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Datasheet for the decision of 23 June 2017

Case Number: T 0003/12 - 3.5.02

Application Number: 00963251.4

Publication Number: 1212760

IPC: H01F6/00, H01F27/28, H01F41/04

Language of the proceedings: EN

Title of invention:
Rotor assembly with superconducting magnetic coil

Patent Proprietor:
American Superconductor Corporation

Opponents:
Zenergy Power GmbH
GE Energy Power Conversion UK Limited

Relevant legal provisions:
EPC Art. 123(2), 123(3), 56

Keyword:
Amendments - broadening of claim (yes) : main request claim 1
- intermediate generalisation : main request claim 16
Inventive step - (yes): auxiliary request I

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Case Number: T 0003/12 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 23 June 2017

Appellant: (Patent Proprietor)	American Superconductor Corporation 64 Jackson Road Devens MA 01432 (US)
Representative:	Isarpatent Patent- und Rechtsanwälte Behnisch Barth Charles Hassa Peckmann & Partner mbB Postfach 44 01 51 80750 München (DE)
Appellant: (Opponent 1)	Zenergy Power GmbH Heisenbergstrasse 16 53359 Rheinbach (DE)
Representative:	Prietsch, Reiner Henkel, Breuer & Partner Patentanwälte Maximiliansplatz 21 80333 München (DE)
Appellant: (Opponent 2)	GE Energy Power Conversion UK Limited Boughton Road Rugby Warwickshire CV21 1BU (GB)
Representative:	Serjeants LLP Dock 75 Exploration Drive Leicester, LE4 5NU (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 14 November 2011 concerning maintenance of the European Patent No. 1212760 in amended form.**

Composition of the Board:

Chairman	R. Lord
Members:	G. Flyng
	J. Hoppe

Summary of Facts and Submissions

I. The patent proprietor (American Superconductor Corporation, hereinafter the "Proprietor") and both opponents filed notice of appeal against the interlocutory decision of the Opposition Division concerning the form in which European Patent EP 1 212 760 could be maintained.

The appeal for the opponent Zenergy Power GmbH (hereinafter "Opponent 1") was filed in the name of Dirk Obermüller as insolvency administrator.

The opponent Converteam UK Ltd, which is now GE Energy Power Conversion UK Limited (hereinafter "Opponent 2"), also appealed the decision.

II. In the contested decision the Opposition Division found inter alia that:

- Both independent claims 1 and 21 of the patent as granted contained added subject-matter and therefore the ground of opposition under Article 100(c) EPC was prejudicial to the main request;

- Independent claim 1 of auxiliary request I filed in the oral proceedings of 3 November 2011 contained added subject-matter and therefore the amendment infringed Article 123(2) EPC.

- Auxiliary request II filed in the oral proceedings of 3 November 2011 satisfied the requirements of Articles 123(2), 123(3), 84, 52(1), 54 and 56 EPC.

III. The following documents have been relied upon in the appeals:

E1: US 4 554 731
E15: US 5 777 420

IV. With a communication dated 21 March 2017 the Board summoned the parties to attend oral proceedings, setting out their observations in a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal.

V. With a letter dated 15 May 2017 the Proprietor responded to the Board's observations and filed sets of claims of a main request and a first auxiliary request.

VI. With a letter dated 16 May 2017 Opponent 2 advised that they would not be attending the oral proceedings and did not wish to make any further written submissions.

VII. The appeal in the name of Opponent 1 was withdrawn with a letter dated 29 May 2017, but Opponent 1 remains in the proceedings as respondent to the Proprietor's appeal and as party as of right with respect to Opponent 2's appeal.

VIII. Oral proceedings were held as scheduled on 23 June 2017.

The Board noted that Opponent 1's sole substantive request in the appeal procedure, for revocation of the patent, was no longer valid now that Opponent 1 was no longer an appellant. Consequently, the Proprietor's request to reject Opponent 1's appeal was no longer relevant.

The Board also noted that Opponent 2 had requested in writing that the decision under appeal be set aside and that the patent be revoked.

The Proprietor withdrew a request for reimbursement of the appeal fee that had been submitted in the statement of grounds of appeal. The Proprietor also withdrew the first auxiliary request filed with the letter dated 15 May 2017 and requested finally:

- as main request, to set aside the decision under appeal and maintain the patent in amended form on the basis of the set of claims filed as main request with letter dated 15 May 2017;

- as first auxiliary request, to set aside the decision under appeal and maintain the patent in amended form on the basis of:
  - the set of claims 1 to 24 filed as Auxiliary Request I, during the oral proceedings of 23 June 2017,
  - pages 2 and 5 of the description filed during the oral proceedings of 23 June 2017,
  - pages 3 and 4 of the description of the patent specification,
  - figures 1 to 9 of the patent specification;

- as second auxiliary request, to dismiss the appeal of Opponent 2.

The present decision was announced at the end of the oral proceedings.

IX. The various versions of the independent claims are set out below for ease of reference, with amendments indicated by the Board using strikeout and underlining.

Apparatus claim 1 as granted

"1. A rotor assembly (200) comprising:
a support member (220); and
a superconducting coil (100/230) having an axis (16), a first end, and a second end, the superconducting coil (100) comprising a superconductor tape (12) wound about the axis (16) of the superconducting coil (100) to provide a plurality of concentric turns disposed along the axis and defining an opening (19) having a dimension which gradually decreases, in a direction along the axis (16), from the first end to the second end of the superconducting coil (100), each turn of the superconductor tape having a broad surface (22) substantially parallel to the axis (16) of the superconducting coil (100), and the superconductor tape (12) is wound so that the superconducting coil (100) conforms to a surface of the support member (220)."

Method claim 21 as granted

"21. A method of providing a rotor assembly (200) comprising a superconducting coil (100) having an axis (16), a first end, and a second end, the method comprising: winding a superconductor tape (12) about the axis (16) of the coil (100) to provide a plurality of concentric turns defining an opening (19) having an inner dimension, the superconductor tape (12) wound and having a broad surface (22) maintained substantially parallel to the axis (16) of the coil, with the opening (19) gradually decreasing from the first end to the second end in the direction along the axis (16); and positioning the superconducting coil (100) within an annular region (240) defined by an outer surface of a torque tube (220)."

Apparatus claim 1 of the main request
(showing amendments compared to claim 1 as granted)

"1. A rotor assembly (200) comprising:
a ~~support member~~ torque tube (220);
pole caps (260); and
a plurality of superconducting coil assemblies (230),
the superconducting coil assemblies (230) being positioned within annular regions (240) defined by the outer surface of the torque tube (220) and an inner surface of the pole caps (260) such that the superconducting coil assemblies (230) conform within and fill the annular regions (240),
each superconducting coil assembly (230) including a plurality of superconducting coils (10; 100) in a stacked arrangement,
~~a~~ the superconducting coils (10; 100~~/230~~) each having an axis (16), a first end, and a second end, ~~the~~ and each superconducting coil (10; 100) comprising a superconductor tape (12) wound about the axis (16) of the superconducting coil (10; 100) to provide a plurality of concentric turns disposed along the axis (16) and defining an opening (19) having a dimension which gradually decreases, in a direction along the axis (16), from the first end to the second end of the superconducting coil (10; 100), each turn of the superconductor tape (12) having a broad surface (22) substantially parallel to the axis (16) of the superconducting coil (10; 100)~~, and the superconductor tape (12) is wound so that the superconducting coil (100) conforms to a surface of the support member (220)~~."

Method claim 16 of the main request
(showing amendments compared to claim 21 as granted)

"16. A method of providing a rotor assembly (200) comprising a superconducting coil (10; 100) having an axis (16), a first end, and a second end, the method comprising:
winding a superconductor tape (12) about the axis (16) of the superconducting coil (10; 100) to provide a plurality of concentric turns defining an opening (19) having an inner dimension, the superconductor tape (12) wound and having a broad surface (22) maintained substantially parallel to the axis (16) of the superconducting coil (10; 200), with the opening (19) gradually decreasing from the first end to the second end in the direction along the axis (16); and
positioning the superconducting coil (10; 100) within an annular region (240) defined by an outer surface of a torque tube (220) and an inner surface of pole caps (260) of the rotor assembly (200)."

Apparatus claim 1 of auxiliary request I (showing amendments compared to claim 1 of the main request)

"1. A rotor assembly (200) comprising:
a torque tube (220);
pole caps (260); and
a plurality of superconducting coil assemblies (230), the outer surface of the torque tube (220) supporting the superconducting coil assemblies (230),
the superconducting coil assemblies (230) being positioned within annular regions (240) defined by the outer surface of the torque tube (220) and an inner surface of the pole caps (260) such that the superconducting coil assemblies (230) conform within and fill the annular regions (240),
each superconducting coil assembly (230) including a plurality of superconducting coils (10; 100) in a stacked arrangement,
the superconducting coils (10; 100) each having an axis (16), a first end, and a second end, and each superconducting coil (10; 100) comprising a superconductor tape (12) wound about the axis (16) of the superconducting coil (10; 100) to provide a plurality of concentric turns disposed along the axis (16) and defining an opening (19) having a dimension which gradually decreases, in a direction along the axis (16), from the first end to the second end of the superconducting coil (10; 100),
each turn of the superconductor tape (12) having a broad surface (22) substantially parallel to the axis (16) of the superconducting coil (10; 100)."

Method claim 16 of auxiliary request I (showing amendments compared to claim 16 of the main request)

"16. A method of providing a rotor assembly (200) comprising a plurality of superconducting coil assemblies (230), each superconducting coil assembly (230) including a plurality of superconducting coils (10; 100) in a stacked arrangement, each superconducting coil (10; 100) having an axis (16), a first end, and a second end, the method comprising: winding a superconductor tape (12) about the axis (16) of the superconducting coil (10; 100) to provide a plurality of concentric turns defining an opening (19) having an inner dimension, the superconductor tape (12) wound and having a broad surface (22) maintained substantially parallel to the axis (16) of the superconducting coils (10; 200), with the opening (19) gradually decreasing from the first end to the second end in the direction along the axis (16); and positioning the superconducting coil ~~(10; 100)~~ assemblies (230) within ~~an~~ annular regions (240) defined by an outer surface of a torque tube (220) and an inner surface of pole caps (260) of the rotor assembly (200) such that the superconducting coil assemblies (230) conform within and fill the annular regions (240)."

Reasons for the Decision

1. Admissibility of the Appeals

1.1 The appeal for Opponent 1 has been withdrawn. Hence, any questions over its admissibility are now moot.

1.2 The appeals of the Proprietor and of Opponent 2 are admissible.

2. Proprietor's Main Request

2.1 **Independent Claim 1**

2.1.1 Independent apparatus claim 1 as granted included the features that:

- the rotor assembly (200) comprises (inter alia) **"a support member (220)"**; and
- **"the superconductor tape (12) is wound so that the superconducting coil (100) conforms to a surface of the support member (220)".**

2.1.2 In the contested decision the Opposition Division found that these features were broader than what was originally disclosed and therefore the subject-matter of claim 1 as granted extended beyond the content of the application as filed (i.e. published International Application WO 01/08173 A1), contrary to Article 100(c) EPC (Reasons for the decision, 11.1, 11.2 and 11.4).

2.1.3 On appeal the Proprietor has not challenged this finding, but rather has filed amendments aimed at removing the problem of added subject-matter whilst not

extending the protection conferred by the patent (Article 123(3) EPC). The Board considers that with the following exception, that aim has been achieved.

2.1.4 In claim 1 of the main request the feature "support member (220)", which was not originally disclosed, has been replaced by the more specific feature "torque tube (220)". As the Board explained during the oral proceedings, whilst the torque tube was without doubt originally disclosed (cf. page 11, lines 3 to 6 of the application), this feature does not necessarily imply the aspect of "support" that was inherent in the "support member" feature of granted claim 1. By the removal of this aspect of support, claim 1 of the main request amends the patent in such a way as to extend the protection it confers, and hence contravenes Article 123(3) EPC.

2.2 **Independent claim 16**

2.2.1 Independent claim 16 of the main request, like independent claim 21 of the patent as granted, is directed to a "method of providing a rotor assembly". The application as filed did not include a claim to a method of providing a rotor assembly. The Board concurs with the opponent 2 (see paragraph 8.5 of the statement of their grounds of appeal) that in order for a newly introduced claim to a method of providing a rotor assembly to be directly and unambiguously disclosed in the application as filed, it must include all of the features which, according to the description and figures, are essential to that method. If any of the essential features are absent from the new method claim then the scope of the claim will be broader than the content of the application as filed and the amendments

made will therefore not comply with Article 100(c) or 123(2) EPC, whichever is applicable.

2.2.2 Opponent 2 argued further (see paragraphs 8.6 to 8.7 of the statement of their grounds of appeal) that it is an essential feature of a rotor assembly as disclosed in the application as filed that each coil assembly (rather than individual coil) of the rotor assembly conforms to and fills an annular region of the rotor assembly. For the reasons set out below, the Board concurs with Opponent 2 on this point and considers that it applies not only to the disclosed rotor assembly, but also to the implicitly disclosed method of providing it.

2.2.3 The application as filed refers to superconducting coils 10, 100 and to superconducting coil assemblies 230, which comprise a plurality of superconducting coils 10, 100 in a stacked arrangement (cf. page 2, lines 20 to 26; page 3, line 26 to page 4, line 6; page 4, lines 17 to 20; page 11, line 32 to page 12, line 3; claim 25).

On page 11, lines 29 to 32 it is disclosed that "Because superconducting coil 10 and superconducting coils 100 are tapered, either linearly or in a curved manner, either coil assembly can conform within and fill annular regions 240". This passage differentiates between the superconducting coils and the "coil assembly" and emphasises the importance of using coil assemblies that are able to conform within (i.e. to) and fill annular regions. There is no suggestion that a single superconducting coil is able to do this.

Whilst the last paragraph of the description on page 12 mentions with reference to tapered and conical coils

that "in certain applications it is desirable to wind the superconducting coil as a single pancake, rather than a number of thinner, stacked coils having the same width", there is no suggestion, let alone a direct and unambiguous disclosure, that the applications referred to here include rotor assemblies. More specifically, there is no disclosure of providing a rotor assembly by positioning just a single superconducting coil in the annular region defined by the outer surface of a torque tube and the inner surface of pole caps of the rotor assembly. This is only disclosed for assemblies of stacked coils.

2.2.4 As independent method claim 16 does not define that a plurality of the superconducting coils is included in each of a plurality of superconducting coil assemblies of the rotor assembly and that each superconducting coil assembly of the rotor assembly conforms to and fills an annular region, its scope encompasses methods of providing rotor assemblies in which that is not the case and therefore its subject-matter extends beyond the content of the application as filed contrary to Article 123(2) EPC.

2.2.5 The Proprietor argued in section IV of the letter dated 1 August 2012 that these were not essential features because they were not part of the original independent claims or the summary of invention passages. As the original claims and the summary of invention were not directed to a rotor assembly or a method of providing same, that argument is not persuasive.

2.3 For the reasons set out above the Board cannot accede to the Proprietor's main request.

3. Proprietor's Auxiliary Request I

3.1 Independent claim 1 of Auxiliary Request I includes the additional feature that the outer surface of the torque tube (220) supports the superconducting coil assemblies (230). With this the aspect of supporting that was inherent in the "support member" feature of granted claim 1 has been reintroduced, such that claim 1 according to Auxiliary Request I no longer contravenes Article 123(3) EPC.

3.2 Independent claim 16 of Auxiliary Request I has been amended by introducing the essential features that were omitted in claim 16 of the main request. More particularly, it specifies that the rotor assembly provided by the method comprises a plurality of superconducting coil assemblies (230), each superconducting coil assembly (230) including a plurality of superconducting coils (10; 100) in a stacked arrangement. Furthermore, it specifies that the method involves positioning the superconducting coil assemblies (230) within annular regions (240) defined by an outer surface of a torque tube (220) and an inner surface of pole caps (260) of the rotor assembly (200) such that the superconducting coil assemblies (230) conform within and fill the annular regions (240). With the introduction of these essential features claim 1 according to auxiliary Request I no longer contravenes Article 123(2) EPC.

3.3 Opponent 2 raised objections of insufficiency of disclosure under Articles 100(b) and 83 EPC on the basis that the claims encompassed a rotor assembly including coil assemblies that each comprise only a single coil. With claims 1 and 16 of Auxiliary Request I it is now clear that each coil assembly includes a

plurality of superconducting coils. Hence, the basis for Opponent 2's insufficiency objection has been removed.

3.4 Articles 100(a), 56 EPC

3.4.1 In the contested decision the Opposition Division held that the closest prior art was that disclosed in document E15 (cf. Reasons for the decision, paragraph 17.5). This finding is not contested and the Board agrees.

3.4.2 E15 discloses (see figures 1 and 2) a rotor assembly with superconducting coil assemblies 30 that are positioned within spaces that are defined by the outer surfaces of a torque tube 20 and the inner surfaces of pole caps 40. Each superconducting coil assembly 30 comprises a plurality of stacked racetrack double "pancake" coils 32 (see figure 4). In such coils it seems to be commonly known that a superconductor tape is wound about the axis of the superconducting coil to provide a plurality of concentric turns. As can be seen in figures 1 and 2, each double pancake coil 32 is essentially flat and each coil assembly 30 is made up of double pancake coils of various inner and outer diameters so that it can fit within the respective space defined by the torque tube 20 and the pole caps 40.

3.4.3 The subject-matter of claims 1 and 16 differs from the disclosure of E15 in that the superconductor tape is wound about the axis of the superconducting coil in such a way that the plurality of concentric turns defines an opening (19) that has a dimension which gradually decreases, in a direction along the axis (16), from the first end to the second end of the

superconducting coil. In other words, the superconducting coils are not flat as in E15, but "tapered" or "curved" in the manner shown in figures 1, 3, 5B, 6 and 7 of the patent.

3.4.4 Document E1 discloses a method and apparatus for making curved generally pancake-shaped coils adapted to be mounted around a 180-degree segment of a cylindrical support, such coils being particularly useful for use as superconducting magnet coils (see E1, column 1, field of the invention and claim 1). As stated there, such coils may be employed very advantageously in pairs of coils mounted around opposite 180-degree segments of a cylindrical support to provide a dipole magnet.

3.4.5 In the contested decision the Opposition Division held that whilst the skilled person starting from E15 would readily consult E1, the combination of E1 with E15 was neither plausible nor obvious. In coming to this conclusion the Division stated in paragraph 17.5.3 of the reasons for the decision:

> "In the wire winding method of E1 additional wedging strips (e.g resinous plastic material) are used to ensure a tight winding around the 180 degree segment of the mandrel. Alternatively, the wire can have a wedge-shaped cross section (col. 5, line 67 col.6, line 11). Both of these essential features in the wire winding method of E1 as well as the fact that the teaching is only concerned with achieving a tight wire winding around a 180° support member make the teaching incompatible with a solution for the problem of making the most efficient use of a confined annular region in a multipolar of a rotor assembly while simplifying the manufacturing method."

3.4.6 The Board finds the above reasoning convincing. It is fundamental to the teachings of document E1 that the coils are adapted to be mounted around a 180° segment of a cylindrical support and to achieve this wedges or wedge-shaped wires are used. In document E15, however, the only arrangement explicitly disclosed is a 4-pole arrangement which has windings spanning about 90°. The Board is convinced that a skilled person starting from the disclosure of document E15, looking to make the most efficient use of the confined annular region between the support member and the inner surfaces of pole caps of E15, would not seek a solution in a document that is clearly only concerned with 180° windings. This is all the more so given that E1 makes no mention of pole caps and no mention of filling the space between a support and pole caps.

3.4.7 Opponent 2 has argued that the skilled person would realise that the generally curved shape of the magnet windings disclosed in E1 was not limited to dipole magnets and that four, six or eight pole magnets could also be readily made according to the teaching of E1 with only minor and obvious modifications of the method disclosed in E1. The Board does not find this argument convincing because E1 refers specifically and exclusively to 180° windings.

3.4.8 In addition to the above the Board notes that with the wedges or wedge-shaped wires as disclosed in document E1, the superconducting coils of E1 do not include the feature of claims 1 and 16 of the first auxiliary request that each turn of the superconductor tape has a broad surface substantially parallel to the axis of the superconducting coil. The presence of wedges would inevitably mean that the broad surfaces of at least the outer turns could not be parallel to the axis. Hence,

even if coils as disclosed in E1 were used in E15, the resultant assembly and method would not fall within the terms of claims 1 and 16. The Opponents have not presented any arguments concerning this missing feature.

3.4.9 For these reasons the Board finds that the subject-matter of the claims of Auxiliary Request I is not obvious in view of the cited prior art.

4. Conclusions

In view of the above findings the Board is in a position to accede to the Proprietor's first auxiliary request. Consequently the appeal of Opponent 2 has to be dismissed.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of:
   - the set of claims 1 to 24 filed as Auxiliary Request I during the oral proceedings of 23 June 2017,
   - pages 2 and 5 of the description, filed during the oral proceedings of 23 June 2017,
   - pages 3 and 4 of the description of the patent specification,
   - figures 1 to 9 of the patent specification.

3. The appeal of Opponent 2 is dismissed.

The Registrar: The Chairman:

U. Bultmann R. Lord

Decision electronically authenticated