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D E C I S I O N
of 26 February 1997

Case Number: T 0299/94 - 3.4.2

Application Number: 85850055.6

Publication Number: 0155247

IPC: G02B 21/00

Language of the proceedings: EN

Title of invention:
A method for microphotometering microscope specimens

Patentee:
MOLECULAR DYNAMICS

Opponent:
Firma Carl Zeiss
Leica Industrieverwaltung GmbH, Wetzlar Konzernstelle Patente + Marken

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0299/94 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 26 February 1997

Appellant: (Opponent 01)
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Respondent: (Proprietor of the patent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 8 February 1994 concerning maintenance of European patent No. 0 155 247 in amended form.**

Composition of the Board:

Chairman: E. Turrini
Members: W. W. G. Hofmann
M. Lewenton

Summary of Facts and Submissions

I. The Appellants I and II (Opponents I and II) lodged appeals against the interlocutory decision of the Opposition Division on the amended form in which the patent No. 0 155 247 (application number 85 850 055.6) can be maintained.

Oppositions had been filed against the patent as a whole and based on Article 100(a) EPC.

While the Opposition Division had rejected Claim 1 according to the main request, it had held that the grounds for opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent as amended according to the auxiliary request, having regard to the following documents

(E1) Journal of Microscopy, Vol. 117, 1979, pages 219 - 232;

(E2) Review of Scientific Instruments, Vol. 54, 1983, pages 1047 - 1052;

(E3) Nature, Vol. 302, 1983, pages 676 - 681;

(E4) "Scanned Image Microscopy" edited by E. A. Ash, Academic Press, 1980, pages 183 - 225;

(E5) Laser und Optoelektronik, No. 2, 1983, pages 93 - 101;

(D2) Applied Optics, Vol. 22, 1983, pages 1474 - 1478;

(II) US-A-3 013 467;

(III) Applied Pysics, Vol. B27, 1982, pages 211 - 213;

(IV) Journal of Microscopy, Vol. 117, 1979, pages 233 - 242;

(VI) DE-A-23 60 197;

(VII) IEEE International Conference on Electronic Image Processing, 1982, pages 101 - 104;

(VIII) Castleman: "Digital Image Processing", Prentice-Hall, 1979, pages 30, 351 - 353, 371 - 373.

In the appeal proceedings, the further documents

(E6) Harrison, Sandler and Miller (editors): "Cardiovascular Imaging and Image Processing", The Society of Photo-optical Instrumentation Engineers , Palos Verdes Estates, California, 1975, pages 183 - 194;

(IX) Journal of Computer Assisted Tomography, Vol. 5, 1981, pages 881 - 887;

(X) The Journal of the Acoustical Society of America, Vol. 52, 1972, pages 673 - 687;

(XI) IEEE Conf. Pub. No.214 of: The IEEE Symposium 26-28 July 1982, at University of York, "Contents" pages III - VII;

(XII) Cox: "Image Processing in the Scanning Optical Microscope" (Thesis submitted for the degree of Doctor of Philosophy, Trinity Term 1983); front page, acknowledgements, abstract, table of contents, pages 6-1 to 6-13, pages 7-1 to 7-6, references, publications arising from this thesis;

(XIII) Microscopica Acta, Vol. 81, 1978, pages 31 - 35;

(XIV) Computer Graphics and Image Processing, Vol. 9, 1979, pages 1 and 2;

as well as the further page 348 of document VII were cited by the Appellants.

II. Oral proceedings were held, at the end of which Appellants I and II requested that the decision under appeal be set aside and that the patent be revoked.

The Respondents (Proprietors of the patent) requested that the patent be maintained in amended form on the basis of Claims 1 to 6 filed with the letter of 17 February 1997.

III. The wording of Claim 1 on file at the time of the present decision reads as follows:

"1. A method of microphotometry of a plurality of layers in a specimen (10), and of subsequent image processing, by the repetition of identical steps, each step comprising the substeps of

- generating, with the aid of a convergent light beam, a luminous dot in the focal plane (11) of a microscope (30);

- using the dot to scan a plurality of parts in a predetermined layer of the specimen (10);

- collecting the light emanating from each scanned part of the specimen (10);

- screening-off any disturbing light created synchronously from adjacent parts, i.e. parts above, beneath and beside the measured part in the specimen (10), by using an aperture (34) in a confocal arrangement wherein the backprojected image of the aperture (34) on the specimen (10) coincides with the luminous dot;

- detecting the collected light after screening-off, thus producing electric signals;

- storing measurement values obtained through said detection, said storage optionally being performed synchronously with the scanning by the luminous dot of the parts of the specimen (10); and

- changing the distance (z-direction) between the specimen (10) and the focal plane (11), thus allowing subsequent scanning of the next predetermined layer of the specimen, repeating the step a predetermined number of times to obtain a set of values representing a given volume of the specimen, then processing selected values from selected locations in said plurality of layers corresponding to a desired section inclined to said predetermined layers, to obtain data associated with a said desired section of the specimen."

Claims 2 to 6 are dependent on Claim 1.

IV. The Appellants I argued essentially as follows:

The method according to Claim 1 comprises two distinct parts, the first one relating to the production of a three-dimensional data field by means of confocal optical microscopy, and the second one relating to the processing of the data of this data field. The features of the first part, up to obtaining a set of values representing a given volume of the specimen, are entirely known from VII. The second part does not even refer to displaying an image of an inclined section, but only to obtaining data associated with such an inclined section. The aim underlying these features can be seen in finding another way of using the three-dimensional set of data. In any case, displaying inclined sections by selecting corresponding values from a three-dimensional data field, is described in E6, or in IX. Although these documents relate to X-ray tomography, the suggestions contained therein can immediately be used for treating the data obtained in accordance with VII since, for treating given image data, it does not matter how these data have been obtained. Even the Patentees must have assumed that every skilled person in microscopy has good overall knowledge of the techniques of digital image processing since they did not find it necessary to include any details on the process of image processing in the specification of the patent. For these reasons, it was obvious to use the teachings of E6 (or of IX) in the method of VII.

V. The Appellants II supported the arguments of the Appellants I and, moreover, stressed the following points:

VII describes the production of a three-dimensional set of data in a confocal optical microscope. Such three-dimensional data are more extensively described

in VIII to which reference is made in VII. VIII does not relate to confocal microscopy, but it is evident that confocal microscopy is even better suited for obtaining three-dimensional data sets than "high resolution microscopy" since the deblurring step is no longer required. The fact that the author of VII (Cox) indeed realized the possibility of using confocal scanning for obtaining and storing data of the volume of a specimen, becomes particularly clear from his thesis, document XII.

Producing the image of inclined sections from a set of three-dimensional image data is well known in X-ray computer tomography and ultrasonic diagnosis (see IX and X), where it is also known that such oblique sections may help in finding the optimal orientation of the image plane for a given specimen. This motivation equally applies to three-dimensional microscopy. Image processing in X-ray tomography, ultrasonic imaging and scanning optical microscopy has always faced similar problems and has been discussed in common interdisciplinary conferences, see XI. The reasons why modern image processing in the field of computer tomography and ultrasonic imaging was farther developed than in optical microscopy, are purely commercial in nature: at times when powerful computers were still very costly, it was doubtful whether microscopes could be sold at the correspondingly high price.

VI. The Respondents' arguments may be summarised as follows:

In VIII, the Appellants focus their considerations only on very short passages of the text (on pages 351 and 371). If one interprets the whole content of VIII correctly, it becomes clear that this document does not suggest volume processing, but is rather restricted to two-dimensional processing. The disclosure of VII is

also ambiguous. As regards three-dimensional image processing, VII only mentions a form of tomographic imaging accomplished by using three independent colours. Thus, there is no three-dimensional sectioning, but only two-dimensional image capturing and simultaneous display of three different colours. E6, IX and X deal with computer tomography, two-dimensional echoscopy, video X-ray imaging and similar imaging techniques. According to these documents, the image data do not correspond to isolated points in a plane, but either to two-dimensional summation images or data columns which must be mathematically decomposed before they can be used. Because of these differences, it was not obvious to apply some of the knowledge from computer tomography without also applying its densitometric mathematical techniques. Contrary to the methods described in E6, IX and X, the data obtained by confocal microscopy are so free of interference with neighbouring data points that mathematical separation is not needed. Moreover, in 1984 (when the priority document to the present patent was filed), the fields of microscopy and of large diagnostic apparatuses in medicine were still strictly separated, and knowledge of the one field was admitted to the other only very hesitatingly. Therefore, an expert in microscopy would not have informed himself about the techniques of computer tomography or ultrasonic imaging.

Reasons for the Decision

1. The appeals are admissible.

2. *Amendments*

In view of the modifications to Claim 1 filed by the Respondents, Appellants I have not maintained their objections regarding contravention of Article 123(2) EPC. Indeed, the feature that the "desired" section is inclined to the "predetermined" layers, is disclosed on the original page 11, last paragraph, and in the original Figure 7. Moreover, the said additional feature and the deletion of the second one of the alternatives "section" and "projection" do not extend, but only restrict the protection conferred by Claim 1, as compared with the granted version of Claim 1.

Thus, the requirements of Articles 123(2) and (3) EPC are fulfilled.

3. *Novelty*

The cited documents may be divided into two groups. The documents of the first group (E1, E2, E3, E4, E5, D2, II, III, IV, VI, VII, VIII, XII and XIII) relate to optical microscopy (many of them to confocal microscopy; VI, VII and XII additionally to determining and storing the measurement values of the light intensities collected by scanning a plurality of layers representing a given volume in a specimen). However, none of these documents mentions processing selected values from locations corresponding to a section inclined to the previously scanned layers and obtaining data associated with the said inclined section.

The documents of the second group (E6, IX, X and XIV) describe the processing of values corresponding to inclined sections and obtaining data associated with the said inclined sections. However, these documents do not relate to optical microscopy, but to X-ray and ultrasonic imaging.

XI is only a table of contents for a conference publication and does not give any technical information on the topics mentioned.

The method according to Claim 1 is therefore novel in the sense of Article 54 EPC.

4. *Inventive step*

4.1 VII relates to optical confocal scanning microscopy (see page 101, left-hand column, last paragraph, and right-hand column, fourth paragraph). This means that the known method necessarily comprises the first six steps marked by dashes in the present Claim 1. Moreover, in further correspondence with the claimed method, the paragraph bridging pages 101 and 102 clearly mentions the possibility of scanning three (or more) different planes (distinguished by their z-coordinates) **within** a (cellular) specimen, so that the obtained set of values, contrary to the allegation of the Respondents, represents a given volume of the specimen. (This disclosure cannot be invalidated by the fact that - as the Respondents argue - VII also mentions several other embodiments of digital image processing which have nothing to do with values representing a volume in a specimen.)

The differences between the claimed and the known subject-matter begin only at the point where, starting from the known three-dimensional set of values, use is made of these values for displaying an image in a suitable way.

Thus, according to Claim 1, those data from the whole set of data are selected and image processed, which belong to locations corresponding to a section inclined with respect to the layers of scan, while according to the above-cited paragraph of VII each one of the scanned planes is displayed (and marked by an individual colour).

Choosing inclined sections serves the purpose of improving the flexibility of the imaging method for allowing a person carrying out an investigation of a specimen to produce, in short time, views under those angles which may be desired as the investigation proceeds (cf page 2, lines 55 to 57, and page 6, lines 57/58, of the patent specification).

4.2 For this very purpose, choosing image sections inclined with respect to the plurality of layers for which the image data had precedingly been obtained, and calculating the data for the chosen section from corresponding data of the plurality of layers, is well known in X-ray tomography and ultrasonic imaging.

For example, IX describes an X-ray tomographic method of this type (see in particular the abstract; page 881, left-hand column, first paragraph and right-hand column, lines 16 to 18; page 883, right-hand column, lines 13 to 20; page 884, left-hand column, second and third paragraphs). In this known method, a stack of parallel cross-sectional image density distributions is calculated. IX thus obtains a set of values (voxels) representing a plurality of layers in a given volume,

in correspondence with the set of values obtained according to VII and with that specified in the present Claim 1. From this set of values, IX calculates sections inclined with respect to the original scanned cross-sectional layers, using for this calculation values from selected locations in said plurality of layers corresponding to the desired inclined section.

4.3 Contrary to the Respondents, the Board cannot see a decisive difference, as far as further image processing is concerned, in the fact that in the case of IX already the determination of the values for the set of layers (voxels) requires extensive calculation (since the primarily obtained X-ray scans only represent projections through the whole depth of the specimen, while confocal microscopy immediately leads to separated values within the set of layers). Three-dimensional picture elements (voxels) have technically the same meaning and the same properties, whether they have been obtained from optical microscopy or from X-ray tomography via more or less complicated calculations, and can consequently be further processed in the same way, achieving the same advantages. The Board is convinced that a person skilled in the art was aware of this fact.

4.4 It is true that microscopic specimens are usually small, while X-ray tomography usually serves to image relatively large objects (eg blood vessels or a canine thorax in the case of IX). However, while this difference in size of the object may considerably influence the techniques necessary for obtaining the image data, it is evident for any skilled person that it does not matter as far as the further processing of already existing image data is concerned.

The Respondents further argue that in 1984, the year of priority of the patent in suit, the fields of microscopy and of X-ray tomography were still very much separated from each other, so that techniques known in the one field would not be known to or at least not seriously considered by experts in the other field. Contrary to this allegation, however, document XI (see in particular pages IV and V) proves that in 1982 even common conferences were held for experts in optical microscopy, X-ray tomography, ultrasonic and NMR imaging, dealing with the problems of image processing. This shows that, on the one hand, exchange of ideas existed between these fields, and that, on the other hand, the fields of optical scanning microscopy, X-ray computer tomography and ultrasonic imaging must be considered as neighbouring fields.

4.5 It was therefore obvious for a person skilled in the art of scanning microscopy and starting from the method according to VII, to make use of the advantages, regarding flexibility of the display of sections, offered by the method according to IX and, to this end, replace the step of image processing proposed in VII by that described in XI.

4.6 A teaching similar to that of IX, also relating to obtaining image data associated with inclined sections in a volume, is contained in E6 (relating to X-ray tomography; see in particular page 185, last paragraph to page 186, right-hand column, second paragraph and page 188, left-hand column, second paragraph) and in X (relating to ultrasonic imaging; see in particular abstract, chapter "Section Generation" on page 676 and chapter "Oblique Sections" on page 682). For the same reasons as indicated above, the combination of each of these teachings with that of VII is also obvious.

4.7 It is therefore concluded that the subject-matter of Claim 1 does not involve an inventive step in the sense of Article 56 EPC. Consequently, Claim 1 is not allowable under Article 52 EPC and the patent has to be revoked (Article 102(1) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The European patent No. 0 155 247 is revoked.

The Registrar: The Chairman:

P. Martorana E. Turrini