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Datasheet for the decision of 30 January 2013

Case Number: T 0407/09 - 3.5.02

Application Number: 95939529.4

Publication Number: 786141

IPC: H01F7/00, H01F6/06

Language of the proceedings: EN

Title of invention:
Variable profile superconducting magnetic coil

Patent Proprietor:
American Superconductor Corporation

Opponent:
Siemens Aktiengesellschaft

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0407/09 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 30 January 2013

Appellant I: (Patent Proprietor)	AMERICAN SUPERCONDUCTOR CORPORATION Two Technology Drive Westborough, MA 01581 (US)
Representative:	Wright, Howard Hugh Burnby Withers & Rogers LLP 4 More London Riverside London SE1 2AU (GB)
Appellant II: (Opponent)	SIEMENS AKTIENGESELLSCHAFT Postfach 22 16 34 D-80506 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted 15 December 2008 concerning maintenance of the European Patent No. 786141 in amended form.**

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flyng
W. Ungler

Summary of Facts and Submissions

I. The proprietor and opponent have appealed the interlocutory decision of the opposition division concerning maintenance of the European Patent 786141 in amended form.

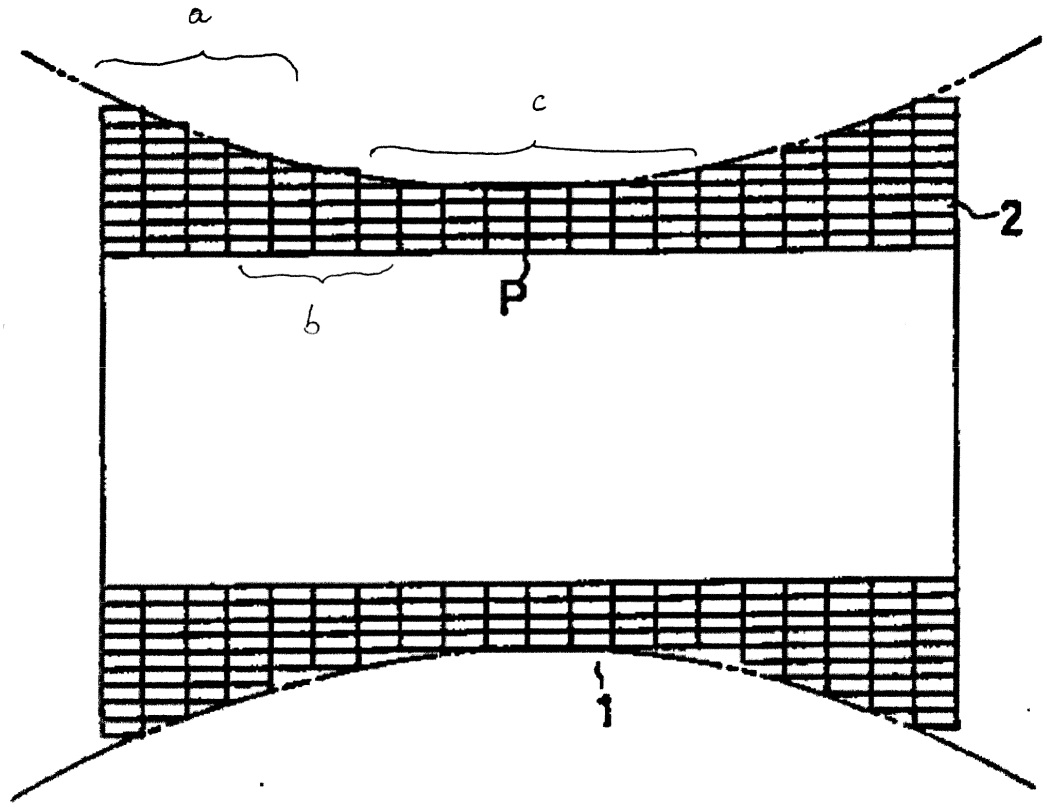
In the contested decision the opposition division found that claim 1 of the proprietor's main request (filed by fax on 5 September 2008) contained added subject-matter contrary to Article 123(2) EPC, but that the claims of the proprietor's first auxiliary request (filed during oral proceedings on 5 November 2008) met the requirements of the convention. The following documents were mentioned in the contested decision:

D1: JP 61-082404 A (including JPO English abstract)
D2: JP 06-005414 A (including JPO English abstract)
D3: EP 0 472 197 A1
D4: DE 36 13 682 A1
D5: US 4 623 864 A
D6: DE 25 57 527 A1
D7: DE 2 217 718 A
D8: JP 04-028208 A (including JPO English abstract)
D9: US 5 318 948 A
D10: JP 06-284691 A (including JPO English abstract)
D11: DE 37 05 294 A1
D12: EP 0 397 943 A1
D13: JP 03-108704 A (including JPO English abstract)
D14: US 4 906 960 A.

II. The Board summoned the parties to oral proceedings, setting out its preliminary observations on the appeal in an annex to the summons.

III. With a letter dated 21 December 2012 the opponent filed an English translation of document D1.

IV. Oral proceedings were held as scheduled on 30 January 2013. The opponent submitted an annotated copy of the figure of document D1, which is reproduced below.



The patent proprietor (as appellant) requested that the opposition division's decision under appeal be set aside and that the patent be maintained in amended form in the following version:

Description: pages 2, 2a, 3, 4, 5, 6 and 7 filed in the oral proceedings of 30 January 2013.

Claims: 1 to 20 filed in the oral proceedings of 30 January 2013.

Figures: 1 to 8 filed in the oral proceedings of 30 January 2013.

The opponent (as appellant) requested that the decision under appeal be set aside and that the European patent No. 786141 be revoked.

V. Claim 1 as filed in the oral proceedings of 30 January 2013 reads as follows (amendments with respect to claim 1 of the patent as granted underlined by the Board):

"1. A superconducting magnetic coil assembly comprising:

at least a plurality of double pancake coils, coaxially disposed along a longitudinal axis of the coil assembly, each double pancake of the plurality of double pancake coils having a pair of individual pancake coils, each individual pancake coil including an anisotropic high temperature superconductor wound about a longitudinal axis of the coil assembly and defining a bore of the superconducting magnetic coil assembly, each of the plurality of double pancake coils electrically connected to an adjacent one of the plurality of double pancake coils, the coil assembly of electrically connected pancake coils having a varying radial cross section with respect to the longitudinal axis, wherein the bore is centered about the longitudinal axis, wherein the individual coils of each of the plurality of double pancake coils have a different outer dimension from each other, and wherein the outer dimensions of adjacent pancake coils of the adjacent double pancake coils are substantially the same."

Claim 18 filed in the oral proceedings of 30 January 2013 is practically identical to claim 30 of the patent and reads as follows:

"18. A method for providing a superconducting magnetic coil assembly having a varying radial cross section along a longitudinal axis of the coil assembly comprising the steps of:

a) providing double pancake coils, each comprising a pair of pancake coils wound from a continuous length of anisotropic high temperature superconductor about the longitudinal axis of the coil assembly, each individual pancake including an outer edge and an inner edge both being parallel to the longitudinal axis, and at least one of said double pancake coils including a pair of pancake coils having a different spacing between an inner edge of the individual pancake coils and the longitudinal axis;

b) coaxially positioning the double pancake coils along the longitudinal axis so that at least one pancake coil of each double pancake coil has a spacing between an outer edge of the individual pancake coil and the longitudinal axis substantially equal to a spacing between an outer edge of the individual pancake coil and the longitudinal axis of an adjacent pancake coil of an adjacent double pancake; and

c) electrically connecting the at least one pancake coil of each double pancake to the pancake coil of the adjacent double pancake having substantially equal spacing between an outer edge of the individual pancake and the longitudinal axis."

Claims 2 to 17 and claims 19 and 20 are dependent on claim 1 and claim 18, respectively.

VI. In essence, the opponent submitted that the subject-matter of claims 1 and 18 filed during the oral proceedings of 30 January 2013 lacked an inventive step.

More particularly, the subject-matter of claim 1 was obvious for the skilled person starting from document D1 as closest prior art. The only difference between claim 1 and the disclosure of D1 was the use of an anisotropic high temperature superconductor, but it was obvious to use such materials as they became known, for example from document D3.

Furthermore, according to the opponent, the subject-matter of method claim 18 was obvious for the skilled person starting either from document D1 or from document D2 as closest prior art.

VII. The proprietor argued in essence that the subject-matter of claims 1 and 18 did involve an inventive step.

In particular, document D1 did not disclose all of the features of the double pancake coil arrangement specified in claim 1. Furthermore, it was not obvious to use an anisotropic high temperature superconductor for the coil assembly of D1 because the skilled person would have considered them too brittle.

Considering method claim 18, the proprietor argued that many features of the claim were not disclosed either in D1 or in D2. Neither document discussed how to connect one double pancake coil to another and neither document suggested double pancake coils with individual pancake coils of differing inner dimensions.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments, Article 123(2) EPC

2.1 The opponent did not raise any objection under Article 123(2) EPC to the amendments made.

2.2 The Board too sees no contravention of Article 123(2) EPC.

In particular, the feature of claim 1 that "individual coils of each of the plurality of double pancake coils have a different outer dimension from each other" has a basis in the application as filed, for example at page 5, lines 28 to 32 (see WO96/12288). Furthermore, the feature that "the outer dimensions of adjacent pancake coils of the adjacent double pancake coils are substantially the same" is derivable inter alia from page 3, lines 26 to 32 of the application as filed. Figures 3 and 5 as filed show embodiments that are consistent with these features.

The amendments to the dependent claims render them consistent with the originally disclosed embodiments and the amendments to the description render it consistent with the subject-matter now claimed.

3. Novelty and inventive step, Article 100(a) EPC

3.1 Novelty of the claims has not been contested.

3.2 Considering claim 1 for inventive step, it is not disputed that document D1 may be taken as the closest prior art.

3.3 The object of the invention in document D1, according to the English translation filed with the opponent's letter dated 21 December 2012, is "to provide a superconducting magnet whereby a uniform magnetic field can be obtained by a single coil and that is not prone to difficulties in the manufacturing step" (see page 3, lines 27 to 30). The invention in D1 "is characterised in that a superconducting wire is wound in such a way that the external diameter gradually increases towards both ends in the axial direction, from the middle in the axial direction" (see page 3, lines 34 to 37). With this arrangement, "the number of turns at both ends of the coil is necessarily greater than the number of turns in the middle thereof" (see page 4, lines 3 to 8). According to page 4, line 36 to page 5, line 1, the superconducting coil "can be formed by two winding techniques, namely, double pancake winding or solenoid winding".

Apart from the indication that the coil can be formed by double pancake winding, the text of document D1 does not give any further details of how double pancake windings might be constructed and arranged to form the coil assembly. In particular, there is no suggestion in the text of D1 to arrange the double pancake coils such that there exists within the coil assembly a plurality

of electrically connected, adjacent double pancake coils which satisfies the two claimed features that (references added by the Board):

i) the individual coils of each of the plurality of double pancake coils have a different outer dimension from each other, and
ii) the outer dimensions of adjacent pancake coils of the adjacent double pancake coils are substantially the same.

3.4 Regarding these two features, the opponent conceded that it was not evident from the figure of D1 which individual pancake coils were joined together to form double pancake coils. Nevertheless, the opponent argued that it was evident from the figure that (see the annotations a, b and c on the copy of the figure of document D1 submitted in the oral proceedings before the Board):

- in the first five pancake coils from the left, which the opponent referred to as region a, all of the individual pancake coils had a different outer dimension from each other;
- in the eight pancake coils in the centre, which the opponent referred to as region c, all of the individual pancake coils had the same outer dimension;
- in the fourth to seventh pancake coils from the left, which the opponent referred to as region b, the fourth and fifth coils had a different outer dimension from each other, the fifth and sixth coils had the same outer dimension and the sixth and seventh coils had a different outer dimension from each other.

From this, the opponent argued that regardless of which individual pancake coils were joined together to form the double pancake coils, feature i) would definitely exist in the region a and feature ii) would definitely exist in region c, so document D1 did disclose these features.

The Board is not convinced by this argumentation because the wording of claim 1 is such that the features i) and ii) both have to exist for one and the same plurality of double pancake coils in which each of the plurality of double pancake coils is electrically connected to an adjacent one of the plurality of double pancake coils. This is because claim 1 specifies that each of the plurality of double pancake coils (is) electrically connected to an adjacent one of the plurality of double pancake coils, and because feature i) refers to individual coils of each of the plurality of double pancake coils and feature ii) refers to outer dimensions of adjacent pancake coils of the adjacent double pancake coils. Thus, even if it were derivable, directly and unambiguously, from the figure of D1 that the feature i) definitely existed in region a of the coil assembly and that feature ii) definitely existed in region c of the coil assembly, this would still not meet the requirement that both conditions exist in one and the same plurality of adjacent, electrically connected double pancake coils. In other words, not even the figure of D1 discloses a plurality of electrically connected, adjacent double pancake coils in which the individual coils of each of the plurality of double pancake coils have a different outer dimension from each other and the outer dimensions of

adjacent pancake coils of the adjacent double pancake coils are substantially the same.

3.5 The opponent has not put forward any arguments as to why the combination of features discussed above would be obvious to the skilled person starting from document D1. The Board considers that neither D1, nor any of the other cited prior art documents discloses or suggests a winding assembly with a plurality of double pancake windings that satisfies the features i) and ii). For this reason, the Board concludes that the subject-matter of claim 1 is not obvious in view of the cited prior art.

3.6 The independent method claim 18 involves providing double pancake coils, at least one of which includes a pair of pancake coils having a different spacing between an inner edge of the individual pancake coils and the longitudinal axis, and coaxially positioning the double pancake coils along the longitudinal axis so that at least one pancake coil of each double pancake coil has a spacing between an outer edge of the individual pancake coil and the longitudinal axis substantially equal to a spacing between an outer edge of the individual pancake coil and the longitudinal axis of an adjacent double pancake. In short, such a method can provide a coil assembly in which the distance between the inner edge of the pancake coils and the longitudinal axis varies along the longitudinal axis.

3.7 A coil assembly like this is discussed in document D1 in the discussion of the technical background (see page 3, lines 8 to 23 of the translation). Specifically,

D1 refers to "making the inside surface of this superconducting coil a two dimensional curved surface, with respect to the centre point of the coil". However D1 suggests that such a coil has disadvantages, stating: "with such a superconducting coil, since the coil has to have curvature in the axial direction at its inner peripheral surface, when the coil is formed by so-called pancake winding, several winding frames of different diameter had to be employed". It is worth noting that whilst document D1 mentions "pancake winding" at this point, it does not disclose or suggest the use of double pancake windings for a coil assembly having a varying inner peripheral surface. Indeed, D1 does not in any context disclose or suggest a double pancake coil which includes a pair of pancake coils that have a different spacing between an inner edge of the individual pancake coils and the longitudinal axis. It is only in the description of the embodiment that D1 mentions double pancake winding (see page 4 line 36 to page 5, line 1). In the embodiment, however, the inner periphery of the coil assembly does not vary along the longitudinal axis, but rather it is cylindrical. According to D1 this makes it unnecessary to make the winding shaft or the winding frame of a special shape, so no particular difficulties are experienced in the winding step (see page 5, lines 14 to 18). Thus, when referring to double pancake windings, D1 teaches away from providing a coil assembly in which the inner periphery varies along the longitudinal axis. For this reason the Board considers that it would not be obvious from document D1 to provide a double pancake coil which includes a pair of pancake coils that have a different spacing between an inner edge of the individual pancake

coils and the longitudinal axis, as set out in present claim 18.

3.8 During the oral proceedings before the Board the opponent also argued that the method of claim 18 was obvious when starting from document D2.

The abstract of document D2 mentions a superconducting magnet in which the inner diameter R2 on the end part is made larger than the inner diameter R1 on the central part. The arrangement is shown in figure 1. However, there does not seem to be any suggestion in document D2 that the superconducting magnet is made from double pancake windings. Furthermore, given that D1 teaches away from providing a coil assembly in which the inner periphery varies along the longitudinal axis when referring to double pancake windings, the Board is not convinced that D1 would render it obvious for a skilled person starting from document D2 to use double pancake windings to make the superconducting magnet.

3.9 For these reasons the Board concludes that the subject-matter of claim 18 is not obvious in view of the prior art and hence meets the requirements for inventive step.

3.10 Claims 2 to 17 and claims 19 and 20 also meet the requirements for inventive step at least through their dependency on claim 1 and claim 18, respectively

4. For the reasons set out above the Board concludes that the requirements of the EPC do not prejudice maintenance of the patent in the amended form requested by the proprietor and that the opponent's request that the patent be revoked cannot therefore be granted.

Order

For the above 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 as amended in the following version:

Description: pages 2, 2a, 3, 4, 5, 6 and 7 filed in the oral proceedings of 30 January 2013.
Claims: 1 to 20 filed in the oral proceedings of 30 January 2013.
Figures: 1 to 8 filed in the oral proceedings of 30 January 2013.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu