Datasheet for the decision of 13 January 2011

Case Number: T 1348/07 - 3.4.01

Application Number: 00309261.6

Publication Number: 1094332

IPC: G01R 3/565

Language of the proceedings: EN

Title of invention:
Phase distribution measurement method and apparatus, phase correction method and apparatus, and magnetic resonance imaging apparatus

Applicant:
GE Medical Systems Global Technology Company LLC

Opponent:
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Headword:
-

Relevant legal provisions:
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Relevant legal provisions (EPC 1973):
EPC Art. 84

Keyword:
"Clarity (no)"

Decisions cited:
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Catchword:
-
Case Number: T 1348/07 - 3.4.01

DECISION
of the Technical Board of Appeal 3.4.01
of 13 January 2011

Appellant: GE Medical Systems Global Technology Company LLC
3000 North Grandview Boulevard
Waukesha
Wisconsin 53188 (US)

Representative: Pedder, James Cuthbert
London Patent Operation
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Composition of the Board:
Chairman: B. Schachenmann
Members: F. Neumann
H. Wolfrum
Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse the European patent application number 00 309 261.6.

II. The appellant has requested that the decision be set aside and a patent be granted on the basis of claims 1 to 15 filed with the statement of the grounds of appeal dated 23 July 2007.

As an auxiliary measure, oral proceedings were requested.

III. The Board issued a summons to oral proceedings and in an annex thereto set out the points to be discussed. It was anticipated that inventive step would be the main issue, but that clarity and sufficiency of disclosure may have to be discussed in order to fully understand the invention. The annex to the summons concluded by drawing attention to some clarity objections.

IV. The appellant responded to the summons simply by cancelling the request for oral proceedings and requesting a decision according to the state of the file. No comments or amendments were filed in reaction to the observations set out in the annex to the summons.

Reasons for the Decision

1. The invention concerns the "unwrapping" of a phase map which has been obtained by calculating the phase of
magnetic resonance imaging (MRI) data for each pixel of an image.

Mapping the phase information of an MRI signal pixel-by-pixel provides a representation in which all phase values within the resulting phase map lie within the range $-\pi$ to $+\pi$. This is because the value of the phase of the complex MRI signal is represented by a "principal value" contained in the range $-\pi$ to $+\pi$. Phase values lying outside this range are "wrapped around" to give a principal value within the range. This wrapping procedure consists of adding or subtracting a multiple of $2\pi$ such that the result is contained within the principal range. The phase values represented on the phase map are therefore ambiguous: they may contain any multiple of $2\pi$ but will still be represented by the same principal value.

In order to access the true phase information contained in a wrapped phase map, it must first be "unwrapped". This unwrapping process can be considered to be a correction process in which the true phase value is determined from the wrapped phase value.

In order to unwrap the phase map, the application proposes calculating phase differentials for each pixel of a magnetic resonance image, calculating the corresponding integrals for each pixel and forming a new ("corrected") phase map from these integrals. In this way, an unwrapped phase map is obtained, the phase values of which are no longer limited to the range $-\pi$ to $+\pi$. 
2. In the annex to the summons to oral proceedings dated 27 October 2010, the Board raised, inter alia, the following objections which are still maintained.

2.1 Independent claim 1 is directed to a phase distribution measurement method comprising the steps of calculating differentials of phases of pixel data in a magnetic resonance image for each pixel and calculating integrals of said differentials for each pixel. The step of "forming a phase distribution from said integrals", which was included in a previous version of claim 1, has been omitted from present claim 1 in response to the criticism of the examining division that this step adds nothing to claim 1 since the step of integration itself provides a phase distribution.

The aim of the invention is to provide an unwrapped phase map (see paragraphs [0008], [0009], [0010] and [0122] of the published application) yet the method defined in claim 1 ends with the step of calculating (or of low-pass filtering) the integrals of the differentials.

The examining division held that the integration already gives a phase distribution and that it is not clear which additional processing the step of "forming a phase distribution from said integrals" actually comprises. However, according to the description (see paragraph [0121] of the published application), integration is performed by an integral calculating unit 704 and then this step is followed up by the formation of a phase map in phase map forming unit 706 using the output data of the integral calculating unit. Hence the raw data resulting from the pixel-by-pixel
calculation of the integrals is subjected to a further processing step to obtain the desired phase map. The Board agrees with the examining division that a phase distribution can be derived from the individual pixel-by-pixel integration values but the description consistently presents that a further processing step is performed to convert this raw data to a phase distribution. The fact that a method step which is consistently presented as being essential to the performance of the invention is in fact missing from the independent method claim, means that claim 1 is not supported by the description (Article 84 EPC 1973).

2.2 Correspondingly, independent claim 6 is directed to a phase distribution measuring apparatus comprising means for calculating differentials of phases of pixel data in a magnetic resonance image for each pixel and means for calculating integrals of said differentials for each pixel. The "phase distribution forming means", which was previously included in claim 6, has now been omitted therefrom, resulting in a lack of support by the description (Article 84 EPC 1973).

2.3 A further consequence of these omissions is that the reference to "said phase distribution" in claims 4, 5, 9 and 10 lacks an antecedent, making these claims unclear (Article 84 EPC 1973).

3. The presence of this deficiency is enough, on its own, to justify refusal of the application. In spite of being fully aware of this deficiency - attention having been drawn thereto in the annex to the summons to oral proceedings dated 27 October 2010 - the appellant has not made any attempt to overcome this objection, but
instead has explicitly requested a decision according to the state of the file.

In these circumstances, the Board considers that it is not unreasonable to refuse the application on this basis alone and that it is not necessary to enter into a discussion of any other issues.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:     The Chairman:

R. Schumacher     B. Schachenmann