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Datasheet for the decision of 8 January 2014

Case Number: T 1085/09 - 3.5.02

Application Number: 99300920.8

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IPC: H01F6/06, H02H9/02

Language of the proceedings: EN

Title of invention:
Resistive fault current limiter

Patent Proprietor:
American Superconductor Corporation

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
Novelty - (yes)
Inventive step - after amendment - (no)

Decisions cited:

Catchword:

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Case Number: T 1085/09 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 8 January 2014

Appellant: (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: (Opponent)	Siemens Aktiengesellschaft Wittelsbacherplatz 2 80333 München (DE)
Representative:	Siemens AG Postfach 22 16 34 80506 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 19 March 2009 concerning maintenance of the European Patent No. 935261 in amended form.**

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flyng
P. Mühlens

Summary of Facts and Submissions

I. The proprietor and the opponent appealed against the interlocutory decision of the opposition division, in which the following documents were mentioned:

D1: EP 0 503 447 A2
D2: Final Report of the Electric Power Research Institute, EPRI EL-329 (Research Project 328), December 1976, Section 5, Pages 5-1 to 5-4
D3: FR 2 701 789 A1
D4: Cryogenics, 1994, Vol. 34, ICEC Supplement, pages 753 to 756
D5: US 5 414 586 A
D6: "Recovery Time of Superconducting Non-Inductive Reactor Type Fault Current Limiter", IEEE Transactions on Magnetics, Vol. 32, No. 4, July 1996, Pages 2403- 2406
D7: WO 95/20228 A1
D8: US 5 532 664 A
D9: DE 39 19 487 A1
D10: WO 96/08830 A2
D11: US 4 952 554 A
D12: DE 39 19 487 A1
D13: WO 96/038864 A1
D14: US 5 617 280 A
D15: WO 95/20826 A1

In the decision the opposition division found that claims 1 and 14 of the patent as granted (proprietor's main request) lacked an inventive step. In short, the opposition division considered that starting from document D2 as closest prior art the subject-matter of claims 1 and 14 of the patent was obvious in view of common general knowledge (as evidenced by any of documents D3 to D6 or D13) and also was obvious by

virtue of being a routine choice between only two ways that the different pancake coils of D2 could possibly be connected.

Regarding the proprietor's first auxiliary request the opposition division held that the subject-matter of independent claims 1 and 11 (filed during oral proceedings on 17 February 2009) did involve an inventive step. In essence, the opposition division considered that the feature that the conductive winding sections are formed from an integral piece of superconducting material was not obvious in view of the cited prior art (documents D1 and D7 being discussed in particular).

II. The opponent filed grounds for appeal with a letter dated 14 July 2009, requesting inter alia that two further documents be introduced into the proceedings.

The proprietor filed grounds for appeal with a letter dated 27 July 2009 and responded to the opponent's appeal in a letter dated 8 December 2009.

III. The Board summoned the parties to oral proceedings, setting out preliminary observations on the appeals in an annex to the summons.

The Board enclosed an excerpt from the Collins English Dictionary, Third Edition, 1991, page 802, which gives inter alia the following definitions for the adjective "integral":

2. intact; entire.
3. formed of constituent parts; united.
6. a complete thing; whole.

IV. With a letter dated 27 December 2013 the Board was advised that the proprietor would not be present at the oral proceedings. The proprietor made no further submissions in response to the summons.

The opponent responded to the summons in a letter dated 4 December 2013.

V. Oral proceedings were held as scheduled on 8 January 2014. As announced the proprietor did not attend. The Board considered the following requests before announcing the present decision:

- The patent proprietor requested in writing (see letter dated 22 May 2009) that the decision under appeal be set aside and that the opposition be rejected (i.e. that the patent be maintained unamended).
- The opponent requested that the decision under appeal be set aside and that the patent be revoked, and that the appeal of the patent proprietor be dismissed.
- The patent proprietor requested that the appeal of the opponent be dismissed (i.e. that the patent be maintained on the basis of the first auxiliary request as filed during the oral proceedings before the department of first instance on 17 February 2009).

VI. Independent claim 1 of the patent (proprietor's main request) reads as follows:

"1. A coil assembly (10, 50, 60) having a longitudinal axis, the coil assembly comprising a plurality of bifilar pancake coils (12) disposed in a stack arrangement along the longitudinal axis, each coil including a pair of conductive winding sections

(32, 34) joined along an innermost radial region of the coil, wound together, one over the other, radially outward and around the longitudinal axis, **characterised in that** each pancake coil (12) is electrically connected to an adjacent pancake coil (12) so that current flowing in adjacent turns of adjacent pancake coils (12) flows in opposite directions at all radial regions of the coil assembly (10)."

Independent claim 1 that was the subject of the interlocutory decision (proprietor's first auxiliary request) reads as follows (amendments with respect to the main request highlighted by the Board):

"1. A coil assembly (10, 50, 60) having a longitudinal axis, the coil assembly comprising a plurality of bifilar pancake coils (12) disposed in a stack arrangement along the longitudinal axis, each coil including a pair of conductive winding sections (32, 34) joined along an innermost radial region of the coil, wound together, one over the other, radially outward and around the longitudinal axis, ~~**characterised in that**~~ wherein each pancake coil (12) is electrically connected to an adjacent pancake coil (12) so that current flowing in adjacent turns of adjacent pancake coils (12) flows in opposite directions at all radial regions of the coil assembly (10), and the conductive winding sections (32, 34) are formed from an integral piece of superconducting material (14)."

VII. The arguments of the proprietor may be summarised as follows:

The opposition division should not have considered the issue of novelty separately because the patent was opposed under Article 100(a) EPC only on the ground that the claims lacked an inventive step.

Document D2 should not be considered to be the closest prior art: It only discloses a conceptual design and the skilled person, recognising the impracticability of that design, would not use it as a basis for development.

Document D2 does not disclose "a pair of conductive winding sections joined along an innermost radial region of the coil, wound together, one over the other" as set out in claim 1.

The subject-matter of claim 1 further differs from D2 by each pancake coil being electrically connected so that current flowing in adjacent turns of adjacent pancake coils flows in opposite directions at all radial regions of the coil assembly.

VIII. The opponent argued in essence that starting from document D2 as closest prior art, the subject-matter of claim 1 of the main request lacked novelty or lacked an inventive step.

Reasons for the Decision

1. **Proprietor's Main Request**

1.1 In the contested decision the opposition division considered the novelty of independent claims 1 and 14 of the patent with respect to each of the documents D1 to D14 and concluded that their subject-matter was new. In view of this conclusion the proprietor cannot be seen as being adversely affected by the fact that the opposition division considered the issue of novelty separately, even though the patent was opposed under Article 100(a) EPC only on the ground that the claims lacked an inventive step. Hence, the proprietor's objection on this point is moot.

Furthermore, the Board notes that in G 10/91 (OJ 1993, 420) it was established that an opposition division may exceptionally consider grounds for opposition not covered by the statement under Rule 55(c) EPC 1973 (Rule 76(c) EPC 2000). Also, it is established case law (see G 7/95, OJ 1996, 626) that in such a situation the ground of lack of novelty is a fresh ground for opposition and accordingly may not be introduced into the appeal proceedings without the agreement of the proprietor, but that an allegation that the claims lack novelty in view of the closest prior art document may be considered in the context of deciding upon the ground of lack of inventive step.

1.2 The proprietor argues that when considering inventive step document D2 should not be taken as the closest prior art because it only discloses a conceptual design and the skilled person, recognising the

impracticability of that design, would not use it as a basis for development. The proprietor gives four reasons for the alleged impracticability of D2's design:

- Around the edge of the Mylar ribbon the path through the liquid helium would be unable to withstand the electrical field existing between the two superconducting layers;
- No structure is disclosed to support the coiled Mylar ribbon in the manner described;
- The turns of the coils would need to be spaced more widely because in a fault the helium would boil;
- The magnetic arrangement suggested for triggering (quenching) the superconductor is impractical compared to the general state of the art in which the fault current automatically causes quenching.

This line of argumentation is supported by an affidavit by Bruce Gamble, an employee of the proprietor. As is evident from paragraph 2 thereof, the affidavit concerns Mr. Gamble's opinion as an expert witness, rather than a statement of fact.

Accepting, for the sake of argument, that the skilled person might recognise such limitations in the conceptual design proposed by D2, then one question to consider is whether that realisation would necessarily deter the skilled person from attempting any further development based on D2's conceptual design. Having considered the proprietor's arguments the Board is not convinced that that is the case. Rather, the Board considers that the skilled person would consider an implementation based on the design of D2 and would attempt to find solutions to any such limitations when doing so. Hence, the Board concludes that document D2

may be taken as representing the closest prior art for the purpose of assessing inventive step and that when doing so the allegation of lack of novelty from D2 may also be considered.

1.3 As to the content of document D2, it discloses a superconducting fault current limiter comprising an assembly of "modules" that are arranged in a stack (cf. figure 5-2 and page 5-3, first paragraph). As explained in the second paragraph of page 5-1, to keep the inductance very small a bifilar winding is used for the module. This is accomplished by depositing (sputtering) superconducting films on both sides of a thin substrate, with the current in opposite directions on either side. Each module is made from one long ribbon of Mylar, with the current travelling down one side, crossing over at the end and travelling back down the other side. According to figure 5-1 and the text above and below it on page 5-2, the ribbon is wound spirally out from a 10cm diameter hollow drum, on which the conductors on each side of the Mylar are connected together. At the outside of the spiral the terminals are connected to other modules on either side.

1.4 The proprietor argues that document D2 does not disclose "a pair of conductive winding sections joined along an innermost radial region of the coil, wound together, one over the other" because the two conductive surfaces of D2's double sided ribbon cannot be considered as "a pair of" conductive winding "sections", since they are both mounted on the same ribbon substrate.

The Board is not convinced by the proprietor's arguments on this point and can see no reason why the two superconducting films on either side of the ribbon

of D2 should not be considered as a pair of conductive winding sections. They each form a section (i.e. a part) of a winding, they are conductive, and together they could be considered as a pair. What's more, it is evident from the disclosure to the effect that the conductors on each side of the Mylar are connected together on the hollow drum that they are "joined along an innermost radial region of the coil" as claimed. Furthermore, as the proprietor states, when the ribbon is wound into a coil, the conductive surfaces of the ribbon are also wound. The Board considers that in that respect they are wound together, one over the other as claimed.

1.5 The proprietor also argues that the subject-matter of claim 1 differs from D2 by each pancake coil being electrically connected so that current flowing in adjacent turns of adjacent pancake coils flows in opposite directions at all radial regions of the coil assembly. In particular, the proprietor argues that in D2:

(a) adjacent pancake coils are not necessarily wound in the same direction and could be wound in opposite directions;

(b) adjacent pancake coils are not necessarily angularly aligned and they could have different angular positions relative to one another; and

(c) there are 3 different ways that the inner and outer superconducting films of adjacent pancake coils might be connected, namely:

(i) so that current flows into every coil on the outer surface of the ribbon;

(ii) so that current flows into every coil on the inner surface of the ribbon; or

(iii) so that current flows into the coils on the outer surface of the ribbon of one coil and

then the inner surface of the ribbon of the next coil, and so on.

In order for the current flowing in adjacent turns of adjacent pancake coils to flow in opposite directions at all radial regions of the coil assembly as claimed, adjacent pancake coils would have to be wound in the same direction, angularly aligned in the same angular position relative to one another, and connected so that current flows into the coils on the outer surface of the ribbon of one coil and then the inner surface of the ribbon of the next coil, and so on. The proprietor argues that this is not disclosed in or obvious from document D2.

The opponent maintains that when implementing the design of D2 it would be evident to the skilled person that this arrangement of features would be necessary, or if not obvious, and that the claimed current flow direction in adjacent coils would result.

1.6 The Board can find no disclosure in document D2 as to whether adjacent modules are arranged with their spirals wound in the same direction or in opposite directions, nor any mention of their angular positioning. Furthermore, no detail is given as to how the two (inner and outer) superconducting films of any one module are connected to those of the adjacent module(s). Whilst figure 5-2 shows connections between modules, it does so only schematically: it does not seem to be possible to derive the winding directions or angular positions of the modules from the figure and it does not seem to be possible to derive how the inner and outer films of the modules are interconnected. Hence, the Board concludes that there is not sufficient information directly and unambiguously derivable from

D2 from which it can be concluded that adjacent pancake coils are electrically connected in such a way that "current flowing in adjacent turns of adjacent pancake coils flows in opposite directions" and that that condition exists "at all radial regions of the coil assembly". Hence, the subject matter of claim 1 of the main request is considered to be novel in the sense of Article 54 EPC.

1.7 In the contested decision the opposition division regarded the objective technical problem as being to provide a coil assembly having a minimised inductance and noted that the skilled person would have this problem in mind as it was addressed in D2 (see decision, page 8, first and third paragraphs and D2, page 5-1, second paragraph). The parties have not challenged this choice of objective problem and the Board agrees with it.

Also, the opposition division held that it was part of the skilled person's common general knowledge that a coil assembly having coils with currents flowing in opposite directions has a lower inductance than an assembly having coils with currents flowing in the same direction and cited D3 to D6 and D13 as evidence of this.

1.8 The assessment of inventive step hangs on the question whether it would be obvious for the skilled person, seeking to reduce inductance, to arrange the adjacent pancake coils of D2 such that they are:

(a) wound in the same direction,

(b) angularly aligned and

(c) connected so that current flows into the coils on the outer surface of the ribbon of one coil and

then the inner surface of the ribbon of the next coil, and so on.

It is common ground that these are the conditions that would be necessary in D2 for the current flowing in adjacent turns of adjacent pancake coils to flow in opposite directions at all radial regions of the coil assembly as set out in present claim 1.

1.9 Knowing from D2 that the adjacent pancake coils have to be connected together, the Board is convinced by the opponent's argument that it would be obvious for the skilled person to make the interconnections between them as short and simple as possible. The Board is furthermore convinced that to achieve that aim it would be obvious to arrange the adjacent pancake coils such that they are wound in the same direction and annularly aligned, because it would be immediately apparent that this would position the ends of the adjacent pancake coils as close as possible to one another. What's more, the most straight-forward way to connect the ends of adjacent pancake coils together would be to connect the sputtered superconducting film on one side of the ribbon of one pancake coil to the sputtered superconducting film on the same side of the ribbon of the next pancake coil. Given that current flowing into a pancake coil on one side of the ribbon flows back out of the other side of the ribbon, this would lead to an arrangement in which current flows into the pancake coils on the outer surface of the ribbon of one pancake coil and then on the inner surface of the ribbon of the next coil, and so on. Thus, it would be obvious for the skilled person starting from D2 to would come to an arrangement in which the current flowing in adjacent turns of adjacent pancake coils flows in opposite directions at all radial regions of the coil assembly as set out in claim 1 of the main request. Hence, claim

1 of the main request does not involve an inventive step, Article 56 EPC.

2. **Proprietor's Auxiliary Request**

2.1 Independent claim 1 of the auxiliary request differs from the main request by addition of the feature that:

"the conductive winding sections (32, 34) are formed from an integral piece of superconducting material (14)."

2.2 In assessing inventive step the opposition division considered whether it would be obvious, starting from D2 as closest prior art, to connect the superconductive films sputtered on both sides of the Mylar ribbon by also sputtering around the edge of the ribbon. The opposition division considered that due to shrinking of the Mylar ribbon when cooled, such a joint would be particularly strained, causing cracks and problems with adhesion, and concluded that for that reason such a joint would not be obvious.

Furthermore the opposition division took the view that two superconducting layers on both sides of a Mylar sheet and connected in an arbitrary way could "not be regarded as being formed from an integral piece of superconducting material".

2.3 The opponent argues that the term "integral piece" is unclear and covers not only an arrangement in which the pancake coil is formed from the "same continuous length of superconducting tape" (cf. paragraph [0029] of the patent), but also the alternative arrangement mentioned in that paragraph in which the pancake coil is formed from two separate conductors joined together at the intermediate loop region 36 (cf. figure 4).

The proprietor disagrees and argues that the expression "an integral piece of superconducting material" excludes an arrangement that contains a joint between two conductive winding sections and excludes the alternative arrangement mentioned in paragraph [0029].

2.4 In order to establish how this expression might be construed, the Board cited an excerpt from the Collins English Dictionary, Third Edition, 1991, page 802, which gives inter alia the following definitions for the adjective "integral":

2. intact; entire.
3. formed of constituent parts; united.
6. a complete thing; whole.

In the Board's view it is evident from definition number 3 that the feature "an integral piece of superconducting material" can include an arrangement in which the piece of superconducting material is formed of constituent parts. This corresponds to the arrangement disclosed in D2, in which the two superconductor layers sputtered onto the Mylar ribbon are connected together on the hollow drum. Hence, the Board concludes that this additional feature is known from D2 and that claim 1 of the auxiliary request lacks an inventive step from D2 for the same reasons as given for the main request, Article 56 EPC.

3. Additional Observations

3.1 For the sake of completeness the Board notes that the requested claim sets also include an independent method claim. In view of the Board's findings on the independent apparatus claim 1 it has not been necessary

to address the method claim in the reasons for this decision.

3.2 The opponent (as appellant) requested that the following documents, filed with the grounds for appeal, be admitted into the proceedings:

D16: EP 0 503 448 A2
D17: US 3 715 703 A.

The proprietor requested that these documents be ruled inadmissible, or otherwise that costs be awarded in respect of the opposition proceedings and the case be remitted to the opposition division for consideration.

In view of the Board's findings on the basis of document D2 it was not necessary to admit these further documents.

4. Conclusion

Given that neither of the proprietor's requests meets the requirements of the EPC, the patent has to be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu

Decision electronically authenticated