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Datasheet for the decision of 2 February 2010

Case Number: T 1157/08 - 3.4.01

Application Number: 00311615.9

Publication Number: 1113287

IPC: G01R 33/34

Language of the proceedings: EN

Title of invention:
Magnetic resonance imaging head coil

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

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

Keyword:
"Added subject-matter (no)"
"Clarity (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1157/08 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 2 February 2010

Appellant: GENERAL ELECTRIC COMPANY
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Schenectady, NY 12345 (US)

Representative: Pedder, James Cuthbert
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 28 January 2008 refusing European patent application No. 00311615.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: B. Schachenmann
Members: H. Wolfrum
F. Neumann

Summary of Facts and Submissions

I. European patent application 00 311 615.9 (publication No. EP-A-1 113 287) was refused by a decision of the examining division dispatched on 28 January 2008. The decision followed a request for an appealable decision according to the state of the file made by the applicant on 15 January 2008. Its grounds make reference to reasons set out in communications dated 6 June 2007, 31 October 2007 and 14 January 2008, concerning lack of inventive step (Articles 52(1) and 56 EPC 1973), lack of clarity (Article 84 EPC 1973) and added subject-matter (Article 123(2) EPC).

II. The applicant lodged an appeal against the decision and paid the prescribed fee on 1 April 2008. On 4 June 2008 a statement of grounds of appeal was filed. The appellant requested the grant of a patent on the basis of an amended set of claims.

III. On 21 October 2009 the appellant was summoned to oral proceedings.
In an annex to the summons the board pointed to problems concerning *inter alia* added subject-matter, clarity and inventive step. In view of the fact that the board nevertheless saw patentable subject-matter, a wording proposal for acceptable claims was indicated.

IV. By facsimile of 17 December 2009 the appellant filed a replacement set of claims as well as replacement pages 2, 2a, 3 and 6 of the description and a replacement page 2/2 of the drawings, in line with the board's suggestions.

V. On 22 December 2009 the board informed the appellant that the oral proceedings appointed for 19 January 2010 were cancelled and that the proceedings would be continued in writing.

Subsequent to a telephone conversation on 19 January 2010, in which the board pointed to some remaining deficiencies in the description, the appellant filed by letter of 19 January 2010 an amended description.

VI. The appellant requests that the decision under appeal be set aside and a patent be granted on the basis of the following documents :

claims	1 to 3, filed by facsimile of 17 December 2009,
description	pages 1, 2, 2a and 3 to 6 as filed by letter of 19 January 2010,
drawings	sheet 1/2, as originally filed, sheet 2/2, filed by facsimile of 17 December 2009

VII. In examination and appeal, reference was made to the following prior art documents :

D1 : EP-A-0 758 092;

D2 : G. Adriany et al : "A Transmit/Receive Quadrature Birdcage Array Coil for 4 Tesla"; Proceedings of the International Society for Magnetic Resonance in Medicine, 5th Scientific Meeting and Exhibition; ISMRM '97; Vancouver, BC, April 12 - 18, 1997; vol. 1, p. 177; and

D3 : US-A-5 453 692.

VIII. Independent claim 1 reads as follows :

"1. A short radio frequency coil (146) for the magnetic resonance imaging of a head, the coil including a birdcage configuration of conductors and comprising:

a plurality of spaced conductors (152) positioned parallel to and about an axis (151) to form a first substantially cylindrical shaped portion (154) around said axis (151) and adapted to receive a head to be imaged;

two circular conductors (156, 158) each of which supports an opposite end of the spaced conductors (152) forming said first cylindrical portion (154);

wherein said spaced conductors (152) extend beyond one of said circular conductors (158) at an angle to extend inwardly towards said axis (151) to form a tapered portion (155) in the shape of the frustum of a cone;

wherein said spaced conductors (152) extend further beyond said tapered portion (155) parallel to and about said axis (151) forming a second and reduced diameter cylindrical portion (157) remote from said first cylindrical portion (154);

the spaced conductors (152) terminating in a third circular conductor (153) having a smaller diameter than said two circular conductors (156, 158) and supporting the ends of said spaced conductors (152); the ratio of the diameter of the third circular conductor (153) to that of the first and second circular conductors (156, 158) being in the range 0.4 to 0.6; and

said spaced conductors (152) and first to third circular conductors (156, 158, 153) thus forming said

head coil with a generally circular opening at each end."

Claims 2 and 3 are dependent claims.

Reasons for the Decision

1. In the following reference is made to the provisions of the EPC 2000, which entered into force as of 13 December 2007, unless the former provisions of the EPC 1973 still apply to pending applications.

2. The appeal complies with the requirements of Articles 106 to 108 EPC and Rule 99 EPC and is, therefore, admissible.

3. Basis of disclosure

Claim 1 on file is based on a combination of originally-filed claims 1, 2 and 4 which is supplemented by features disclosed on page 4, last paragraph and page 5, first and second paragraphs and the paragraph bridging pages 5 and 6 of the description as originally filed. Claims 2 and 3 correspond to originally-filed claims 3 and 5, respectively.

In view of the amendments made, the objections as to added subject-matter which were raised by the examining division (point 5 of the communication of 17 January 2008) no longer apply.

The board is thus satisfied that the claims on file meet the requirement of Article 123(2) EPC.

4. Clarity

Due to the amendments made, claim 1 comprises all features which are, according to the description of Figure 3 of the application, essential for a complete solution to the problem of improving the RF magnetic field homogeneity for the imaging of a patient's head.

At the same time, in particular the fact that the coil is defined to be of a birdcage configuration removes the ambiguities concerning the coil structure to which the examining division had drawn attention (point 3 of the communication of 31 October 2007; point 4 of the communication of 17 January 2008).

Finally, the amendments made remove previous inconsistencies of the terminology used.

Therefore, the board considers the requirement of Article 84 EPC 1973 to be met.

5. Novelty and inventive step

5.1 As will become apparent from the following more detailed discussion, none of documents D1 to D3 discloses a radio frequency coil which would show all the features defined in claim 1 under consideration.

The subject-matter of claim 1 on file is thus novel with respect to the documents of the cited prior art.

5.2 Document D1 (Figures 1 and 6 and the corresponding description) shows a short radio frequency coil of the

birdcage type for the magnetic resonance (MR) imaging of a head. It includes a plurality of spaced conductors positioned parallel to and about an axis to form a first substantially cylindrical shaped portion around said axis which is adapted to receive a head to be imaged. Two circular conductors are provided, each of which supports an opposite end of the spaced conductors forming the said first cylindrical portion. The said spaced conductors extend beyond one of said circular conductors and bend inwardly towards said axis to form a dome portion in the apex of which the said spaced conductors converge to a virtual ground interconnection point.

The subject-matter of claim 1 on file differs from the known coil in that

(i) the portions of the said spaced conductors which extend beyond one of said circular conductors do so by extending inwardly towards said axis at an angle so as to form a tapered portion in the shape of the frustum of a cone;

(ii) the said spaced conductors extend further beyond said tapered portion parallel to and about said axis thus forming a second and reduced diameter cylindrical portion remote from the said first cylindrical portion;

(iii) the further extending spaced conductors terminate in a third circular conductor which has a smaller diameter than said two circular conductors at the ends of the said first cylindrical portion and supports the ends of said spaced conductors, so that said spaced conductors and said first to third circular conductors form said head coil with a generally circular opening at each end, wherein the ratio of the diameter of the third circular conductor to that of the

first and second circular conductors is in the range 0.4 to 0.6.

Due to the provision of the second and reduced diameter cylindrical portion according to features (ii) and (iii), the spaced conductors are prevented from meeting at a point and the end ring is displaced away from the patient's head. These measures avoid the occurrence of areas of high magnetic fields and improve the homogeneity of the radio frequency field (page 2, fourth and fifth paragraph; page 5, fourth paragraph to page 6, first paragraph of the description as originally filed).

5.3 The available prior art does not hint at this particular problem nor does it teach the claimed solution.

Document D2 (chapters "Introduction" and "Methods") shows a radio frequency coil for MR imaging of the human head which is composed of two coaxially arranged birdcage-type coils (coils #1 and #2). Coil #1 is of cylindrical shape. Coil #2, which has the form of a frustrated dome, can slide into coil #1. Its spaced conductors start from a first circular conductor and bend inwardly towards said axis ending in a second circular conductor of smaller diameter than that of the first circular conductor.

Although document D2 thus suggests a variant of the dome-shaped birdcage structure which shows an improved homogeneity in that it avoids the common virtual ground interconnection point of the structure known from document D1, it does not give any indication as to the

provision of a further extension of the spaced conductors in the form of a second and reduced diameter cylindrical portion as defined by aforementioned feature (ii), in order to dispose the smaller second circular conductor further away from the head to be imaged.

5.4 Document D3 (Figure 5 and the corresponding description) shows a radio frequency coil system for MR imaging which consists of a pair of cylindrical birdcage-type coils that are arranged in series along a common axis. The two coils possess basically the same diameter. An undesired coupling between the magnetic fields of the two coils is eliminated by overlap of the adjacent ends of the coils. In order to accomplish this overlap the end of one of the coils which faces the other coil is increased in diameter whereas the corresponding adjacent end of the other coil is reduced in diameter. Thus the spaced conductors of each coil form two cylindrical sections of different diameter with an intermediate tapered section of frusto-conical shape.

From a formal point of view, the resulting shape of each of the two coils thus meets the definitions of aforementioned features (i) and (ii). However, the known coil structure does not show the features summarized under (iii) above in that each coil of the pair of coils has only two circular conductors and in that the ratio of diameters of the two cylindrical portions of a coil does not fall within the claimed range.

5.5 The examining division argued that, in view of the fact that documents D1 to D3 all concerned the same

technical field of radio frequency coils for MR imaging, it would have been obvious for the skilled person to complement a head coil of document D1 or D2 by a second cylindrical portion according to the example of document D3.

The board does not share this judgement just for the simple fact that the specific shaping of the birdcage coils according to document D3 serves exclusively for the purpose of allowing two cylindrical coils of an as such identical diameter to axially overlap. The teaching of document D3 thus addresses a problem which does not arise in any of the head coils known from documents D1 and D2 and, moreover, has no relation to that solved by the subject-matter of claim 1 under consideration. Thus document D3 simply does not provide any motivation for the skilled person to modify a radio frequency head coil as known from document D1 or D2 by adding a second cylindrical portion at the apex of the dome so as to displace the third circular conductor away from the head to be imaged.

5.6 In conclusion, the subject-matter of claim 1 under consideration is new with respect to the teachings of the prior art documents on file and, moreover, is not rendered obvious by these documents, when taken either alone or in any conceivable combination. Therefore, the claimed subject-matter meets the requirements of Article 52(1) EPC and Articles 54(1) and (2) and 56 EPC 1973.

6. After amendment the description and drawings meet the requirements of the EPC.

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 grant a patent with :

   – claims 1 to 3, filed by facsimile of 17 December 2009

   – description pages 1, 2, 2a and 3 to 6, filed by letter of 19 January 2010;

   – drawings sheet 1/2, as originally filed, sheet 2/2, filed by facsimile of 17 December 2009.

The Registrar The Chairman

R. Schumacher B. Schachenmann