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**Datasheet for the decision
of 23 May 2007**

Case Number: T 0850/05 - 3.2.02

Application Number: 98945417.8

Publication Number: 1107694

IPC: A61B 5/05

Language of the proceedings: EN

Title of invention:

Apparatus and method for detecting abnormalities in bodily matter

Patentee:

DE MONTFORT UNIVERSITY

Opponent:

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Headword:

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Relevant legal provisions:

EPC Art. 83

Keyword:

"Sufficiency of description (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0850/05 - 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 23 May 2007

Appellant: DE MONTFORT UNIVERSITY
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Representative: Robertson, James Alexander
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 25 January 2005
refusing European application No. 98945417.8
pursuant to Article 97 (1) EPC.

Composition of the Board:

Chairman: T. Kriner
Members: S. Chowdhury
M. Vogel

Summary of Facts and Submissions

- I. This appeal is against the decision of the examining division dated 25 January 2005 to refuse European patent application No. 98 945 417.8.

The application was refused on the grounds that the application did not satisfy the requirements of Articles 83 and 84 EPC because the claims were unclear since it was not clear what "fractal model of tissue impedance" meant, and the application did not explain how an equivalent circuit based on this concept could be constructed, or how it was used to establish a correlation between detected tissue impedance and the presence or absence of abnormalities.

- II. On 24 March 2005 the appellant lodged an appeal against the decision and paid the prescribed fee on the same day. On 6 June 2005 a statement of grounds of appeal was filed.

- III. Oral proceedings took place on 23 May 2007. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of:
- claims 1 to 19, filed on 23 April 2007 (main request)
 - claims 1 to 18, filed on 23 April 2007 (auxiliary request).

IV. Independent claim 1 of the main request reads as follows:

"Electrical impedance tomography apparatus adapted to detect abnormalities in bodily matter 10 comprising: electrical signal generating means 12 for generating electrical signals at a plurality of frequencies; an electrode arrangement 14, 16, 18, 20 for applying said electrical signals to said bodily matter 10 and detecting electrical impedance properties of said bodily matter 10; and data processing means 20 for comparing said detected electrical impedance properties with a database of impedance properties corresponding to bodily matter of known composition in order to determine the presence or absence of abnormalities in said bodily matter 10; wherein electrical signals of a frequency greater than 1 MHz, preferably greater than 2 MHz, more preferably greater than 3 MHz and most preferably greater than 4 MHz are applied to said bodily matter 10; and characterised in that said data processing means 16, 18, 20 correlates said detected electrical impedance properties with the database of impedance properties using a fractal model of tissue impedance which comprises a first cellular equivalent circuit (Zcell) structure level comprising first, second and third Zcells, said first and second Zcells being in series, and said first and second Zcells being in parallel with said third Zcell, each Zcell in the Zcell structure level comprising a single cell equivalent circuit which comprises:

(i) a first membrane impedance circuit (101) comprising cell membrane capacitance (102) in series with membrane resistance (103), said cell membrane capacitance and

membrane resistance being in parallel with cross-membrane resistance (104);

(ii) a second intracellular impedance circuit (111) comprising intracellular capacitance (112) in series with intracellular resistance (113), said intracellular capacitance and intracellular resistance being in parallel with intracellular cross-resistance (114); and

(iii) a third extracellular impedance circuit (121) comprising extracellular capacitance (122) in series with extracellular resistance (123), said extracellular capacitance and extracellular resistance being in parallel with extracellular cross-resistance (124); said first membrane impedance circuit and said second intracellular impedance circuit being in series, and said first membrane impedance circuit (101) and said second intracellular impedance circuit (111) being in parallel with said third extracellular impedance circuit (121)".

Claims 2 to 19 are dependent claims.

Claim 1 of the auxiliary request reads as follows:

"Electrical impedance tomography apparatus adapted to detect abnormalities in bodily matter 10 comprising: electrical signal generating means 12 for generating electrical signals at a plurality of frequencies; an electrode arrangement (14, 16, 18, 20) for applying said electrical signals to said bodily matter 10 and detecting electrical impedance properties of said bodily matter 10; and wherein electrical signals of a frequency greater than 1 MHz, preferably greater than

2 MHz, more preferably greater than 3 MHz and most preferably greater than 4 MHz are applied to said bodily matter 10; and characterised in that said data processing means 20 correlates said detected electrical impedance properties with a database of impedance properties corresponding to bodily matter of known composition in order to determine the presence or absence of abnormalities in said bodily matter 10: using a fractal model of tissue impedance which fractal model of tissue importance comprises a cellular equivalent circuit (Zcell) structure level comprising first, second and third Zcells, said first and second Zcells being in series, and said first and second Zcells being in parallel with said third Zcell, each Zcell comprising a single cell equivalent circuit which comprises:

(i) a first membrane impedance circuit (101) comprising cell membrane capacitance (102) in series with membrane resistance (103), said cell membrane capacitance and membrane resistance being in parallel with cross-membrane resistance (104);

(ii) a second intracellular impedance circuit (111) comprising intracellular capacitance (112) in series with intracellular resistance (113), said intracellular capacitance and intracellular resistance being in parallel with intracellular cross-resistance (114); and

(iii) a third extracellular impedance circuit (121) comprising extracellular capacitance (122) in series with extracellular resistance (123), said extracellular capacitance and extracellular resistance being in parallel with extracellular cross-resistance (124);

said first membrane impedance circuit (101) and said second intracellular impedance circuit (111) being in series, and said first membrane impedance circuit (101) and said second intracellular impedance circuit (111) being in parallel with said third extracellular impedance circuit (121)".

Claims 2 to 18 are dependent claims.

V. The appellant argued as follows:

The problem addressed by the application was the understanding that electrical impedance properties could be modelled as an equivalent circuit having the fractal structure as defined in claim 1. The interpretation of the EIT results could then be performed by determining information about the values of Z_i , Z_x , etc., and the electrical impedance properties could be interpreted by comparing the measured impedance properties with a database of impedance properties using this fractal model of tissue impedance. The determination of information about the values of Z_i , Z_x , etc. was a standard problem solvable by the person skilled in the art.

The appellant understood from the Board's communication that it was not clear how the equivalent circuit was constructed, it did not appreciate that the Board's problem was how to determine the values of the circuit elements. Therefore, it did not address the latter problem and could not provide proof at the oral proceedings that this was common general knowledge.

Regarding how the fractal model of tissue impedance was used to correlate the data, this was implicit in the description.

Reasons for the Decision

1. The appeal is admissible.

2. Article 83 EPC requires a patent application to disclose the invention in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art, and Rule 27 (1) (c) EPC requires the description to disclose the invention, as claimed, in such terms that the technical problem (even if not expressly stated as such) and its solution can be understood.

The Board, in its communication dated 28 February 2007, had expressed its doubts as to whether the application sufficiently discloses how to carry out the claimed invention, but the appellant was unable, either in its written submissions or at oral proceedings, to dispel these doubts. The following points discuss the shortcomings of the application in this respect.

These considerations are directed both to the main request and to the auxiliary request since claim 1 of both requests defines the use of a fractal model of tissue impedance.

3. A sine qua non of every patent application is that a technical problem and its solution be apparent, either by being set out explicitly or being implicit in the

application. In the present case, however, the technical problem is not understood.

The description states (see WO-A-00/12005, page 1, last paragraph) that electrical impedance tomography apparatus (EIT) is a well known technique which provides 2 dimensional images or "slices" through an object using an array of electrodes which typically encircle the object. Then, on page 2, second complete paragraph it is stated that the present invention is concerned with an improved EIT technique which enables non-invasive detection and imaging of abnormalities in bodily matter, and on page 11, last paragraph it is stated that an important aspect of the present invention is the two-tier fractal or cascaded model of tissue impedance that is used to interpret the EIT measurements. Claim 1 also relates to electrical impedance tomography apparatus which implies an imaging step.

Accordingly, the reader of the application is entitled to believe that the application provides an improved imaging apparatus for detecting abnormalities in bodily matter. Claim 1, however, contains no imaging step. For this reason the technical problem is not understood.

4. The present technical solution is also not understood. The apparatus of claim 1 is defined by means of constructional features in the preamble of the claim, but its characterising part defines how a data processing means carries out its operation. However, it is not clear from the application how the operations may be carried out.

Central to the functioning of the apparatus is that data processing means correlates detected electrical impedance properties with a database of impedance properties using a fractal model of tissue impedance. The description is insufficient, however, regarding how such a model may be constructed.

It is well known in the art, as stated by the appellant, that the impedance properties of a dielectric such as human tissue may be represented by a simple equivalent circuit comprising a parallel arrangement of C/CR or R/RC elements.

The Board also accepts that a more sophisticated equivalent circuit, such as one having a fractal structure as defined in claim 1, may be pre-defined as an equivalent circuit, but it is not clear how the values of the circuit elements of such a circuit may be determined. The application gives no examples to illustrate the method.

According to the appellant this is common general knowledge for the person skilled in the art, and evidence of this would have been provided had the appellant not been misled by the Board's communication, point 2.2 a).

It is correct that the Board's communication states that it was not clear how the circuit may be constructed, and accepts that an equivalent circuit may be predefined. However, implicit in Board's communication is also the matter of how the circuit values are to be determined, because a circuit has both a structure and circuit elements with defined values.

The appellant should have appreciated this point and furnished the necessary evidence in this respect. In the absence of evidence that the person skilled in the art would be able to determine the values of the circuit elements, the Board concludes that the application does not sufficiently disclose how the equivalent circuit is to be constructed.

5. Since the electrodes are applied about a body, it is expected that any derived equivalent circuit would represent bulk tissue. It is not clear how the apparatus could resolve finer detail and deduce the equivalent circuit values for single cells, extra-cellular impedance, intra-cellular impedance, and membrane impedance. Therefore, the application is insufficient in this respect also.
6. The description is also insufficient regarding how the fractal model of tissue impedance is used to correlate the detected electrical impedance properties with the database of impedance properties, as defined in claim 1. According to the appellant this is implicit from the description.

However, there is a discrepancy between claim 1 and the description as to how the fractal model is used. According to claim 1 the data processing means correlates detected electrical impedance properties with a database of impedance properties, ie purely electrical values are compared. According to the particular description (page 10) of the apparatus with reference to the Figures, however, an image is first constructed and data is extracted from this image, and it is this data that is correlated to a database. Thus,

according to the description it is not the electrical values that are compared but data derived from an image which are compared with a database.

The grounds of appeal give yet another explanation of the correlation step. On page 3 thereof it is stated that parameters of the fractal model are compared with parameters in a database.

7. For the above reasons the Board endorses the decision of the examining division entirely. The application lacks sufficiency in the sense of Article 83 EPC.

ORDER

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

V. Commare

T. K. H. Kriner