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D E C I S I O N
of 10 September 2003

Case Number: T 0061/01 - 3.4.3

Application Number: 92307054.4

Publication Number: 0533330

IPC: H01J 37/28

Language of the proceedings: EN

Title of invention:

A scanning microscope and a method of operating such a scanning microscope

Patentee:

Hitachi, Ltd.

Opponent:

Firma Carl Zeiss
Leica Microsystems Holdings GmbH
Konzernstelle Patente + Marken

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (denied)"

Decisions cited:

-

Catchword:

-



Case Number: T 0061/01 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 10 September 2003

Appellant: Hitachi, Ltd.
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted 30 October 2000
revoking European patent No. 0533330 pursuant
to Article 102(1) EPC.**

Composition of the Board:

Chairman: R. K. Shukla
Members: V. L. P. Frank
J. P. B. Seitz
M. Chomentowski
G. E. Weiss

Summary of Facts and Submissions

I. European patent No. 0 533 330 was opposed by the opponents 01 (Carl Zeiss) and 02 (Leica Microsystems International Holdings GmbH) on the ground of lack of an inventive step pursuant to Article 100(a) EPC. The patent was revoked by the Opposition Division's decision dispatched on 30 October 2000 pursuant to Article 102(1) EPC.

The following prior art documents were *inter alia* considered in the opposition proceedings:

E3: 'Beiträge zur elektronenmikroskopischen Direktabbildung von Oberflächen', U. Ehrenwerth (ed.), Band 23, 1990, Verlag R. A. Remy, Münster 1990, ISSN 0340-3815, pages 339 to 342, and

E14: 'Raster-Elektronenmikroskopie', L. Reimer et al., Springer Verlag Berlin 1977, pages 1 to 9.

The Opposition Division revoked the patent in suit since it lacked an inventive step in the sense of Article 56 EPC having regard to documents E3 and E14. It argued that the patent in suit concerns a method of varying the magnification of a scanning microscope. Document E14, however, disclosed variation in magnification by variation of scan interval of the electron beam as the usual application oriented scanning mode of a scanning electron microscope (SEM) and document E3 disclosed a 'magnifying glass' function in a scanning electron microscope by which details could be magnified out of an image of a scanned sample which was stored in a computer's memory. It was, therefore, obvious to a

skilled person to use in the scanning electron microscope disclosed in document E3 both magnification modes to increase the magnification range of the SEM.

II. The patent proprietor filed a notice of appeal on 28 December 2000 against the decision of the Opposition Division. The appeal fee was paid the same day. The statement of grounds of appeal was filed on 2 March 2001.

III. At the oral proceedings held on 10 September 2003, the parties submitted the following requests:

The appellant (patent proprietor) requested that the decision under appeal be reversed and the patent be maintained on the basis of the main or auxiliary request submitted together with the statement of grounds of appeal.

The respondents I and II (opponent 01 and 02, respectively) requested that the appeal be dismissed.

IV. Claim 1 according to the main and auxiliary requests reads as follows (the amendments to the claim with respect to claim 1 of the auxiliary request before the Opposition Division have been highlighted by the Board):

Main request:

"1. A method of operating a scanning microscope in which a sample (4) is scanned by an energy beam (1) to generate sample image signals, said sample image signals are stored in image memory (14), and the sample image signals of a selected part of

said image memory (4) are read to generate a display image (20); the magnification of the scanning microscope being varied; characterized in that: the selected part corresponds to part of a scanning frame, and the scan interval of said energy beam (1) is varied in dependence on a variation in magnification **and the proportion of said image memory corresponding to said selected part is constant** when said magnification is lower than a predetermined value; and the proportion of said image memory (14) corresponding to said selected part is varied in dependence on the variation in said magnification and the scan interval is constant when said magnification exceeds said predetermined value."

Auxiliary request:

Claim 1 according to the auxiliary request differs from claim 1 of the main request in that the following sentence is added at the end of claim 1 of the main request:

"wherein said sample is scanned in a series of adjacent scanning lines by a spot of said energy beam (1), and said predetermined magnification corresponds to the magnification at which the area of said sample (4) scanned by said spot for one scanning line is contiguous with the area scanned by said spot for an adjacent scanning line."

V. The appellant argued essentially as follows in favour of his request:

- The Opposition Division's analysis of the prior art was based on hindsight having the present invention in mind. The method according to claim 1 specifies two different magnification regimes for magnifications above and below a predetermined value. For magnifications below this value the scan interval is varied. This mode of operating a scanning microscope is the conventional way of varying the magnification, as disclosed eg in document E14. For magnifications above a predetermined value only a part of the stored image is used to generate the display image and, consequently, the display image is further magnified. This second mode of operation is, however, different from the 'magnifying glass' function disclosed in document E3. It is submitted that when the relevant passage on page 342 of this document is read in the whole context of the document, in particular in the context of the discussion on the different image storage formats on page 340, it follows that the 'magnifying glass' function is only used for matching the stored image to the size of the display and the magnification is subsequently not changed using this mode.

- In the auxiliary request the predetermined value has been further defined to correspond to the physical limit of magnification. Although the magnification limit is imposed by fundamental theoretical considerations, the authors of document E3 did not suggest the use of the 'magnifying glass' function to overcome it. This clearly shows that the claimed method was not obvious to the

skilled person at the priority date of the patent in suit.

VI. The respondents argued on the issue of inventive step essentially as follows:

- The 'magnifying glass' function according to document E3 is disclosed independently of the matching of the stored image's size to the size of the monitor. This is made clear by the statement in document E3 that this function is useful **in particular** when the stored image's size is larger than the monitor's size.

- The theoretical limit of magnification by varying the scan interval is a physical reality acknowledged in the patent in suit and the skilled person in the art was aware of it. The 'magnifying glass' function is implicitly described in document E3 as a way to overcome this limit. Moreover, in the art of SEM, the skilled person would strive to reduce the computing power required. He would, in consequence, use the variation of the scan interval up to the theoretical limit of magnification and then apply the 'magnifying glass' function for overcoming a known theoretical limit.

Reasons for the Decision

1. The appeal is admissible.
2. *Inventive step*

The only issue in this appeal is that of inventive step having regard to documents E3 and E14.

2.1 Claim 1 according to the auxiliary request specifies that the predetermined magnification value at which the operation of the scanning microscope is switched from one mode to the other corresponds to the scan interval at which the area covered by two adjacent scanning lines is contiguous, ie the theoretical limit beyond which no further magnification would be physically possible. In the method according to claim 1 of the main request the predetermined magnification value is any arbitrary value.

The discussion on inventive step in respect of claim 1 of the auxiliary request is, therefore, applicable to claim 1 according to the main request in so far as the 'predetermined value' corresponds to this theoretical limit.

The following discussion is, therefore, based on the method according to claim 1 of the auxiliary request.

2.2 Document E14, which is a part of a textbook on scanning electron microscopy, discloses that variation in the magnification of a scanning electron microscope (SEM) is achieved by variation of the scanned area, since the size of the displayed image remains constant (cf. page 6, second paragraph).

Having regard to the nature and disclosure of document E14, it was part of the common general knowledge of the skilled person in the field of scanning microscopy that the usual way of varying a SEM's magnification is by variation of the distance between two adjacent scanning lines, ie the scan interval. This fact was not contested

by the parties and is, moreover, acknowledged in the patent in suit (cf. the patent in suit, column 1, lines 10 to 37).

- 2.3 As the desired magnification is increased, and the scan interval decreased, the areas swept out by each scanning line approach each other. At a certain interval the area swept out by the spot along one scanning line will adjoin the area swept out by the spot for the immediately adjacent scanning line. For smaller scan intervals, the areas will overlap. When such overlapping occurs, no further increase in the resolution of the scanned image is possible (cf. the patent in suit, column 1, line 48 to column 2, line 4).

Although it is possible to generate the display image directly from the sample image signals, it is conventional to convert the sample image signals into digital signals and store those signals in an image memory from which they can be read out to generate the display image (cf. *ibid*, column 1, lines 38 to 43).

According to the patent in suit, it has been realized that the reading of a part of the content of the image memory, corresponding to a part of the scanning frame, and displaying a display image of that part can result in an effective increase in magnification. This technique allows to achieve magnifications above the theoretical limit (cf. *ibid*, column 2, lines 39 to 43).

- 2.4 It is common ground that document E3 is the most relevant state of the art. This document discloses a SEM with variable framestore and image processing functionality. The SEM is connected to a microcomputer

having a 4 MB image memory which carries out all the image processing functions. Several formats are available for storing the images (ie 256 x 256, 512 x 512, 1024 x 1024 and 2048 x 2048 pixels) depending on the intended SEM's operation mode. It is furthermore mentioned that, depending on the chosen format, up to 15 images may be stored in the image memory (cf. Abstract; page 340, third paragraph).

By using a 'magnifying glass' function details of a stored image may be magnified. This is particularly useful when the image's format is larger than the size of the display of 512 x 512 pixel (*'Mit einer Lupenfunktion können aus einem Bildspeicherbild Details herausvergrößert werden. Dies ist insbesondere dann von Interesse, wenn das Bildformat die Monitorbildgröße von 512 x 512 Pixel überschreitet'*, cf. page 342, sixth paragraph).

- 2.5 The method of operating a scanning microscope according to claim 1 of the auxiliary request differs, therefore, from the disclosure of document E3 in that the magnification is increased by reducing the scan interval until the areas of the adjacent scanning lines are contiguous and the magnification reaches the theoretical limit. Moreover, when that limit is reached the scan interval is maintained constant and the magnification is increased by reducing the part of the image memory being displayed.

The objective technical problem addressed by the invention is, therefore, as disclosed in the patent, to enable an effective increase in magnification (cf. the patent in suit, column 2, lines 39 to 43).

2.6 According to the arguments presented by the appellant, the Opposition Division interpreted the disclosure concerning the 'magnifying glass' function of document E3 with hindsight. It was submitted by the appellant that it becomes clear that this function was solely intended to be used to match the stored image's size to the monitor when the description of the 'magnifying glass' function is read in the context of document E3 taken as a whole. During use of the SEM, the operator has to make a decision in which format the acquired images will be stored in the image memory (from 256 x 256 up to 2048 x 2048 pixels, cf. E3, page 340) and this decision on the format necessarily influences the way the images are displayed on the monitor. For these reasons, it was incorrect to interpret the 'magnifying glass' function of document E3 as disclosing an operation mode which is equivalent to the one disclosed in the patent in suit.

2.7 The Board, however, concurs with the respondents in that the 'magnifying glass' function is disclosed in document E3 as an operation mode that can be employed whenever the skilled person considers it useful. Matching the image size to the monitor's size is merely a specific non-limiting use of the 'magnifying glass' function. This is made clear by the following sentence that states that it is **particularly useful** in such a case, but without limiting it to that use. The format in which the images are stored can vary from 256 x 256 to 2048 x 2048 pixels (cf. E3, page 340). With the highest image resolution of 2048 x 2048 pixels and using a monitor whose display size is of 512 x 512 pixels only every fourth point of the image can be used for displaying the whole scanned area of the sample.

This allows the 'magnifying glass' function to be employed to a 4x zoom into the stored image without losing resolution.

The use of the 'magnifying glass' function disclosed in document E3 is, therefore, not limited to a particular application mode of the microscope nor to a specific magnification range.

- 2.8 The appellant has argued further that although the skilled person could have modified the teaching of document E3, there are no reasons why he would have done so. In particular, the authors of this document failed to recognize that the 'magnifying glass' function could be used to overcome the theoretical limit on magnification although this limit was well known to any skilled person in the field of scanning microscopy.
- 2.9 The method of operating a scanning microscope according to claim 1 specifies that at magnifications below the theoretical limit, ie the predetermined value, the proportion of the image memory being displayed is constant and the scan interval is varied. In contrast thereto, the method disclosed in document E3 allows the use of the 'magnifying glass' function also at all magnifications below the theoretical limit. However, the limitation in the claim does not contribute to the solution of the technical problem addressed by the invention, namely to achieve an effective increase in magnification. According to the established case law of the Boards of Appeal, a feature which does not contribute to the solution of the problem is not to be considered in assessing inventive step.

On the other hand, as already mentioned, the 'magnifying glass' function is not limited to a specific magnification range and can also be used at magnifications corresponding to the theoretical limit of magnification. That this possibility is not specifically disclosed in document E3 would not hinder the skilled person to apply it. Under the present circumstances, a skilled person would try out all the suitable means known in the state of the art to overcome the magnification's theoretical limit.

2.10 For the above reasons, in the Board's judgement the method of operating a scanning microscope according to claim 1 of the auxiliary request does not involve an inventive step in the sense of Article 56 EPC.

As already discussed (cf. point 2.1) the above considerations are applicable to the subject-matter of claim 1 of the main request, so that claim 1 of the main request also does not involve an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

D. Spigarelli

R. K. Shukla