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D E C I S I O N
of 3 March 1999

Case Number: T 0201/97 - 3.5.2

Application Number: 87102796.7

Publication Number: 0234588

IPC: G11B 7/24

Language of the proceedings: EN

Title of invention:
Optical memory

Patentee:
Kabushiki Kaisha Toshiba

Opponent:
Koninklijke Philips Electronics N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 54(2), 54(3), 56

Keyword:
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
G 0009/91

Catchword:
-

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Case Number: T 0201/97 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 3 March 1999

Appellant: (Proprietor of the patent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 19 December 1996 concerning maintenance of European patent No. 0 234 588 in amended form.**

Composition of the Board:

Chairman: W. J. Wheeler
Members: M. R. J. Villemin
B. J. Schachenmann

Summary of Facts and Submissions

I. The Appellant (patent proprietor) contests the interlocutory decision of the Opposition Division which rejected the proprietor's main request and the auxiliary request A1 and maintained the patent in amended form on the basis of the auxiliary request A2. The impugned interlocutory decision refused the main request and the auxiliary request A1 for the reason that the subject-matter of their respective claims 1 lacked novelty.

The Opponent has not appealed.

II. Oral proceedings were held on 3 March 1999. In response to objections raised by the Respondent (Opponent) and the Board during these oral proceedings, the Appellant submitted the following documents:

- Text A for the contracting states DE, FR and GB, comprising a single claim and pages 2 to 8 of an amended description,

- Text B for the contracting state NL, comprising a single claim and pages 2 to 8 of an amended description.

III. The single claim of text A reads as follows:

"A method of using an optical memory for recording information, comprising:

(a) a substrate (3); and

(b) a recording layer (7) supported on the substrate (3) and undergoing phase-changing from a crystalline state of an equilibrium phase to a non-

equilibrium phase through a liquid phase when the recording layer (7) is heated and then quenched and from the non-equilibrium phase to the equilibrium phase when the recording layer (7) is heated and then cooled gradually,

(c) the recording layer (7) being an intermetallic compound in an amount of more than 80% by atomic percentage, the intermetallic compound having a melting point between 300°C and 800°C; and

(d) the composition of the memory being such as to have only one kind of crystalline structure in the intermediate solid phase, which is an intermediate phase compound A_mB_n including metals A and B,

said non-equilibrium phase being an amorphous structure; and

the method including the steps of

(e) recording information in a bit portion (13) of the memory by heating the portion (13) to the liquid phase, then quenching the portion (13) from the liquid phase to create the amorphous, non-equilibrium structure in the portion (13); and

(f) erasing information in the bit portion (13) by heating then slow cooling the amorphous structure, in order that it returns to said equilibrium crystalline state from the intermediate solid phase without phase separation; and

the intermetallic compound being a normal valency compound selected from a group consisting of AuSn, $AuIn_2$, SnAs and CaSb, or a size factor compound selected from a group consisting of $AuPb_2$, $PdGa_5$, KPb_2, Au_2Pb, KBi_2, $MgZn_2$, Mg_2Ba, Au_2Bi, Mg_2Sr, Mg_2Ca and $MnSn_2$

or an electron compound selected from a group consisting of $MgTl_2$, LiPb, $CuGa_2$, Cu_5Cd_8, MgHg, and AuZn."

IV. The single claim of text B reads as follows

"A method of using an optical memory for recording information, comprising:

(a) a substrate (3); and

(b) a recording layer (7) supported on the substrate (3) and undergoing phase-changing from a crystalline state of an equilibrium phase to a non-equilibrium phase through a liquid phase when the recording layer (7) is heated and then quenched and from the non-equilibrium phase to the equilibrium phase when the recording layer (7) is heated and then cooled gradually,

(c) the recording layer (7) being an intermetallic compound in an amount of more than 80% by atomic percentage, the intermetallic compound having a melting point between 300°C and 800°C; and

(d) the composition of the memory being such as to have only one kind of crystalline structure in the intermediate solid phase, which is an intermediate phase compound A_mB_n including metals A and B,

said non-equilibrium phase being an amorphous structure; and

the method including the steps of

(e) recording information in a bit portion (13) of the memory by heating the portion (13) to the liquid phase, then quenching the portion (13) from the liquid phase to create the amorphous, non-equilibrium structure in the portion (13); and

(f) erasing information in the bit portion (13) by heating then slow cooling the amorphous structure, in order that it returns to said equilibrium crystalline state from the intermediate solid phase without phase separation; and

the intermetallic compound being a normal valency compound selected from a group consisting of AuSn, $AuIn_2$, InSb, BiTe, SnAs, CaSb, and GeTe, or a size factor compound selected from a group consisting of $AuPb_2$, $PdGa_5$, KPb_2, Au_2Pb, KBi_2, $MgZn_2$, Mg_2Ba, Au_2Bi, Mg_2Sr, Mg_2Ca and $MnSn_2$

or an electron compound selected from a group consisting of $MgTl_2$, LiPb, $CuGa_2$, Cu_5Cd_8, MgHg, and AuZn."

V. The arguments presented in the appeal proceedings concentrated on the following prior art documents:

D3: EP-A-0 212 336, which represents prior art according to Article 54(3) EPC for the designated states DE, FR, GB, IT, and

D4: EP-A-0 153 807.

VI. The Appellant argued that the subject-matter of the claim according to text A was novel over the prior art disclosed in D3 which, pursuant to Article 54(4) EPC was not prior art for text B (NL), and that the

subject-matter of each of the claims according to text A and text B involved an inventive step with regard to the method of using the optical information recording media described in D4.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form with:

- text A (description pages 2 to 8 and single claim) as filed in the oral proceedings before the Board and drawings (figures 1 to 4) of the patent specification for the contracting states DE, FR and GB;

- text B (description pages 2 to 8 and single claim) as filed in the oral proceedings before the Board and drawings (figures 1 to 4) of the patent specification for the contracting state NL.

VIII. The Respondent did not challenge the admissibility of texts A and B and did not challenge the patentability of the subject-matter of the claims according to these texts.

IX. The Respondent made no formal request in the oral proceedings, but suggested that the acknowledgement of document D4 (EP-A-0 153 807) in the descriptions of texts A and B should mention the use of Sb_2Se_3 as intermetallic compound in the optical memory disclosed in this document.

Reasons for the Decision

1. The appeal is admissible.

2. The Respondent raised no objections to text A or text B submitted by the Appellant in the oral proceedings. Nevertheless, as explained by the Enlarged Board of Appeal in its decision G 9/91 (OJ EPO 1993, 408), see paragraph 19 of the reasons, the amendments are to be fully examined as to their compatibility with the requirements of the EPC.

3. *Admissibility of texts A and B submitted in the oral proceedings*

3.1 The single claim according to text A includes all of the features of claim 1 of the former auxiliary request A2 accepted by the Opposition Division and the intermetallic compounds AuSn, $AuIn_2$, SnAs and CaSb specified in claim 2 of the patent specification.

3.2 The single claim according to text B includes all of the features of claim 1 of the former auxiliary request A2 accepted by the Opposition Division and all intermetallic compounds specified in claim 2 of the patent specification.

3.3 Document D4 (EP-A-0 153 807) is now mentioned in the descriptions of texts A and B in order to comply with Rule 27(1)(b) EPC and minor amendments were performed in these descriptions to render it clear that the claimed subject-matter is a method of using an optical memory.

3.4 The amendments made to the granted patent to arrive at the present texts A and B comply with the requirements of the EPC, in particular with Articles 123(2) and (3) EPC, since they are all supported in the application documents as originally filed and do not extend the protection conferred by the claims as granted.

4. *Novelty*

4.1 D3 is a prior art document according to Article 54(3) EPC for the contracting states DE, FR and GB designated in the patent in suit. It discloses a method of optical recording in an optical memory including a recording layer undergoing phase-changing from a crystalline state to an amorphous state and vice-versa. None of the intermetallic compounds recited in the claim of text A for contracting states DE, FR and GB is mentioned in D3. Thus, the subject-matter of the claim of text A is novel over D3.

4.2 Since NL is not designated in D3, it is not comprised in the state of the art (Article 54(4) EPC) and cannot be taken into consideration for appreciating the patentability of the subject-matter claimed in text B for contracting state NL.

4.3 D4 describes optical information recording media including a recording layer undergoing phase-changing from a crystalline state to an amorphous state and vice-versa. None of the intermetallic compounds recited in the claim of text A or of text B is mentioned in D4. Thus, the subject-matter of the claim according to text A or text B is novel over D4.

4.4 It is concluded from the above that the subject-matter of the claim according to text A or text B is novel over the disclosure in the documents D3 and D4 cited by the Opponent in the appeal proceedings.

5. *Inventive step*

5.1 The description of the patent specification mentions that there exists a problem in certain prior art optical memories where the non-equilibrium phase state (amorphous, recording state) is prone to return to the equilibrium phase state due to a change with the passage of time and thereby the recorded information is erased naturally (page 2, lines 33 to 40). The problem addressed by the patent in suit is to provide a method of using an optical memory able to maintain a stable recording state for a long time and which can be erased at high speed.

5.2 This problem is solved by the features specified in the claim of text A or text B. *Inter alia* these claims specify:

- the recording layer is an intermetallic compound in an amount of more than 80% by atomic percentage, the intermetallic compound being selected from the groups of normal valency compounds, size factor compounds and electron compounds specified in the claims;

- the composition of the memory is such as to have only one kind of crystalline structure in the intermediate solid phase, which is an intermediate phase compound A_mB_n including metals A and B; and

- erasing information in the bit portion by heating then slow cooling the amorphous structure, in order that it returns to said equilibrium crystalline state from the intermediate solid phase without phase separation.

5.3 The patent specification mentions that intermetallic compounds are suitable for solving the problem because, since the bonding strength between metals is high, they are proof against oxidation so that the recording layer will not deteriorate appreciably with time. Moreover, a high speed erasing operation become possible with intermetallic compounds, because, since the phase transition from the amorphous state to the crystalline state can be attained when the atoms move within a short range, the crystallization speed is extremely high as compared with ordinary alloy compounds (see page 5, line 53 to page 6, line 1).

5.4 None of the intermetallic compounds specified in the claim of text A or text B is mentioned or suggested in D4, which is the only prior art document cited in the appeal which can be considered for assessing whether the claimed subject-matter involves an inventive step.

5.5 According to claim 1 of D4, the recording film is composed of an SbSe compound containing from 58 to 85 atomic % Sb. The only intermetallic compound mentioned in D4 is Sb_2Se_3, which is discussed in the paragraph bridging pages 1 and 2 of D4. However, paragraph 2 of page 2 of D4 indicates that, "in actual practice, however, the transition from the crystalline state to the amorphous state may not be completely effective in such recording material". Thus, while the problem addressed by the patent in suit resides in achieving both high speed erasing operation and reducing natural erasing with time in order to maintain a stable recorded state, the problem to be solved according to

D4 consists in improving the efficiency and the reliability of the recording operation when the recording material is changed from the crystalline state to the amorphous state.

5.6 To solve the problem addressed by D4, this document teaches the use of a recording layer composed of an SbSe compound containing from 58 to 85 % Sb. This requires the use of binary alloys exhibiting a mixed crystal structure. Thus, the method of D4 deliberately involves a phase separation, in contrast to what has to be strictly avoided in the method according to the claim of text A or text B of the patent in suit. Owing to this phase separation, the atoms have to move within larger ranges than in the case of intermetallic compounds where no phase separation occurs. This makes it easier to change from the crystalline to the amorphous state without unwanted recrystallization during cooling, and so solves the problem addressed by D4, but it cannot contribute to solving the problem addressed by the patent in suit since it results in a slower erasing operation.

5.7 D4 gives no guidance which could render obvious the combination of features specified in the claim of text A or text B. Therefore, the subject-matter of the claim of text A or text B is considered as involving an inventive step within the meaning of Article 56 EPC, having regard to the prior art cited during the appeal proceedings.

6. The patent, amended in the form now requested by the Appellant, and the invention to which it relates meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form with:

   - text A (description pages 2 to 8 and single claim) as filed in the oral proceedings before the Board and drawings (figures 1 to 4) of the patent specification for the contracting states DE, FR and GB;

   - text B (description pages 2 to 8 and single claim) as filed in the oral proceedings before the Board and drawings (figures 1 to 4) of the patent specification for the contracting state NL.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler