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**Datasheet for the decision
of 9 December 2014**

Case Number: T 1223/14 - 3.5.07

Application Number: 08876525.0

Publication Number: 2361432

IPC: G11B20/10, G11B20/12,
G11B20/14, G11B27/30

Language of the proceedings: EN

Title of invention:

Methods and apparatus for detecting a syncmark in a hard disk drive

Applicant:

LSI Corporation

Headword:

Syncmark detection/LSI

Relevant legal provisions:

EPC Art. 56, 123(2)

Keyword:

Amendments - added subject-matter -
main request and second auxiliary request (yes)
Inventive step -
first, third and fourth auxiliary request (no)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 1223/14 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 9 December 2014

Appellant: LSI Corporation
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Representative: Dilg, Haeusler, Schindelmann
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 22 November
2013 refusing European patent application No.
08876525.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Moufang
Members: R. de Man
P. San-Bento Furtado

Summary of Facts and Submissions

- I. The applicant (appellant) lodged an appeal against the decision of the Examining Division refusing European patent application No. 08876525.0.

- II. The Examining Division decided that the subject-matter of the independent claims before it was not new in view of the following document:

D1: US-A-5 844 920, published on 1 December 1998.

- III. With the statement of grounds of appeal, the appellant filed a main request and an auxiliary request. The main request comprised claims 1 to 12, which corresponded to claims 1 to 11 and 15 as refused by the Examining Division, with a minor amendment to dependent claim 11. The auxiliary request comprised claims 1 to 7, which corresponded to claims 1 to 3 and 6 to 9 as refused by the Examining Division, with amendments to the independent claims.

- IV. In a communication accompanying a summons to oral proceedings, the Board expressed the preliminary view that neither request was allowable. In particular, both requests appeared to infringe Article 123(2) EPC. Interpreting claim 1 of either request in line with the original disclosure, its subject-matter appeared to lack an inventive step.

- V. With a letter dated 7 November 2014, the appellant replaced its requests with a main request and first to fourth auxiliary requests.

- VI. Oral proceedings were held on 9 December 2014. At the end of the oral proceedings, the chairman pronounced the Board's decision.
- VII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed with the letter dated 7 November 2014 or, in the alternative, on the basis of one of the first to fourth auxiliary requests filed with the same letter.
- VIII. Claim 1 of the main request reads as follows:
- "An iterative read channel, comprising:
a read head for obtaining a sector signal (300) from a storage media, said sector signal comprising a first syncMark (120), a data portion and a second syncMark (330) substantially at an end of said sector;
a memory; and
at least one processor coupled to the memory and operative to:
determine whether said first syncMark is detected in said sector signal;
characterized in that said at least one processor is further configured to:
search for said second syncMark if said first syncMark is not detected in said sector signal; and
detect and decode at least said data portion of said sector signal preceding said second syncMark based on a detection of said second syncMark, wherein said second syncMark is positioned in a postamble portion of said sector signal that identifies an end of said data in said sector signal."
- IX. Claim 1 of the first auxiliary request reads as follows:

"An iterative read channel, comprising:

 a read head for obtaining a sector signal (300) from a storage media, said sector signal comprising a first syncMark (120), a data portion and a second syncMark (330);

 a memory; and

 at least one processor coupled to the memory and operative to:

 determine whether said first syncMark is detected in said sector signal;

 characterized in that said at least one processor is further configured to:

 search for said second syncMark if said first syncMark is not detected in said sector signal; and

 detect and decode at least said data portion of said sector signal preceding said second syncMark based on a detection of said second syncMark, wherein said second syncMark is positioned in an end-of-sector portion of said sector signal that follows data in said sector signal and identifies an end of said data in said sector signal."

- X. Claim 1 of the second auxiliary request differs from claim 1 of the main request in that the last paragraph has been replaced by the following two paragraphs:

 "adjust a signal index of said sector signal before a subsequent global iteration based on a detected location of said second syncMark; and

 detect and decode at least said data portion of said sector signal preceding said second syncMark using at least said subsequent global iteration based on said detection of said second syncMark, wherein said second syncMark is positioned in a postamble portion of said

sector signal that identifies an end of said data in said sector signal."

- XI. Claim 1 of the third auxiliary request differs from claim 1 of the first auxiliary request in that the last paragraph has been replaced by the following two paragraphs:

"adjust a signal index of said sector signal before a subsequent global iteration based on a detected location of said second syncMark; and
detect and decode at least said data portion of said sector signal preceding said second syncMark using at least said subsequent global iteration based on said detection of said second syncMark, wherein said second syncMark is positioned in an end-of-sector portion of said sector signal that follows data in said sector signal and identifies an end of said data in said sector signal."

- XII. Claim 1 of the fourth auxiliary request differs from claim 1 of the first auxiliary request in that the last paragraph has been replaced by the following two paragraphs:

"adjust a signal index of said sector signal based on a detected location of said second syncMark in order to re-align said sector signal and detected data; and
detect and decode at least said data portion of said re-aligned sector signal preceding said second syncMark using a global iteration based on said detection of said second syncMark, wherein said second syncMark is positioned in an end-of-sector portion of said sector signal that follows data in said sector signal and identifies an end of said data in said sector signal."

Reasons for the Decision

1. The appeal complies with the provisions referred to in Rule 101 EPC and is therefore admissible.
2. *The invention*

The background section of the present application explains with reference to Figure 1 that a common recording format for disk drives includes a servo address mark (SAM) pattern that identifies the start of the next set of embedded servo information, as well as a sync mark ("syncMark") pattern before and a postamble pattern after the recorded data. Once the sync mark pattern is identified, the location of the data section within a recording track can be determined.

According to a known technique for recovering from a failure to detect a sync mark pattern, a secondary sync mark is inserted into the data separated from the primary sync mark by a constant length. If detection of the primary sync mark fails, the hard disk drive can rely on the secondary sync mark to locate and detect the data. A disadvantage of this technique is that inserting the secondary sync mark into the data impairs the efficiency of the recording format, which results in reduced data capacity.

The invention essentially proposes a modification of this known technique for recovering from a failure to detect a sync mark pattern, whereby the secondary sync mark pattern is written at the end of a sector.

3. *All requests - admissibility*

The main request and the second auxiliary request correspond respectively to the main request and auxiliary request as filed with the statement of grounds, with minor editorial improvements.

The first and third auxiliary requests address the objection as to added subject-matter raised in the communication accompanying the summons to oral proceedings. The fourth auxiliary request addresses a clarity objection raised in the same communication.

None of the requests raises an issue that the Board cannot deal with. The Board therefore exercises its discretion under Article 13(1) and (3) RPBA to admit these requests into the proceedings.

4. *Main request - added subject-matter*

4.1 The feature of claim 1 "wherein said second syncMark is positioned in a postamble portion of said sector signal that identifies an end of said data in said sector signal" was not present in the independent claims as originally filed. According to the appellant, it is based on original dependent claim 3 and on page 3, lines 15 to 17, of the original description.

4.2 The additional feature of original dependent claim 3 reads "wherein said second syncMark is positioned where a postamble pattern would be positioned according to one or more conventional techniques". Original page 3, lines 15 to 17, discloses that the "second syncMark pattern" is positioned at the end of a sector "where a postamble pattern would normally be expected in the format of FIG. 1".

Figure 1 shows a "conventional" recording format comprising a data portion followed by a postamble pattern. The Board understands original claim 3 and original page 3, lines 15 to 17, as disclosing that in the recording format according to the present invention the data portion is followed not by the "expected" postamble pattern, but by a sync mark pattern.

- 4.3 At the oral proceedings, the appellant argued that the term "postamble portion" as used in the claim did not refer to an actual postamble pattern, but was merely a label for a portion of the sector signal that followed the data portion.

The Board considers that if the claim term "postamble portion" was not intended to refer to an actual postamble, i.e. a portion of the signal storing a postamble pattern, a different term should have been used.

- 4.4 In the Board's view, claim 1 requires the secondary sync mark pattern to be either identical to or contained in the postamble pattern. Since this is not what the application as filed discloses, the claim feature "wherein said second syncMark is positioned in a postamble portion of said sector signal" infringes Article 123(2) EPC.

5. *First auxiliary request - added subject-matter*

- 5.1 Claim 1 of the first auxiliary request specifies that the secondary sync mark is positioned in an "end-of-sector portion of said sector signal that follows data in said sector signal and identifies an end of said data in said sector signal".

- 5.2 This feature finds a basis in original claim 2, which specifies that "said second syncMark follows data in said sector signal". The Board accepts that "end-of-sector portion" is a label for the portion of the sector signal following the data portion. This portion implicitly "identifies an end of said data in said sector signal".
- 5.3 Claim 1 therefore overcomes the objection under Article 123(2) EPC raised in respect of claim 1 of the main request.
6. *First auxiliary request - inventive step*
- 6.1 Document D1, abstract, proposes the use of a secondary sync mark in a magnetic disk storage system in order to achieve byte synchronisation to sector data in the event of corruption of the primary preamble or sync mark fields. This document hence represents a suitable starting point for the assessment of inventive step.
- 6.2 Document D1, Figure 4D, discloses a data sector format comprising a primary sync mark 116, a data portion (user data 118 and appended ECC bytes 119) and a secondary sync mark 124. The secondary sync mark is positioned in an "end-of-sector portion" following the data portion.
- 6.2.1 The appellant has argued that the secondary sync mark in Figure 4D of document D1 was positioned *within* the data sector. In addition, the skilled person would recognise, based on his common general knowledge, that in Figure 4D a postamble pattern was appended *following* the secondary sync mark.

6.2.2 In so far as the appellant is of the view that the secondary sync mark in Figure 4D of document D1 does not follow the data portion but is part of the data portion, the Board cannot agree. While it is true that document D1 refers to Figure 4D as showing a "data sector format", this does not mean that all fields shown in Figure 4D must be considered part of a "data portion".

6.2.3 Furthermore, claim 1 does not mean that the claimed "second syncMark" cannot still be followed by a postamble pattern.

In fact, if the appellant is correct in stating that the skilled person would recognise that the secondary sync mark in Figure 4D of document D1 is still followed by a postamble pattern, the same must be true for the "second syncMark" of claim 1. As already observed in points 4.1 to 4.4 above, the present application does not disclose that the "second syncMark" pattern of the invention is identical to a postamble pattern. Nor does the application disclose that the "second syncMark" pattern otherwise serves the purpose of a postamble pattern and could therefore replace it.

6.2.4 The data sector format of Figure 4D hence corresponds to that of claim 1.

6.3 Document D1, column 7, lines 30 to 38, in combination with column 10, lines 42 to 57, and column 11, lines 15 to 27, further discloses a read channel comprising an implicitly disclosed read head and a sync controller coupled to a memory ("sync buffer") and operative to perform detection of the sync marks and the data portion. In addition, document D1, column 11, line 58, to column 12, line 11, discloses that said sync

controller transfers the data to the ECC system for decoding.

6.4 The read channel of document D1 employs iterative decoding techniques as explained in column 18, line 44, to column 34, line 20, see in particular column 20, lines 1 to 20, and is therefore an "iterative read channel" within the meaning of the present application (see for example page 3, lines 23 and 24, and page 4, lines 15 to 21, of the original description).

6.5 Document D1, column 10, lines 1 to 16, and column 10, lines 42 to 47, in combination with column 11, lines 15 to 27, discloses that the sync controller is operative to search for and detect the secondary sync mark in case of a failure to detect the primary sync mark and to detect and decode the data portion preceding the secondary sync mark based on the detection of said secondary sync mark.

The appellant observed that the passage in column 11, lines 15 to 27, refers to Figure 5B, which corresponds to the data sector format of Figure 4B and not that of Figure 4D. This observation is correct, but there can be no doubt that the skilled person reading document D1 as a whole would understand that the teaching of this passage applies, *mutatis mutandis*, to the data sector format of Figure 4D as well.

6.6 Document D1 does not disclose the sync controller and the ECC system integrated in one processor. The subject-matter of claim 1 is therefore new over document D1. However, this sole difference amounts to an obvious minor constructional detail.

6.7 The subject-matter of claim 1 hence lacks an inventive step (Articles 52(1) and 56 EPC).

7. *Second auxiliary request - added subject-matter*

The objection set forth in points 4.1 to 4.4 in respect of claim 1 of the main request also applies to claim 1 of the second auxiliary request. The second auxiliary request hence does not comply with Article 123(2) EPC.

8. *Third auxiliary request - inventive step*

8.1 Claim 1 of the third auxiliary request adds the feature "adjust a signal index of said sector signal before a subsequent global iteration based on a detected location of said second syncMark" and further specifies that the data portion is detected and decoded "using at least said subsequent global iteration".

These amendments are somewhat obscure, in that the claim does not explain what "signal index" is being adjusted and what kind of "global iteration" is being performed.

8.2 However, with the help of the description on page 5, lines 23 to 27, it can be understood that the "signal index" is the location in the data sector signal from where detection and decoding of the data portion starts. Thus, claim 1 states that upon detection of the secondary sync mark, the location of the start of the preceding data portion is determined based on the location of the secondary sync mark, after which said data portion is decoded. This corresponds to what is disclosed in document D1, column 11, lines 15 to 23, and column 11, lines 58 to 64.

8.3 The description on page 4, line 15, to page 5, line 4, further explains that the term "global iteration" refers to a step of a decoding process. Since this passage explicitly admits this step as being known and conventional, it cannot support an inventive step.

8.4 The subject-matter of claim 1 of the third auxiliary request hence lacks an inventive step (Articles 52(1) and 56 EPC).

9. *Fourth auxiliary request - inventive step*

9.1 As the appellant stated in its letter of 7 November 2014 and confirmed at the oral proceedings, the fourth auxiliary request essentially corresponds to the third auxiliary request and merely serves to address the Board's concerns expressed in its communication accompanying the summons to oral proceedings in respect of the clarity of the terms "signal index" and "global iteration".

9.2 Claim 1 of the fourth auxiliary request is indeed an improvement on claim 1 of the third auxiliary request in respect of clarity. However, the reasons given in points 8.2 and 8.3 still apply, so the claim's subject-matter lacks an inventive step (Articles 52(1) and 56 EPC).

10. *Conclusion*

Since none of the requests on file is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



B. Atienza Vivancos

R. Moufang

Decision electronically authenticated