BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

A		B		C	X

File No.: T 1076/92 - 3.5.2

Application No.: 88 903 602.6

Publication No.: 0 308 483

Classification: G11B 5/39

Title of invention: Magneto-resistive thin film head for digital magnetic storage device

D E C I S I O N
of 13 October 1993

Applicant: Digital Equipment Corporation

Proprietor of the patent:

Opponent:

Headword:

EPC: Art. 56

Keyword: "Inventive step - yes, after amendment"

Headnote
Catchwords

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1076/92 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 13 October 1993

Appellant: Digital Equipment Corporation
111 Powdermill Road
Maynard
Massachusetts 01754-1418 (US)

Representative: Goodman, Christopher
Eric Potter & Clarkson
St. Mary's Court
St. Mary's Gate
Nottingham NG1 1LE (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 11 May 1992 refusing European patent application No. 88 903 602.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: R.E. Persson
Members: A.G. Hagenbucher
W.J.L. Wheeler

Summary of Facts and Submissions

I. The present appeal contests the decision of the Examining Division refusing the Appellant's European patent application No. 88 903 602.6 (WO 88 077 41). The reason given for the refusal was that the subject-matter of Claim 1, then on file, did not involve an inventive step having regard to the following prior art documents:

D1: US-A-4 300 177

D2: Patent Abstracts of Japan, volume 10, No. 210 (p 479) (2266), 23 July 1986 and,

D3: JP-A-61-48 116.

D2 and D3 concern the same prior art head.

II. In view of several alternative sets of claims filed with the Statement of Grounds the Board referred in a communication accompanying summons to oral proceedings to the following further documents:

D4: EP-A-3 79 67
D5: US-A-3 921 217
D6: US-A-45 35 375
D7: JP-A-58-111 114.

III. In the course of oral proceedings held before the Board on 13 October 1993 the Appellant amended Claims 1 to 10 according to the first auxiliary request filed with the Statement of Grounds and requested that the decision under appeal be set aside and a patent be granted on the basis of this set of claims.

IV. Claim 1 is worded as follows:

"1. A read/write head for use in a magnetic storage device in a digital data processing system for writing data in the form of magnetic flux onto, and reading data from, a magnetic media which moves relative to the head, the head having two magnetic pole pieces (11, 12) each with a yoke region (13), an energizable coil (16) situated between the pole pieces in the yoke region for generating magnetic flux, one of the pole pieces having a slot (17) in the yoke region, the head further including a strip of magneto-resistive material (20) adjacent and oriented generally transverse to the intended path of magnetic flux traversing the slot, an electrically insulating layer (19) separating the magneto-resistive strip from the slotted pole piece said strip (20) being adapted to be connected to sensing equipment such that as the media is moved relative to the head the resistance of the magneto-resistive strip varies in response to the variations in the magnetic flux recorded onto the media the sensing equipment sensing the variations in the resistance of the magneto-resistive strip, in which the magnetic pole pieces (11, 12) are shaped to provide a narrow tip portion (14) and a wide yoke portion (13) and a variable width region joining the narrow tip portion (14) to the wide yoke portion (13) and characterised in that the pole piece slot (17) is situated in the wide yoke portion (13) of the magnetic pole piece (11), the magneto-resistive strip (20) protrudes beyond the ends of the pole piece slot (17) a sufficient amount to minimize the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip (20) and sensing electrodes (21,22) are

connected to the magneto-resistive strip (20) at the ends of the slot (17)."

V. The Appellant argued in effect that the read/write head, according to the preamble of Claim 1, except the feature concerning the electrical insulation layer separating the magneto-resistive strip from the slotted pole piece, was known from D2(D3). D2(D3) did not show that the magneto-resistive strip (11) was insulated from pole 5. Current applied to the MR strip to sense the resistance change was carried by the entire background permalloy film. The feature that an electrically insulated layer (19) separates the magneto-resistive strip from the slotted pole piece was inserted into the preamble of Claim 1 in view of D1.

According to D2 (D3) the MR (magneto-resistive) element 11 was at best placed in the variable width region near to the narrow tip but not in the wide yoke portion as claimed. Thereby the length of the MR element was increased and the reading improved. By increasing the length of the magneto-resistive strip so that it protrudes beyond the ends of the pole piece slot a sufficient amount and connecting the sensing electrodes to the magneto-resistive strip at the ends of the slot, the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip were minimised.

Reasons for the Decision

1. The appeal is admissible.

2. Present Claim 1 does not contain subject-matter extending beyond the contents of the application documents as filed (Article 123(2) EPC). Claim 1 is supported by originally filed Claim 1 in connection with the description of the first embodiment shown in Figure 1 A and 2A.

3. None of the cited documents shows even all the features in the preamble of Claim 1. The subject-matter of Claim 1 is therefore new. Thus, it remains to be decided whether its subject-matter involves an inventive step.

4. As far as head construction is concerned, D2(D3) represents the closest prior art. The read/write head disclosed in D2(D3) has all the features indicated in the preamble of Claim 1 except the electrical insulation layer separating the magneto-resistive strip from the slotted pole piece. The Appellant has inserted this feature into the preamble of Claim 1 because it is generally known (e.g. from D1) to insulate an MR element from a slotted pole piece. D2(D3) discloses a 'high reproducing output thin film magnetic head'. It proposes to improve the reading ability of the head by using an MR element in place of a coil to sense the flux being read by the head regardless of where the MR element is located relative to the tip and yoke of the pole. Figure 2 of D2 shows that the MR-strip is placed in the variable width region near the narrow tip.

In the introduction of the present application, it is explained that the use of a MR element in a read (write) head renders the head insensitive to the speed of the disc, but has disadvantages because end effects in the MR element lead to multiple domains which result in Barkhausen noise and therefore inaccuracy. Known solutions to this problem (cf. D6) make use of a long magneto-resistive strip, positioned close to the pole tip but sense the resistivity of the strip only across a small portion of its length. Placing the MR element in the pole tip has the disadvantage of limiting the track density attainable.

5. In accordance with the present description the problem underlying the subject-matter of Claim 1 is seen in providing a read/write head with increased sensitivity and accuracy and which facilitates increased track density.

6. According to Claim 1 this problem is solved by the following features:

(a) The pole piece slot is positioned in the wide yoke portion of the magnetic pole piece.

(b) The magneto-resistive strip protrudes beyond the ends of the pole piece slot with a sufficient amount to minimise the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip and

(c) Sensing electrodes are connected to the magneto-resistive strip at the ends of the slot.

Features a and b permit both the width of the pole pieces at the tip portion and the gap at the narrow tip portion to be minimised, thus enhancing the density of data recording, while using a magneto-resistive strip of sufficient length to minimise the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip. Feature c renders sensitivity during reading independent of the track density, because the portion of the strip between the sensing electrodes is relatively long. It is implicit that the area between the sensing electrodes has only a single magnetic domain.

7. Although D4 discloses the positioning of a magneto-resistive strip in the wide yoke portion of a read head, having a narrow tip portion, a wide yoke portion and a variable width region joining the narrow tip portion, this known positioning of an MR element serves for increasing the sensitivity of an MR element by enlarging the magnetic flux sensed from a small head tip. According to D4 (page 5, lines 14 to 16) the length of the MR element is adapted to the width of the wide yoke portion, with sensing electrodes at its ends, but does not protrude beyond it in order to minimise the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip as required by present Claim 1.

Since D4 does not give any hint on how to minimise the effects of the Barkhausen noise due to the creation of multiple magnetic domains at the ends of the magneto-resistive strip, a person skilled in the art, trying to solve this problem, would be led away from the solution in D4 by D6 where the long magneto-resistive strip is positioned close to the pole tip, thus limiting the attainable track density, and the change in resistivity is sensed only across a small portion of its

length in order to minimise the effects of the Barkhausen noise.

Since documents D4 and D6 suggest different positions of the magneto-resistive strip on the head for the respective purposes and according to D6 only a very small portion of the magneto-resistive strip is used in order to minimise the Barkhausen effect, these documents do not lead in an obvious way, in connection with D1 and D2(D3), to the claimed solution which results in a high sensitivity and high accuracy read/write head facilitating an increased track density.

Consequently, the subject-matter of Claim 1 involves an inventive step.

8. Thus, the reason for which the Examining Division refused the present application does not apply to the present Claim 1.

9. Although the Board has not made a thorough examination of the application documents with respect to other requirements of the convention, it has noticed several deficiencies in the application, namely the dependent claims and the introduction of the description have still to be adapted to the present Claim 1, and D1, D2(D3) and D4 have to be indicated in the description in accordance with Rule 27(1)(b).

Since such deficiencies could be better put right by the Examining Division than during oral proceedings before the Board, the Board makes use of its power under Article 111(1) EPC to remit the case to the Examining Division for further prosecution.

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 on the basis that the subject-matter of Claim 1 of the first auxiliary request as amended in the oral proceedings before the Board is novel and inventive and meets the requirements of Article 123(2) EPC.

The Registrar:

M. Kiehl

The Chairman:

E. Persson