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D E C I S I O N
of 14 September 1994

Case Number: T 0307/93 - 3.5.2

Application Number: 85111727.5

Publication Number: 0175339

IPC: G11B 5/70

Language of the proceedings: EN

Title of invention:
Magnetic recording medium

Patentee:
Hitachi Maxell Ltd.

Opponent:
Fuji Photo Film Co., Ltd.

Headword:
-

Relevant legal norms:
EPC Art. 56, 104(1)

Keyword:
"Inventive step (yes, after amendment)"
"Remittal for further prosecution (no)"
"Apportionment of costs (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0307/93 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 14 September 1994

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 4 February 1993 revoking European patent No. 0 175 339 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: A. G. Hagenbucher
B. J. Schachenmann

Summary of Facts and Submissions

I. The Appellant contests the decision of the Opposition Division revoking European patent No. 0 175 339 on the ground that the subject-matter of Claim 1 according to the main and auxiliary requests then on file did not involve an inventive step.

II. In the impugned decision the following documents relating to the prior art were considered relevant:

D2: US-A-4 455 345, and
D3a: EP-A-0 074 410.

III. In the course of the appeal proceedings the following documents, which were cited during the opposition proceedings, were also referred to:

D1a: EP-A-98 307
D15: DE-A-2 538 317
DII: DE-A-3 302 911.

IV. Oral proceedings were held before the Board on 14 September 1994, at which the Appellant filed amended Claims 1 to 7 and description pages 2, 2a, 2b and 3 to 8. It is noted that the description starts with page 2.

Claim 1 is now worded as follows:

"1. A magnetic recording disc comprising a non-magnetic substrate and a magnetic layer comprising a non-magnetic binder and ferromagnetic powder dispersed therein formed on said substrate wherein said magnetic layer has a coercive force of 111.4 x 10^3 to 159.2 x 10^3 Am^{-1} (1400 to 2000 Oersteds), a residual magnetic flux density from 0.13 to 0.2 T (1300 to 2000 gausses) and a thickness of

at least 0.5 micrometre, wherein the ferromagnetic powder is in a substantially non-orientated condition, has a particle size of 0.1 to 1.0 micrometre and is contained in the magnetic layer in an amount of 60 to 85% by weight based on the total weight of the magnetic powder and the binder, wherein the magnetic recording disc has a D_{50}-value of larger than 1.97 kbpmm (50 KBPI), when measured by a magnetic head comprising magnetic cores made of iron-nickel alloy with a gap length of 0.3 µm, a track width of 30 µm and a relative rate against the magnetic recording disc of 3.1 m/s."

Claims 2 to 7 are dependent on Claim 1.

V. The Appellant accepted that D2 was the closest prior art, but argued essentially that although the claims and specification of D2 generally referred to a magnetic medium and the specification stated that the coated materials were slit into any desired width to provide magnetic recording tapes or discs, the particular examples and comparative examples were all in respect of magnetic tapes in which the magnetic film was subjected to magnetic orientation. D2 indicated specific surface areas of the magnetic particles, but gave no specific values for the particle size thereof. There was no correlation between the surface area and the particle size of the ferromagnetic metal powder. The object indicated in D2 corresponded literally with that of the patent in suit in that high density recording in combination with stable magnetic properties, good reliability and high S/N(signal to noise) ratio should be achieved. The meaning of these terms in D2 and in the patent in suit was different, however. This was clear from the measurement of the D_{50}-value of bitwise recorded information (KBPI-kilobits per inch) according to the patent. In contrast thereto, D2 concerned analog video recording. Moreover, D2 did not consider the corrosion

conditions of a disc (whose entire surface is continually exposed to the atmosphere) or mention any specific non-orientated magnetic layer. A person skilled in the art would not try to use the values given in D2 for the less advantageous comparative examples of magnetically oriented tapes for magnetically non-oriented disc layers with more stringent corrosion resistance conditions. The examples in D2 gave the metal content of the powder, not of the powder plus binder. The opponent was merely indulging in speculation.

VI. The Respondent drew attention to the fact that it was informed about the restriction of Claim 1 to the specific D_{50}-value-range for the first time by the Appellant's letter dated 12 August 1994. In view of the fact that the Respondent had its residence in Japan, the relevance of this new feature could not be fully examined within the remaining time. It was possible that the magnetic layer of D2 met the specified D_{50}-range because this may result automatically from the selected coercive force and residual magnetic flux density ranges. If the appeal were not rejected, the case should be remitted to the Opposition Division in order to allow time for tests to be made and the costs incurred by the Respondent in attending the oral proceedings before the Board should be paid by the Appellant.

Regarding inventive step, the Respondent argued that it was common knowledge that a magnetic layer of a disc was not magnetically oriented and that the squareness ratio of a non-oriented magnetic layer was about 0.5 to 0.6. Hence, the values for the magnetic flux density known from D2 could easily be converted into those of a non-oriented disc layer. According to column 4, lines 24 to 39 and column 6, lines 5 to 30 of D2, the known magnetic layer also had about 80%wt of ferromagnetic powder based on the total weight of the powder and the binder. It was

clear from D3a, Figure 1, specimen C, D and E that a specific surface area of 75 m^2/g as disclosed in D2, column 7, comparative example 4, resulted in a mean diameter of the long axis of about 0.1 µm. This value fell in the particle size range of 0.1 to 1.0 µm specified in Claim 1. Therefore, the claimed invention was obvious in view of the disclosures of D2 and D3a. The deletion of the word "usually" in line 11 of page 3 of the patent specification amounted to an infringement of Article 123(2) EPC. The importance of the D_{50}-value was not clear from the patent specification, nor was there any teaching as to how it was obtained.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of Claims 1 to 7 and description pages 2, 2a, 2b, 3 to 8 as filed in the oral proceedings and drawings (Figures 1 to 3) of EP-B1-0 175 339.

VIII. The Respondent requested dismissal of the appeal or, as auxiliary request, that the case be remitted to the Opposition Division for further prosecution with an apportionment of costs incurred in attending the oral proceedings before the Board.

Reasons for the Decision

1. The appeal is admissible.

2. The claims and description of the patent in suit have been amended in the opposition and appeal proceedings.

In addition to the features recited in Claim 1 as granted, the present Claim 1 is restricted with respect to the parameters concerning coercive force, residual flux density, D_{50}-value and the non-oriented condition of the ferromagnetic powder. As pointed out by the Appellant, these features are all disclosed in the originally filed application documents (especially Claim 1 and page 3, lines 6 to 25; page 8, lines 1 to 3; page 7, lines 10 and 11; page 12, last paragraph and page 13, last paragraph) and in the published patent specification (page 2, lines 36 to 40; page 3, lines 36 and 43 to 47; page 5, lines 4 to 6 and 38 to 41). Consequential amendments have been made to the dependent claims and the description has been adapted to the restricted claims. The word "usually" in line 11 of page 3 of the patent specification has been deleted because Claim 1 now specifies a particles size of 0.1 to 1.0 micrometre. According to the Appellant, the word "usually" did not associate the indicated particle size range with the conventional powder composition mentioned in the previous sentence, but related only to the particle size normally used for the invention. In the opinion of the Board, this interpretation is reasonable and the amended claims and patent specification do not contravene Article 123 EPC.

3. The novelty of the magnetic recording disc according to Claim 1 has not been contested. The point in dispute is whether the claimed magnetic recording disc involves an inventive step.

4. There is general agreement between the parties and the Board that the closest prior art is disclosed in D2.

4.1 D2 discloses a magnetic recording medium with a non-magnetic substrate and a magnetic layer comprising a non-magnetic binder and ferromagnetic powder dispersed

therein. The magnetic recording medium is described as having a high S/N ratio, in particular a high video S/N ratio, and stable magnetic properties. Although the claims and description of D2 refer to a magnetic medium in general and it is stated (column 4, lines 59 to 61) that the coated materials are slit into any desired width to provide magnetic recording tapes or discs, the examples and comparative examples are all in respect of magnetic video recording tapes wherein the ferromagnetic powder is subjected to magnetic orientation. D2 indicates specific surface areas of the magnetic particles, but no specific values are given for the particle size thereof. Moreover, D2 states that the particle size of the ferromagnetic powder particles does not necessarily correspond to the specific surface area (column 3, lines 40 to 42). D2 does not mention the specific corrosion resistance problems of discs. Thus, starting from D2, the problem underlying the present invention is to provide a magnetic recording disc which has a high output level, an improved S/N ratio in combination with a good corrosion resistance and good reliability and is suitable for high density digital recording.

4.2 The present invention solves this problem by providing a magnetic recording disc comprising a non-magnetic substrate and a magnetic layer comprising a non-magnetic binder and ferromagnetic powder dispersed therein formed on the substrate wherein said magnetic layer has

(a) a coercive force of 111.4×10^3 to 159.2×10^3 Am^{-1} (1400 to 2000 Oersteds),

(b) a residual magnetic flux density from 0.13 to 0.2 T (1300 to 2000 gausses), and

(c) a thickness of at least 0.5 µm, wherein

the ferromagnetic powder

(d) is in a substantially non-orientated condition

(e) has a particle size of 0.1 to 1.0 µm, and

(f) is contained in the magnetic layer in an amount of 60 to 85% by weight based on the total weight of the magnetic powder and the binder,

and the magnetic recording disc has

(g) a D_{50}-value of larger than 1.97 kbpmm (50 KBPI-kilobit per inch), when measured by a magnetic head comprising magnetic cores made of iron-nickel alloy with a gap length of 0.3 µm, a track width of 30 µm and a relative rate against the magnetic recording disc of 3.1 m/s.

4.3 Whilst document D2 deals with high-density recording of analog video signals, feature (g) of Claim 1 - based on the examples disclosed in the present patent specification - clarifies that according to the patent in suit high-density recording refers to the recording density of signals representing "1" and "0" bits specified in terms of the D_{50}-value. The examples in the patent specification and "Annex 1" filed on 24 September 1991 during the opposition proceedings make it clear that feature (a) is particularly important for a good D_{50}-value as defined in feature (g). According to examples 1 to 5 in D2 coercive force values H_c between 1080 and 1310 Oe are chosen. It can be seen from the comparative examples of the patent in suit that D_{50}-values of larger than 50 KBPI cannot be achieved with such a low range of coercive force H_c. Since D2 intends to obtain a high S/N ratio in video recording, the H_c values of all the examples 1 to 5 in D2 are lower than

the H_c range of the patent in suit, namely less than 1400 Oe. The presently claimed subject-matter provides a magnetic recording disc with higher H_c values. D2 investigates the stability of the magnetic properties of magnetic tapes by means of a "demagnetisation" factor which is related to their corrosion resistance. According to D2, demagnetisation is not too bad even at high residual magnetic flux density B_r, but this is in respect of tapes whose surfaces are less exposed to air than disc surfaces, because tapes are wound on spools. The total surface of the magnetic layer of a magnetic disc is always exposed to air and corrodes more easily than that of a magnetic tape. To achieve such high corrosion resistance, the present invention selects residual magnetic flux density B_r values in the range of 1300 to 2000 G with the ferromagnetic powder in a substantially non-oriented condition.

Although D2 discloses comparative examples, especially 3 and 4, which have B_r and H_c values closer to the claimed ranges, they are not considered there as achieving the objects indicated therein. When a magnetic layer is in a non-oriented state according to the alternative implied in column 4, lines 56, 57 of D2, B_r of comparative example 3 would be between 0.5 to 0.6 x 2100 G, i.e. between 1050 and 1260 G and therefore outside feature (b) of present Claim 1.

Comparative example 4 of D2, however, would have features (a) and (b) if the magnetic layer were not subjected to magnetic orientation. As to feature (c) D2 mentions only a dry thickness of about 3 µm of a recording tape but not that of a disc. In view of the statement in column 4, lines 37 to 39 of D2 to the effect that the binder is generally present in an amount of 10 to 50 parts by weight based on 100 parts by weight of the ferromagnetic metal powder, it may be concluded

that the ferromagnetic powder is contained in the magnetic layer of this prior art in an amount which overlaps with that of feature (f).

It is noted that D1a (page 1, lines 10 to 20; page 4, lines 24 to 26) and D15 (page 9) point to features (c) and (d) for a disc. Therefore, it could be argued that, having regard to comparative example 4 of D2 and the citations referred to above, it would be obvious to apply features (a), (b) and (f) to a magnetic disc having the features (c) and (d). However, a person skilled in the art would not infer from the specific surface area of 75 m^2/g of comparative example 4 in D2 that this comparative example has also feature (e) because D2 states in column 3, line 40 ff. that the particle size of ferromagnetic powder particles does not necessarily correspond to a specific surface area. Although specimens D and E in D3a have values of specific surface area of 60 and 66 m^2/g respectively and particle sizes of 0.13 and 0.12 µm (mean diameter of particle axis), a person skilled in the art would not draw conclusions therefrom for the particle size of comparative example 4 of D2, especially in view of the statement in column 3, lines 40 to 53 of D2. Moreover, he would not try to produce a magnetic disc for solving the problem underlying the subject-matter of the patent in suit from the magnetic tape material of comparative example 4 of D2 because the specific surface area of 75 m^2/g of this comparative example is considered too high for a good S/N ratio and good stability of the metal powder (cf. D2, column 2, lines 61 to 68; column 3, lines 1 to 7 and 48 to 53) and stability (corrosion resistance) of the metal powder is even more important for discs than for tapes for the reasons indicated above. D2 is not concerned with the suitability of its materials for digital recording on a disc (cf. feature (g) of Claim 1). The incidental

reference to discs in column 4, line 61 of D2 does not imply that the specific magnetic tape compositions of the examples and comparative examples in D2 would be appropriate for discs.

DII has been cited only in order to show that the particle size is of less importance for the magnetic properties than the specific surface area. D1a, D3a, D15 and DII have no further relevance for the claimed subject-matter.

The Board, therefore, comes to the conclusion that the subject-matter of Claim 1 cannot be derived in an obvious manner from the cited documents and general knowledge. Hence, the subject-matter of Claim 1 involves an inventive step.

4.4 The same applies to Claims 2 to 7 which are dependent on Claim 1.

5. *Auxiliary request of the Respondent*

By way of an auxiliary request, the Respondent requested that the case be remitted to the Opposition Division for further prosecution, with an apportionment of costs incurred by the Respondent in attending the oral proceedings before the Board, because the restriction of Claim 1 by means of feature (g) (cf. paragraph 4.2 above) one month before the oral proceedings required new tests in order to investigate its relevance. It was argued that these tests could not have been carried out within the remaining time due to the fact that the Respondent has its residence in Japan.

The restriction of Claim 1 by incorporating feature (g) one month before the oral proceedings appears to be justified, because all the examples of the patent

specification refer to the D_{50}-value and the second paragraph of the originally filed description and the patent specification make it clear that the recording density should be measured on the basis of the D_{50}-value, at which the output decreases to 50% compared with long wavelength recording. Already during the opposition proceedings the Appellant provided additional tests (cf. Annex 1 filed 24 September 1991) which underline the fact that a D_{50}-value of larger than 50 KBPI should be achieved as disclosed on page 5, lines 4 to 6 of the patent specification. It has always been reasonably clear that the relative term "high-density recording" as used in the patent in suit should be interpreted in this sense. Feature (g) merely puts this beyond doubt and completes the specification of the properties of the magnetic recording disc in Claim 1. Hence, in the present case, the introduction of feature (g) in Claim 1 did not lead to an unexpected new situation for the Respondent. Moreover, D2 does not hint at all at measuring this kind of recording density and it is not obvious to do so. Any tests in this respect in connection with the examples of D2, let alone a test including the bad comparative example 4, could only be carried out with hindsight. They could not be of any relevance to the present case, therefore. As a consequence, in the Board's judgment, there is no reason for remittal of the case for further prosecution and no reason of equity which could justify deviation from the general principle that each party to the proceedings shall meet its own costs (Article 104(1) EPC). Accordingly, the Respondent's auxiliary request has to be refused.

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 on the basis of the documents indicated in paragraph VII above.

3. The Respondent's auxiliary request for remittal of the case for further prosecution and an apportionment of costs is rejected.

The Registrar:

M. Kiehl

The Chairman:

W. J. L. Wheeler