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D E C I S I O N
of 29 November 2002

Case Number: T 1103/99 - 3.4.3

Application Number: 92302673.6

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Title of invention:
Magnetoresistance effect element

Patentee:
KABUSHIKI KAISHA TOSHIBA

Opponent:
Siemens AG

Headword:
Amendments/TOSHIBA

Relevant legal provisions:
EPC Art. 100(c), 123(2), 111(1)

Keyword:
"Removal of a feature from claim 1 (allowed under
Article 123(2))"
"Interpretation of "alternating""

Decisions cited:
T 0331/87

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 1103/99 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 29 November 2002

Appellant: KABUSHIKI KAISHA TOSHIBA
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Respondent: Siemens AG
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Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 15 October 1999
revoking European patent No. 0 506 433 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: R. K. Shukla
Members: G. L. Eliasson
J. H. Van Moer

Summary of Facts and Submissions

- I. This appeal lies from the decision of the opposition division dated 15 October 1999 revoking European patent No. 0 506 433 pursuant to Article 102(1) EPC. The ground for the revocation was that claim 1 according to a main request and first to fourth auxiliary requests contained subject matter extending beyond the content of the application as filed, and therefore did not meet the requirements of Article 100(c) EPC.

Claim 1 according to the main request had the following wording:

- "1. A magnetoresistance effect element comprising a multilayer formed by two neighbouring magnetic layers (3) and a non-magnetic layer (2) disposed between said neighbouring magnetic layers (3) in a manner to produce a magnetoresistance effect caused by change of the relative magnetic spin direction between said neighbouring magnetic layers, characterised in that said nonmagnetic layer (2) contains at least one element selected from the group of Cu, Au, Ru and Ag, and each magnetic layers (3) are made of Co based materials, wherein at least one of said materials contains an alloy of $Fe_{1-x}Co_x$, where $0.5 \leq x < 1$."
- II. The only independent claim 1 as filed reads as follows:
- "1. A magnetoresistance effect element comprising the multilayer formed by alternately stacking magnetic and nonmagnetic layers (2,3), said magnetic layers (3) containing at least two magnetic elements

selected from a group of magnetic elements consisting of Fe, Co and Ni, any two neighboring magnetic layers (3) being antiferromagnetically coupled under a condition where a magnetic field is not substantially applied thereto."

III. The appellant (patent proprietor) lodged an appeal on 10 December 1999 and paid the appeal fee on 14 December 1999. A statement of the grounds of appeal was filed on 23 February 2000.

The respondent (opponent) filed observations with a letter dated 27 June 2000, and filed new documents E10 to E12.

IV. In response to a communication of the Board accompanying summons to oral proceedings, the patent proprietor filed with the letter dated 29 October 2002 new claims forming a main request and first to fourth auxiliary requests.

V. At the oral proceedings held on 29 November 2002, the parties made the following requests:

The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained on the basis of claims 1 to 12 according to the main request or first to fourth auxiliary request filed with letter dated 29 October 2002.

The respondent (opponent) requested that the appeal be dismissed.

VI. Claim 1 according to the main request reads as follows:

"1. A magnetoresistance effect element comprising a multilayer formed by two neighbouring magnetic layers (3) and a non-magnetic layer (2), wherein

the non-magnetic layer (2) is disposed between neighbouring magnetic layers (3) in a manner to produce a magnetoresistance effect caused by change of the relative magnetic spin direction between said neighbouring magnetic layers, characterised in that said nonmagnetic layer (2) contains at least one element selected from the group of Cu, Au, Ru and Ag, and each magnetic layers (3) contains an alloy of $Fe_{1-x}Co_x$, where $0.5 \leq x < 1.$ "

VII. In the decision under appeal, the opposition division reasoned essentially as follows:

(a) In the application as filed, the structure is in the form of *alternating* magnetic layers (M) and nonmagnetic layer (NM) of the form $(M/NM)_n$ where $n > 2$ (cf. item 3.1). Claim 1 according to the main request, however, allows for structures such as $M/NM/M/NM/M$ which are not disclosed in the application as filed.

Furthermore, the three-layer structure $M/NM/M$ as defined in claim 1 is only disclosed in the application as filed for a structure having antiferromagnetic coupling between the magnetic layers. Antiferromagnetic coupling, however, is not specified in claim 1 (cf. application as published, column 1, lines 54 to 58).

(b) Novelty and inventive step could not be examined as no acceptable request meeting the requirements of Article 100(c) EPC was submitted.

VIII. The patent proprietor (appellant) presented essentially the following arguments relating to Article 100(c) EPC:

- (a) The three-layer structure M/NM/M as defined in claim 1 is supported by the application as filed, since the disclosure of the patent in suit does not contain any indication that term "alternating magnetic layers and non-magnetic layers" in claim 1 as filed should be interpreted in a narrow sense. Secondly, as also acknowledged by the opponent, it was known in the art at the priority date of the patent in suit that the three layer structure M/NM/M would work as a magnetoresistance effect element.

- (b) The wording of claim 1 as filed does not require that *all* layers should be alternately stacked, since it specifies a magnetoresistance effect element *comprising* a multilayer formed by alternately stacking magnetic and nonmagnetic layers. Therefore, structures such as M/NM/**M**/M/NM/M are, contrary to the view held in the decision under appeal, covered by the disclosure of the application as filed.

- (c) The removal of the feature "any two neighboring magnetic layers are antiferromagnetically coupled under a condition where a magnetic field is not substantially applied thereto" satisfies the criteria set by T 331/87 since:

- (1) It is stated in the application as filed that antiferromagnetic coupling is "preferable" (cf. page 4, lines 31 to 34), and therefore this feature was not explained as essential in the disclosure.

It is furthermore taught in the application

as filed in conjunction with Figures 2 and 3 that a trade-off has to be made between having a large magnetoresistance ratio and having a small saturated magnetic field, and for applications requiring a small magnetic saturation field, antiferromagnetic coupling between neighboring magnetic layers is thus not optimal (cf. page 6, lines 14 to 36; page 4, line 31 to page 5, line 11).

- (2) The problem addressed in the application as filed relates to providing a magnetoresistance element which can be produced without using high vacuum equipment (cf. page 2, lines 15 to 20). This is achieved primarily through the choice of materials as specified in claim 1. Therefore, anti-ferromagnetic coupling is not, as such, indispensable for the function of the invention in the light of the technical problem it serves to solve.

- (3) As is evident to a skilled person, no other features have to be modified in order to compensate for the removal of the above feature.

- (d) The feature "to produce a magnetoresistance effect caused by change of the relative magnetic spin direction between said neighboring magnetic layers" in claim 1 according to the main request is not explicitly disclosed in the application as filed, but defines the field of the invention in a terminology employed in the prior art documents cited in the application as filed (cf. application as filed, page 1, line 24 to page 3, line 3).

IX. The arguments by the respondent (opponent), in so far

as they are relevant to the present appeal, can be summarized as follows:

- (a) In addition to the reasons given in the decision under appeal (cf. item VII(a) above), claim 1 according to the main request, in contrast to claim 1 as filed, does not specify anti-ferromagnetic coupling between neighboring magnetic layers. Although antiferromagnetic coupling is described in the application as filed as a "preferable" feature, the skilled person would disregard this statement, since firstly, it is an isolated statement which is not supported by the embodiments which all disclose devices having antiferromagnetic coupling between neighboring magnetic layers, and secondly, in the art there was a common misconception at the priority date of the patent in suit that antiferromagnetic coupling was a prerequisite for obtaining the desired magnetoresistance effect. Evidence for this prejudice in the art is provided by the prior art documents cited in the application as filed and by an affidavit by one of the inventors of the patent in suit, Mr Saito, in which the importance of having antiferromagnetic coupling is emphasized.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *Added subject matter - Main Request*

The only issue dealt with in the decision under appeal was the ground for opposition under Article 100(c) EPC, i.e. whether the subject matter of the patent as amended extends beyond the content of the application as filed.

2.1 In the present appeal, the amendments to claim 1 according to the main request which are in dispute in the consideration of Article 123(2) EPC are as follows:

- (i) The multilayer is specified to be formed by two neighboring magnetic layers and a non-magnetic layer between the neighboring magnetic layers, whereas in claim 1 as filed, the multilayer is formed by alternately stacking magnetic and nonmagnetic layers;
- (ii) the feature "any two neighboring magnetic layers being antiferromagnetically coupled under a condition where a magnetic field is not substantially applied thereto" in claim 1 as filed is deleted; and
- (iii) the feature "to produce a magnetoresistance effect caused by change of the relative magnetic spin direction between said neighboring magnetic layers" has been added.

2.2 With respect to amendment (i), the opponent concurring with the decision under appeal, argued that the application as filed discloses the multilayer structure as having *alternating* magnetic layers (M) and nonmagnetic layers (NM), and thus the smallest unit is a four-layer structure M/NM/M/NM. Claim 1 on the other hand defines a three-layer structure M/NM/M (cf. items VII(a) and IX(a) above).

Furthermore, claim 1 according to the main request covers structures, such as M/NM/**M/M**/NM/M, do not have a basis in the application as filed.

2.2.1 As the patent proprietor convincingly argued, however, the application as filed does not contain any suggestion justifying a narrow interpretation of the term "alternating magnetic layers and non-magnetic layers" in claim 1 as filed (cf. item VIII(a) above). Secondly, it is common ground that it was known in the art at the priority date of the patent in suit that a three layer structure of the type M/NM/M functions as a magnetoresistance effect element. Therefore, the Board comes to the conclusion that the three-layer structure M/NM/M as defined in claim 1 was covered by the disclosure of the application as filed.

2.2.2 The board also agrees with the patent proprietor that a structure such as M/NM/**M/M**/NM/M falling within the scope of claim 1 and having a sequence of layers deviating from a strictly alternate magnetic/-nonmagnetic layer, has a basis in the application as filed. Claim 1 *as filed* specifies a magnetoresistance effect element *comprising* a multilayer formed by alternately stacking magnetic and nonmagnetic layers and therefore does not require that *all* layers should be alternately stacked (cf. item VIII(b) above).

2.3 In T 331/87 (OJ EPO 1991, 22), it was held that a removal of a feature from a claim may not violate Article 123(2) provided the skilled person would directly and unambiguously recognize that

- (1) the feature was not explained as essential in the disclosure,

- (2) it is not, as such, indispensable for the function of the invention in the light of the technical problem it serves to solve, and
- (3) the replacement or removal requires no real modification of other features to compensate for the change.

2.3.1 In connection with amendment (ii) above, the opponent contended that although it is disclosed in the application as filed that antiferromagnetic coupling is merely preferable and not essential, the skilled person at the priority date of the patent in suit would nevertheless disregard this statement, since firstly, it is not supported by the rest of the disclosure, and secondly, the skilled person was prejudiced against considering antiferromagnetic coupling between neighboring magnetic layers as an optional feature (cf. item IX(b) above).

As the patent proprietor convincingly argued, however, the application as filed not only discloses that the condition of having antiferromagnetic coupling between neighboring magnetic layers is an optional feature, but also indicates under which circumstances antiferromagnetic coupling is disadvantageous (cf. item VIII(c)(1) above). As described in conjunction with Figures 2 and 3, both the magnetoresistance ratio and the magnetic saturation are oscillatory functions of the thickness of the nonmagnetic layer and both substantially peak when the thickness of the nonmagnetic layer is such that neighboring magnetic layers are antiferromagnetically coupled. Therefore, for applications requiring a small magnetic saturation field, it is taught to adjust the thickness of the nonmagnetic layer to obtain an optimal relationship between the magnetoresistance ratio and the magnetic saturation field. Consequently, the thickness of the

nonmagnetic layer may be chosen away from the range where antiferromagnetic coupling occurs (cf. page 6, lines 14 to 36; page 4, line 31 to page 5, line 11).

As to the affidavit by Mr Saito referred to by the opponent, this document is only concerned with inventive step having regard to prior art documents cited in the corresponding proceedings before the USPTO, and is therefore not relevant to the present case.

Therefore, the Board finds that condition (1) above is met.

- 2.3.2 Regarding conditions (2) and (3), it was common ground that antiferromagnetic coupling is, in fact, not necessary for the functioning of the magnetoresistance device disclosed in the patent in suit (cf. item VIII(c)(2) above). Furthermore, since the problem addressed in the application as filed relates to providing a magnetoresistance element which can be produced without using high vacuum equipment (cf. page 2, lines 15 to 20), and this problem is solved primarily through the choice of materials as specified in claim 1, antiferromagnetic coupling is not, as such, indispensable for the function of the invention in the light of the technical problem it serves to solve. It also follows from the above that no real modification of other features is required to compensate for the absence of antiferromagnetic coupling between the neighboring magnetic layers (cf. item VIII(c)(3) above). This was also not disputed by the opponent.

Therefore, since all the conditions (1) to (3) set out in T 331/87 are met, the removal of the feature "anti-ferromagnetic coupling between any neighboring magnetic layers under a condition where a magnetic field is not substantially applied thereto" from claim 1 does not contravene the requirements of Article 123(2) EPC.

2.4 As to the amendment (iii), the feature "to produce a magnetoresistance effect caused by change of the relative magnetic spin direction between said neighboring magnetic layers" in claim 1 according to the main request is not explicitly disclosed in the application as filed. The parties agreed, however, that this feature defines the field of the invention which presently is known as the Giant Magnetic Resistance (GMR) effect, in a terminology employed in the prior art documents cited in the application as filed (cf. item VIII(d) above). Therefore, the Board is satisfied that this amendment meets the requirements of Article 123(2) EPC.

2.5 Therefore, in the Board's judgement, claim 1 according to the main request meets the requirements of Article 123(2) EPC

3. Since the decision under appeal did not deal with the other opposition grounds raised by the opponent under Article 100(a) and (b) EPC (cf. item VII(b) above), it is appropriate to remit the case to the opposition division for further prosecution pursuant to Article 111(1) EPC, which also should decide under Article 114(2) EPC whether or not to admit the documents E10 to E12 which were filed by the opponent with the letter dated 27 June 2000.

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 for further prosecution.

The Registrar:

The Chairman:

M. Zawadzka

R. K. Shukla