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D E C I S I O N
of 1 August 2000

Case Number: T 0738/98 - 3.5.2

Application Number: 90123585.3

Publication Number: 0431643

IPC: H01B 12/04

Language of the proceedings: EN

Title of invention:

Method of manufacturing oxide superconducting wire

Patentee:

SUMITOMO ELECTRIC INDUSTRIES, LTD.

Opponent:

Siemens AG

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - no"

Decisions cited:

-

Catchword:

-



Case Number: T 0738/98 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 1 August 2000

Appellant:
(Proprietor of the patent) SUMITOMO ELECTRIC INDUSTRIES, LTD.
5-33, Kitahama 4-chome
Chuo-ku
Osaka-shi
Osaka 541 (JP)

Representative:
Winter, Brandl, Fürniss, Hübner, Röss
Kaiser, Polte
Partnerschaft
Patent- und Rechtsanwaltskanzlei
Alois-Steinecker-Strasse 22
D-85354 Freising (DE)

Respondent:
(Opponent) Siemens AG
Postfach 22 16 34
D-80506 München (DE)

Representative:
Patentanwälte
Westphal, Mussnug & Partner
Mozartstrasse 8
D-80336 München (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 14 May 1998
revoking European patent No. 0 431 643 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: R. G. O'Connell
P. H. Mühlens

Summary of Facts and Submissions

I. This is an appeal from the revocation by the opposition division of European patent No. 431 643. The reasons given for the revocation were *inter alia* that the subject-matter of claim 3 of the main request dated 17 March 1998 lacked novelty having regard to the prior art document:

D7: JP-A-63-270342 and Derwent Abstract.

The opposition division also found that the subject-matter of claim 1 of the single auxiliary request of the same date did not involve an inventive step having regard additionally to the following prior art:

D3: EP-A-0 305 820

D6: EP-A-0 285 319

D8: JP-A-01-147814 and Japio Abstract

and common general knowledge in the art evidenced by:

D2: Enzyklopädie Naturwissenschaft und Technik,
vol. 2, Verlag Moderne Industrie, München, 1980,
page 1165.

The opposition division did not make an explicit finding in relation to claim 1 of the main request dated 17 March 1998 but the interpretation it gave to claim 1 of the auxiliary request implied that the subject-matter of the former claim did not involve an inventive step either.

With the statement of grounds of appeal the appellant filed a further prior art document:

D15: Japanese Journal of Applied Physics, vol. 26,
No. 5, May 1987, pages L865 to L866,
Yutaka Yamada et al. "Critical Current Density of
Wire Type Y-Ba-Cu Oxide Superconductor".

II. Claim 1 of the appellant's main and two auxiliary requests on appeal is in substance the same as claim 1 of the patent and claim 1 of the two requests refused by the decision under appeal. It is worded as follows, the steps of the method being labelled by Roman numerals in square brackets for ease of reference in this decision in accordance with a scheme employed in the decision under appeal and in the statement of grounds of appeal:

"1. A method of manufacturing an oxide superconducting wire (1), comprising:

 a step [I] of preparing powder of an oxide superconductor or raw material by heat treatment of the powder and subsequent pulverization and repeating said step at least once;

 a step [V] of re-heating said powder;

 a step [II] of covering said powder with a sheath (3) of a metal or an alloy being unreactive and nonreductional with respect to said powder at a temperature of not more than 950°C;

 a step [III] of deforming said sheath being filled up with said powder; and

 a step [IV] of heat treating a wire obtained by said deformation processing, characterized in that

 said step [V] of re-heating said powder between said step [I] of preparing powder and said step [II] of covering said powder with a sheath (3) is carried out under decompressed atmosphere of not more than 850°C."

The board observes proleptically that consideration of the above claim will suffice to decide this appeal.

III. Oral proceedings were held before the board on 1 August 2000 in the course of which the appellant filed a complete translation into English of JP-A-63-270342 (prior art document D7).

IV. The appellant proprietor argued essentially as follows:

The argumentation at point 4 of the decision under appeal relevant to the issue of inventive step of the subject-matter of claim 1 of the appeal main request amounted to the contention that degassing was a routine operation to remove undesired residual gases from surfaces or bodies and that the choice of the moment immediately prior to the sheathing step [II] for the degassing step [V] was merely one of several possibilities from which the person skilled in the art would select without an inventive step being involved. This was an *ex post facto* analysis which failed to give due weight to the specific context of oxide superconductors which were prone to undesired oxygen loss during processing, to the specific conditions of temperature and pressure of the reheating step [V] specified in the last paragraph of claim 1, and to the importance of the specific stage of the process, namely immediately prior to the sheathing step, at which the re-heating step was introduced.

Furthermore the decision under appeal had misinterpreted the prior art document D7. It relied on D7 as evidence that a step of reheating the oxide superconductor powder carried out under vacuum at a temperature of 650°C was known from the prior art without giving due weight to the fact that D7 clearly

stated that the powder was **pelletised** whereas in the inventive method underlying the opposed patent no pellets were formed.

The significance of a pelletising step could be seen from prior art document D15, page L865, left hand column, third paragraph, and right hand column, lines 7 to 9, where porosity of the wire type Y-Ba-Cu-O compound was ascribed to a small compaction density, ie lack of pelletisation, in the packing stage of the oxide superconductor powder preparation. It made a difference to crush and pulverise pellets which were very compact and non-porous as in D7 compared to a porous semi-compact "powder cake" in accordance with the present invention.

The respondent's argument that claim 1 was not directed to the most preferred embodiment was irrelevant, there being no such requirement in the EPC.

V. The respondent's arguments can be summarised as follows:

The respondent no longer contested the permissibility of the amendments to the claims under Article 123(3) EPC.

The subject-matter of claim 1 was new but obvious for the person skilled in the art in view of prior art documents D7 and D8 and common general knowledge in the art essentially for the reasons given by the opposition division in the decision under appeal and which were still applicable to the amended claims.

The person skilled in the art - a physicist or materials engineer - would have been aware both of the need to prevent the venting of residual gases causing

problems when the sintered powder was enclosed in its metal jacket and how this problem could be avoided by expelling such gases beforehand by heat treatment. The encyclopedia extract D2 was evidence of the fact that such degassing operations and the awareness of the need for them were part of the common general knowledge in the art.

Prior art document D8 taught repeated heat treatment of the oxide superconductor powder at a reduced pressure to evacuate residual gases during the deforming of the filled metal sheath while D7 disclosed heat treatment during preparation of the oxide superconductor powder within the temperature and pressure range specified in claim 1.

The appellant's argument in relation to the pelletisation mentioned in D7 was not well founded.

In the first place claim 1 did not specifically exclude a pelletisation step. Pelletisation was not mentioned in the opposed patent, in particular there was no suggestion that it should be avoided and hence there could be no basis for interpreting claim 1 so as to exclude it. The reference in the description of the opposed patent at page 3, lines 21 and 27 to a process of "softly pulverising" the powder was not explained in any detail and was not understandable; it could not serve as a basis for interpreting claim 1 to exclude pelletisation.

In the second place the full translation into English of D7 showed that the reference in the abstract to "pellets" did not reflect accurately the process actually described in JP-A-63-270342. At page 4, last paragraph, the process of forming the powder was described thus: "a general method of forming such as CIP, HIP or hot press is used." The abbreviations were

known in the art and meant "cold isostatic pressing" and "hot isostatic pressing" respectively. These were processes which produced so-called "compacts", a kind of billet suitable for manipulation which was quite different from a pellet. The reference in the abstract to "a pellet" was simply a mistranslation; there was no pelletisation process described in D7 so that the distinction the appellant relied on in his argument on inventive step did not exist.

- VI. The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of:

Main request: claims 1 to 6 filed in the oral proceedings, or

First auxiliary request: claims 1 to 7 filed with the statement of grounds of appeal, or

Second auxiliary request: claims 1 and 2 of the main request.

- VII. The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Permissibility of the claim amendments*

The respondent no longer contests the permissibility of the claim amendments under Article 123(3) EPC. This is in accord with the judgement of the board that the amendments are permissible.

3. *Novelty (claim 1, main request)*

Novelty of the subject-matter of claim 1 is not in dispute.

4. *Inventive step (claim 1, main request)*

4.1 The opposed patent relates to the manufacture of a metal clad oxide superconductor wire by the well known 'powder in tube' method. The general technological background is set out in prior art document D6, cited at the bottom of page 2 of the opposed patent. The particular problem addressed by the patent is that the oxide superconductor powder or raw material therefor may generate gas during heat treatment of the wire, ie the clad product, resulting in damage to the metal sheath thus reducing the critical current density J_c in the finished product. The opposed patent refers to this problem as inflation of the sheath; cf opposed patent, page 2, lines 46 to 51.

4.2 Although none of the prior art documents mention the problem of inflation *expressis verbis* essentially all the documents considered in the opposition procedure and in the decision under appeal, in particular D6, D7 and D8, refer to the need to eliminate residual gases, without enlarging on all the deleterious effects produced by such gases, it being implicit for the person skilled in the art what these effects are. By the same token the subject-matter of claim 1 is a method comprising a heat treatment step whose effect - elimination of residual gas thus *inter alia* avoiding inflation - is not specified in the claim. It is therefore legitimate to regard the method of claim 1 of the opposed patent as addressing the problem of eliminating potentially harmful residual gases from the oxide superconductor powder or the raw material therefor prior to the incorporation of the latter in

the metal sheath without differentiation as to which particular deleterious effect is regarded as being of greatest concern. The problem thus framed is that addressed by D7, which in the judgement of the board represents the closest prior art; cf D7, page 3, first full paragraph, which refers to the fact that conventional methods of manufacturing allow residual impurities such as CO₂ to remain in the sintered product.

- 4.3 The solution taught by D7, as expressed broadly in the claim statement at page 1, is to subject the oxide superconductor powder to a (re)heat treatment "characterised in that the powder before forming is thermally processed by heating to and maintaining at a temperature of 200 to 1000°C in a vacuum of at least 10⁻² Torr and thereafter formed under pressure and sintered". At page 6, lines 5 and 6, a particular example is described which involves (re)heating the powder at 650°C for five hours in a vacuum of 10⁻⁶ Torr. This (re)heating step is the counterpart of the powder reheating step V of claim 1 of the opposed patent which specifies "a decompressed atmosphere of not more than 850°C". As is mentioned at page 5 of D7: "Before the above described thermal processing, the step of forming, calcination or pulverization may be included. In that case, forming is a simple forming under pressure. Calcination is performed at a normal pressure in air or oxide atmosphere, the temperature for calcination is about 700 to 900°C and the time for calcination is about several hours." This latter preparation of the oxide superconductor powder is the counterpart of step I of claim 1 of the opposed patent. Although D7 does not specify that this step is repeated at least once (as specified in the claim) the respondent contends persuasively that such repetition of heating and pulverisation steps is standard practice in the preparation of such powders. This is confirmed

by the account in D6, at column 6, line 48, to column 7, line 5 of a typical procedure for preparing such a powder which specifies that: (after a first fragmenting and calcining step) "The calcined fragments are again milled, re-fragmented and fired, as needed to achieve homogeneity". The board interprets this passage as referring to conventional practice in the art.

- 4.4 Steps II, III, and IV of claim 1 of the opposed patent are undisputedly conventional steps of the well known powder in tube method corresponding to the steps of sheathing, rolling and drawing, and wire heat treatment at 950°C described in D7 at page 6, lines 13 to 18, it being implicit in this description that the copper used is unreactive and non-reductional (at least to the degree required to prevent substantial impairment of superconductive properties) with respect to said powder at a temperature of not more than 950°C.
- 4.5 The board notes that in D7 the reheating step (corresponding to step V in the claim) does not immediately precede the sheathing step (corresponding to step II in the claim), there being an intervening sintering and pulverising step (D7, page 6, lines 7 to 13), but claim 1 of the opposed patent does not exclude such an intervening step, the only limitation in the claim being that the reheating step V should be "between" step I and step II.
- 4.6 It follows from the above analysis that the claimed method differs from that known from D7 only in explicit reference to a repetition in step I, which repetition is a standard option in the art. The subject-matter of claim 1 is accordingly, having regard to D7 and common general knowledge in the art, obvious to a person skilled in the art.

4.7 The appellant's assertion that the subject-matter of claim 1 is not obvious having regard to D7 pivots on his interpretation of the latter document as involving a "pelletisation" step - the intervening step referred to above. However the respondent has convincingly argued that despite the appearance of the word "pellet" in the translation and the abstract of D7, what is described there is not the formation of pellets, which would be agglomerations of a few millimetres in size, but rather the formation of a "compact", ie a sintered body which is subsequently pulverised as explicitly described in D7. The other prong of the respondent's counterargument that even if there were a pelletisation step this was not excluded by the claim is, in the judgement of the board, equally convincing. The references in the description of the opposed patent to an optional "soft pulverisation" are too vague and insubstantial to found an argument that the claim has to be interpreted so as to exclude any intervening step whether of true pelletisation or of compaction.

5. *Conclusion*

5.1 In the judgement of the board, therefore, having regard to the prior art document D7 and common general knowledge in the art - as evidenced by references in some passages in D6 to process steps, knowledge of which is implicitly imputed to the person skilled in the art -, the subject-matter of claim 1 of the main request, albeit new, is obvious to a person skilled in the art and accordingly is not to be considered as involving an inventive step within the meaning of Article 56 EPC.

5.2 Since claim 1 of each of the auxiliary requests is the same as claim 1 of the main request, the above finding leads to the conclusion that the ground of opposition of lack of inventive step prejudices the maintenance of the patent on the basis of any of the appellant's requests (Articles 100(a) and 102(1) EPC).

Order

For these reasons it is decided that:

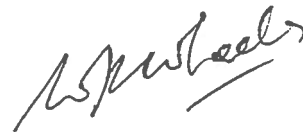
The appeal is dismissed.

The Registrar:



M. Hörnell

The Chairman:



W. J. L. Wheeler