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Datasheet for the decision of 5 February 2014

Case Number: T 1208/09 - 3.4.01

Application Number: 07105422.5

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IPC: G01R33/385

Language of the proceedings: EN

Title of invention:
MRI/MRS gradient coil with integrated cooling circuits

Applicant:
GENERAL ELECTRIC COMPANY

Headword:

Relevant legal provisions:
EPC 1973 Art. 84, 56
EPC Art. 123(2)

Keyword:
Claims - clarity (yes)
Inventive step - (yes)
Amendments - added subject-matter (no)

Decisions cited:

Catchword:

Beschwerdekammern
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Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1208/09 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 5 February 2014

Appellant: (Applicant)	GENERAL ELECTRIC COMPANY 1 River Road Schenectady, NY 12345 (US)
Representative:	Bedford, Grant Richard GPO Europe GE International Inc. The Ark 201 Talgarth Road Hammersmith London W6 8BJ (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 15 January 2009 refusing European patent application No. 07105422.5 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: G. Assi
Members: P. Fontenay
J. Geschwind

Summary of Facts and Submissions

I. The present decision relates to the appeal which was filed against the decision of the examining division to refuse European patent application No. 07 105 422.5.

II. The decision was taken "*according to the state of the file*" and referred to three previous communications of the examining division. It was remitted to the post on 15 January 2009.

III. In the third communication, dated 17 December 2008, which relates to the same requests as those underlying the statement of grounds of appeal, the examining division *inter alia* reiterated its view that there was a "*fundamental lack of an inventive step*". Reference was made, in this respect, to an earlier communication of the examining division dated 16 May 2008, which in turn referred to the European Search Opinion, in which it was stated by way of an *obiter dictum* that the embodiment depicted in Figure 2 of the application comprised merely a combination of well-known features. Reference was made in this regard to documents D1, D3, D4, D5, D7, D8 and D9. It was further stressed that each of said well-known features provided the technical effect that was normally expected and that their combination did not give rise to any surprising synergistic effect (cf. European Search Opinion, page 2, third paragraph).

IV. The notice of appeal was received on 23 March 2009. The appeal fee was paid on the same day. The statement of grounds of appeal was filed on 22 May 2009.

With the notice of appeal the appellant requested "*that the Decision [under appeal] be set aside, and that a*

patent be granted on the basis of the present claims, or on the basis of amended claims which may be submitted in the course of the proceedings". The "*present claims*" correspond to those filed as main request and auxiliary request by letter of 12 December 2008 and underlying the decision under appeal.

With the grounds of appeal the appellant presented arguments according to which none of the cited documents, either alone or in combination, disclosed or suggested the use of a split X-axis gradient coil with a view to improving cooling without reducing the efficacy of the gradient coils. The requests on file were maintained.

V. In accordance with a request filed by the appellant, a summons to attend oral proceedings was issued on 11 October 2013.

VI. On 15 October 2013, the Board issued a communication pursuant to Article 15(1) RPBA, expressing its provisional opinion with regard to the requests then on file.

First, the attention of the appellant was drawn to shortcomings with regard to the requirement of clarity of the claims under Article 84 EPC 1973. It was, secondly, observed that claim 1 of the main request would rely on an intermediate generalisation of the embodiment illustrated in Figures 2 and 3 of the original description, thus infringing Article 123(2) EPC.

Concerning the issue of lack of an inventive step, the Board concurred with the examining division in its view

that the basic idea underlying the disclosed solution of splitting a primary gradient coil into two layers and designing a layer so as to permit the delivery of a coolant fluid was already known at the time the present application was filed.

VII. By letter dated 20 December 2013, the appellant filed a new main request and a new auxiliary request addressing the issues raised by the Board in its provisional opinion. The new requests replaced the previous requests on file.

In the appellant's view, all the essential features necessary to define the invention had been included in the claims so that the requirements of Article 84 EPC 1973 were met. In its view, the requirements of Article 123(2) EPC were also met.

Moreover, the view that the subject-matter of claim 1 of each of the two requests was inventive (Article 56 EPC 1973) was reiterated. It was stressed, in this respect, that the claimed configuration allowed adequate cooling whilst enabling satisfactory performance of the primary gradient coils.

VIII. Oral proceedings took place before the Board on 5 February 2014 in presence of the appellant.

The appellant requested that the decision of the examining division be set aside and that a patent be granted on the basis of a sole request filed during the oral proceedings, i.e. on the basis of following application documents:

Claim 1 of the sole request filed during the oral proceedings,

Description pages 1, 2, 2a and 3-13 filed during the oral proceedings,
Figures 1-4 as originally filed.

IX. Claim 1 of the appellant's request on file reads as follows:

"*1. A magnetic resonance imaging apparatus comprising, in the following order with regard to the radial direction, an examination space (108), an innermost set of coils (208, 206, 204, 203) comprising primary gradient coils for generating magnetic field gradients along x-, y- and z- directions in the examination space; a set of secondary, shielding, gradient coils (302); and an outermost coil (301) comprising a main magnetic field coil; wherein the primary gradient coils comprise, in order, an innermost x-axis gradient coil (208) comprising current-carrying tubing having a coolant channel (214); a y-axis primary gradient coil (206); a second x-axis gradient coil (204) electrically connected in series with the innermost x-axis coil [,] said innermost x-axis gradient coil (208) and said second x-axis gradient coil (204) together forming the x-axis primary gradient coil as a current carrying coil split into two connected layers; and a z-axis primary gradient coil (203) [,] wherein the z-axis primary gradient coil (203) comprises a coolant-carrying channel (202), wherein the innermost x-axis gradient coil (208) is constructed of copper tubing and the second x-axis gradient coil (204) is composed of a solid copper sheet that carries no coolant.*"

X. It is noted that the revised version of the Convention (EPC 2000) does not apply to European patent applications pending at the time of its entry into force (13 December 2007), unless otherwise provided. In

this decision, where Articles or Rules of the former version of the EPC apply, their citation is followed by the indication "1973".

Reasons for the Decision

1. *Clarity (Article 84 EPC 1973)*

1.1 It is established jurisprudence of the boards of appeal that the skilled person, when considering a claim, should rule out interpretations which are illogical or which do not make technical sense. He should namely try to arrive at an interpretation of the claim which is technically sensible. In other terms, the claim must be construed by a mind willing to understand, not a mind desirous of misunderstanding (cf. Case Law of the Boards of Appeal, 7th. Edition 2013, point II.A.6.1, first paragraph).

If the circumstances so require, it is fully justified to depart from a purely literal interpretation of the terms of a claim. This is, for example, the case when the terms used in the wording of the claims have already a recognised meaning in the technical field of the invention or when the general context of the claimed invention conveys a precise idea of their meaning.

Hence, the Board is not convinced by many of the objections raised by the examining division under Article 84 EPC 1973 in the communications referred to in the decision to refuse the application. As a matter of fact, these objections relied on an essentially literal interpretation of the terms used in the claims without any reference to the general context of the

claimed invention, thus disregarding the general principles of interpretation mentioned above.

1.2 Claim 1 has been amended to specify all the necessary features of the MRI apparatus, in particular the order according to which the various gradient coils are located in the radial direction.

1.3 Moreover, claim 1 is clearly supported by Figures 2, 3 and paragraph [0035] of the original application as published. In particular, the claim establishes in unambiguous terms that the x-axis primary gradient coil is formed of the innermost coil layer and the second x-axis gradient coil.

1.4 The claim thus meets the requirements of Article 84 EPC 1973 as to clarity and support by the description.

2. *Added subject-matter (Article 123(2) EPC)*

The definition of the claim reflects the disclosure of the embodiment disclosed in Figures 2 and 3 of the description.

The Board is satisfied, under the present circumstances, that all the features of this embodiment which contribute to the effects recited in paragraph [0030] of the application as published, in terms of improved temperature control and balanced performance of the x- and y- axis gradient magnetic field inside the examining space, are included in the definition of the claim. In particular, the feature of the z-axis primary gradient coil comprising a coolant-carrying channel, which also contributes to the temperature control, is now recited in the claim. Similarly, the fact that according to Figure 2, the second x-axis

gradient coil carries no coolant is explicitly specified in the claim.

For these reasons, the requirements of Article 123(2) EPC are met.

3. *Inventive step (Article 56 EPC 1973)*

3.1 The following documents have been considered during the appeal proceedings.

D1: JP-A-2005-279168;
D2: H. Lu et al., "*Momentum-Weighted Conjugate Gradient Descent Algorithm for Gradient Coil Optimization*", Magnetic Resonance in Medicine, 2004, Vol. 51, Pages 158-164;
D3: US-A-5 786 695;
D4: WO-A-02/075345;
D5: WO-A-2005/043185;
D6: K. Deka et al., "*Quantitative density profiling with pure phase encoding and a dedicated 1D gradient*", Journal of Magnetic Resonance, January 2006, Orlando (US), Vol. 178, pages 25-32;
D7: B. A. Chronik et al., "*A 2000mT/m Multilayer Gradient Coil for Mouse Imaging*", Proceedings of the International Society for Magnetic Resonance in Medicine, Scientific Meeting and Exhibition Proceedings, 1999, page 469, XP-002442399;
D8: J. Leggett et al., "*Actively shielded multi-layer gradient coil designs with improved cooling properties*", Journal of Magnetic Resonance, 12 January 2003, Orlando (US), Vol. 165, Nr. 2, pages 196-207;
D9: US-B-6 741 152;
D10: US-A-2001/0042385.

3.2 Although the Board concurs with the examining division in its finding that the basic idea underlying the disclosed solution of splitting a primary gradient coil into two layers and designing a layer so as to deliver a coolant fluid was already known *per se* at the time the present application was filed, it does not share its conclusion that the presently claimed invention, which reflects the embodiment of Figure 2, results from the mere aggregation of known features.

Although reference is made in the following to the x direction, it is stressed that the x or y direction could be referred to interchangeably.

3.3 In the Board's view, two different, but equally realistic approaches could be envisaged according to the problem-solution approach, depending on whether the skilled person were to start from prior art depicting an apparatus with a gradient coil incorporating a coolant channel or from prior art disclosing an apparatus with a gradient coil split into two sub-layers.

3.3.1 According to the first approach, document D2 as well as D3 or D4 could be considered to illustrate the closest prior art.

The objective problem to be solved would then consist in arranging all coils required to keep a high level of efficiency in terms of strength of the magnetic field inside the imaging volume.

In the Board's judgement, it would be obvious, considering the teaching of D7, to modify the coil arrangement disclosed in D2 (or D3 or D4) by replacing the single layer structure by a multilayer

configuration which, according to document D7, offers much more flexibility in terms of control of both the temperature and the required gradient strength (cf. D7, left column, lines 27-32). However, the apparatus which would result from this approach would include one x-primary gradient coil consisting of two sub-coils with the innermost x-axis gradient coil and the second x-axis gradient coil being both provided with a coolant channel, contrary to the claim's wording. A further modification according to the present invention would imply an *ex post facto* step.

3.3.2 The alternative approach, relying on document D7 as the closest prior art, leads to a similar conclusion.

Document D7, in essence, focuses on the merits of splitting the x-axis gradient coil into two layers.

The problem to be solved consists, in this case, in the necessity of regulating the temperature within the imaging volume in a more efficient way. The Board has no doubt that the skilled person would have considered the teaching of documents D1 (or D2, D3, D4) and would have modified the gradient coil of D7 accordingly so as to permit cooling material to run through its conductors. However, this scenario would again result in an apparatus comprising a x-axis gradient coil with a coolant flowing through both the innermost layer and the outer sub-layer.

3.4 Hence, in the absence of any motivation for the skilled person to do otherwise, the Board holds that it would not be obvious to provide only the innermost x-axis gradient layer with a coolant channel while resorting to a solid copper sheet for the second x-axis sub-layer.

For these reasons, it is considered that the claimed apparatus does not result in an obvious manner from the prior art. It is thus inventive within the meaning of Article 56 EPC 1973.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent on the basis of:

   Claim 1 of the sole request filed during the oral proceedings of 5 February 2014

   Description pages 1, 2, 2a and 3-13 filed during the oral proceedings of 5 February 2014

   Figures 1-4 as originally filed.

The Registrar: The Chairman:

R. Schumacher G. Assi

Decision electronically authenticated