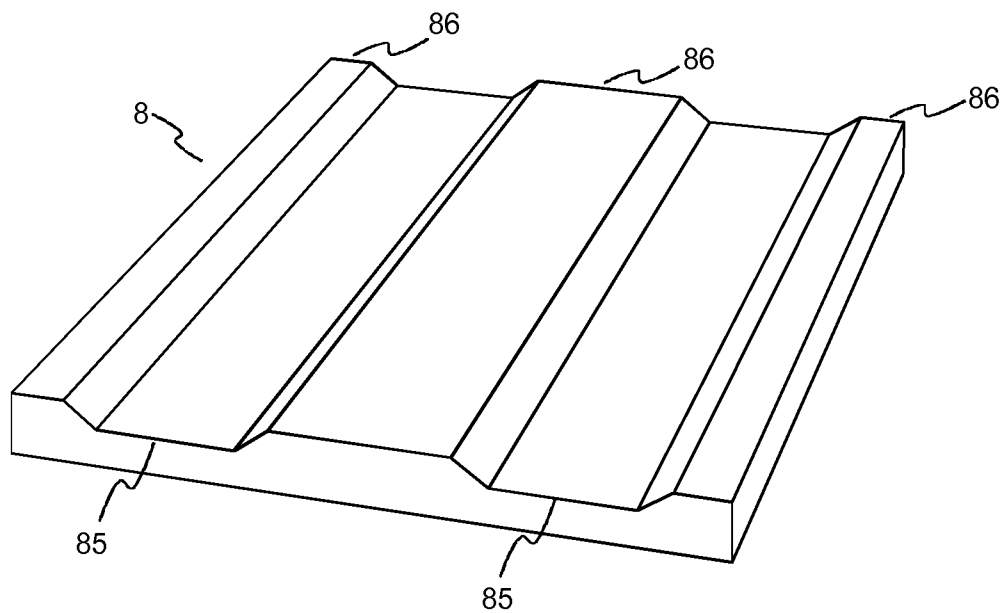


Fig. 2

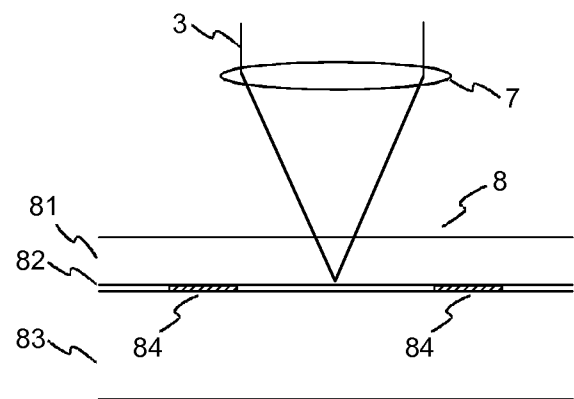


Fig. 3

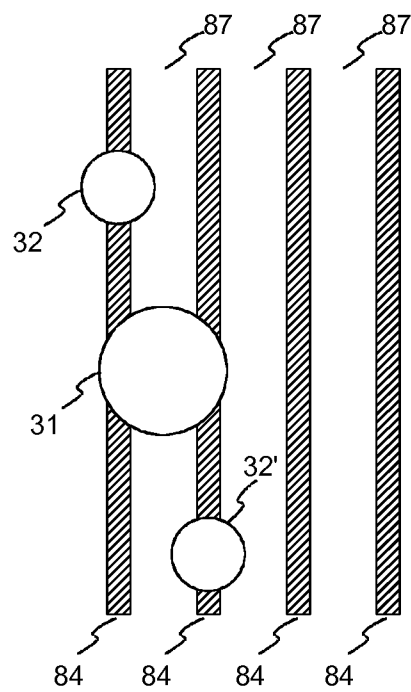


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/057416

A. CLASSIFICATION OF SUBJECT MATTER

INV. G11B7/005 G11B7/24 G11B7/241 G11B7/243 G11B7/258
G11B7/257

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 350 078 A (DAINIPPON PRINTING CO LTD [JP]) 10 January 1990 (1990-01-10) page 7, line 7 - line 29	1,6,10
A	----- DATABASE WPI Week 199321 Thomson Scientific, London, GB; AN 1993-170083 XP002504310 & JP 05 101467 A (HITACHI LTD) 23 April 1993 (1993-04-23) abstract	1,6,10
A	----- JP 05 101467 A (HITACHI LTD) 23 April 1993 (1993-04-23) abstract	1,6,10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

Date of the actual completion of the international search

25 August 2009

Date of mailing of the international search report

08/09/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Poth, Hartwig

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/057416

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0350078	A	10-01-1990	DE 3581759 D1	28-03-1991
			DE 3587773 D1	14-04-1994
			DE 3587773 T2	23-06-1994
			EP 0158906 A2	23-10-1985
			US 5041356 A	20-08-1991
			US 4673626 A	16-06-1987
JP 5101467	A	23-04-1993	NONE	