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D E C I S I O N
of 14 December 1995

Case Number: T 0592/93 - 3.2.2
Application Number: 86902022.2
Publication Number: 0266422
IPC: C21D 8/12, H01F 1/16, B21B 3/00
Language of the proceedings: EN

Title of invention:

Process for producing low core loss, thin, unidirectional
silicon steel plate having excellent surface properties

Patentee:

KAWASAKI STEEL CORPORATION

Opponent:

Thyssen Stahl AG

Headword:

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Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Novelty and inventive step - (yes) after amendment"

Decisions cited:

-

Catchword:

-



Case Number: T 0592/93 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 14 December 1995

Appellant:
(Opponent)

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Representative:

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Respondent:
(Proprietor of the patent)

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Representative:

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office dated 11 May 1993 rejecting
the opposition filed against European patent
No. 0 266 422 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: H. Seidenschwarz
Members: P. Dropmann
J.-C. De Preter

Summary of Facts and Submissions

- I. A Notice of Appeal was filed against the decision of the Opposition Division dated 11 May 1993 rejecting the opposition filed against European patent No. 0 266 422.

The Opposition Division held that the ground of opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent unamended. In its decision it considered documents

D1: FR-A-2 472 614,

D2: EP-A-0 101 321,

D3: EP-A-0 124 964, and

D4: Stahleisen-Berichte, Spurenelemente in Stählen, Verlag Stahleisen mbH, Düsseldorf, 1985, pages 19 and 20.

During the appeal proceedings, the Appellant (Opponent) introduced two further documents, namely

D5: GB-A-1 266 957, and

D6: US-A-4 280 856.

- II. Oral proceedings before the Board were held on 14 December 1995. At these proceedings, the Respondent (Proprietor of the patent) submitted a set of amended Claims 1 to 3 together with adapted pages 3, 9, 14 and 16 of the patent specification.

- III. The Appellant requested that the decision under appeal be set aside and the patent revoked.

IV. The Respondent requested that the appeal be dismissed and the patent be maintained in the following version:

- Claims 1 to 3 as filed during the oral proceedings,
- Description pages 3 with insert A, 9, 14 and 16 as filed during the oral proceedings, and pages 2, 4 to 8, 10 to 13, 15 and 17 of the patent specification,
- Drawings as mentioned in the communication under Rule 51(4) EPC, dated 27 February 1990, i.e. sheets 1/3 to 3/3 of the published patent application.

V. The claims read as follows:

"1. A method of producing low iron loss grain oriented silicon thin steel sheets comprising subjecting a steel slab consisting of 0.030 to 0.080 wt % C, 3.1 to 4.5 wt % Si, 0.003 to 0.1 wt % Mo, 0.005 to 0.06 wt % acid soluble Al, at least one of S and Se in a total amount of not more than 0.005 to 0.1 wt %, optionally 0.005 to 0.2 wt % Sb, and optionally one or more of Sn, Cu and B in a total amount of not more than 0.5 wt %, the remainder being Fe and incidental impurities to a hot rolling to form a steel sheet, and subjecting said steel sheet to

(i) a primary cold rolling at a reduction of 10 to 60%,

(ii) an intermediate annealing including a heating stage from 500°C to 900°C and a cooling stage from 900°C to 500°C wherein the heating and cooling rates respectively are not less than 5°Cs⁻¹,

(iii) a secondary cold rolling at a reduction of 75 to 90% to form a steel sheet having a final gauge of 0.1 to 0.25 mm,

(iv) a decarburization and primary recrystallization annealing in a wet hydrogen atmosphere and

(v) a high temperature finish annealing.

2. A method as claimed in claim 1 wherein either before or after the decarburization and primary recrystallization annealing the steel sheet is subjected to a treatment which causes the formation at the high temperature finish annealing, of heterogeneous microareas on the steel sheet surface.

3. A method as claimed in claim 1 or 2 wherein heterogeneous microareas are formed on the surface of the steel sheet after the high temperature finish annealing."

VI. The Appellant essentially argued as follows:

Due to the absence of Mn in the alloy specified in Claim 1 as amended, the subject-matter of Claim 1 was novel over the state of the art according to document D2 requiring the presence of Mn. However, the subject-matter of Claim 1 did not involve an inventive step in the light of the state of the art known from the documents mentioned during the opposition and appeal proceedings.

The Respondent argued in its counterstatement that these documents did not suggest the improvement in surface quality ascribed by the contested patent to the combined presence of Al and Mo in particular amounts and the choice of particular parameters of the thermal and mechanical treatments mentioned in Claim 1.

Reasons for the Decision

1. The appeal is admissible.
2. No formal objections under Articles 84 and 123 and Rules 27 and 29 EPC arise against Claims 1 to 3, the description and the figures. However, the expression "or 2" in Claim 3 is to be deleted.

As to Article 123(2) EPC, the features concerning the composition of the steel specified in Claim 1 have their basis in original Claim 1 and in page 36 of the description as originally filed. The amendments at pages 14 and 16 of the patent specification and the explicit addition of Figures 1 to 3 as requested by the Respondent serve to overcome a printing error which occurred during the printing of the patent specification. The communication under Rule 51(4) EPC dated 27 February 1990 correctly indicated the text and the drawings provided for the grant of the patent.

The amendments of the claims do not offend against the provisions of Article 123(3) EPC, since, by incorporating into Claim 1 features of Claim 2 as granted, the protection conferred by the patent as granted has not been extended.

3. None of the documents D1 to D6 mentioned during the proceedings discloses a method comprising all of the essential features specified in Claim 1. Indeed, documents D1, D5 and D6 are silent as to the heating rate during the heating stage of the intermediate annealing carried out between the primary and secondary cold rolling. Document D2 is concerned with the treatment of a steel which, unlike the steel mentioned in the amended Claim 1 of the contested patent, contains

Mn as an essential element (the mentioning of Mo at page 24, line 5 of document D2 is obviously based on a typing error; Mo in this line should read Mn since Mn is a requirement of the silicon steel slab as specified in Claim 1 of document D2). The steel mentioned in document D3 does not contain Mo, and Al is included in amounts outside the specified range of the present invention. Document D4 does not relate to a method of producing silicon steel sheets.

The claimed method is, therefore, novel over the state of the art known from documents D1 to D6.

4. The method according to Claim 1 also involves an inventive step.
- 4.1 Irrespective of whether document D2, document D5 or any other document mentioned in the proceedings is considered to represent the closest state of the art, the problem addressed by the present invention lies in the provision of very thin silicon steel sheets having both good magnetic properties and excellent surface properties.

The problem is solved in accordance with Claim 1 by a method in which the composition of the steel, the primary and secondary cold rolling reduction rates, the heating and cooling rates in the intermediate annealing and the final gauge of the sheet are all carefully controlled within defined parameters. This method leads to a surprising improvement in the surface properties of thinned steel sheets (cf. in particular Tables 1 to 3 and Figures 1 and 3).

- 4.2 None of the documents D1 to D6 is concerned with an improvement in the surface properties of such steel sheets. These documents are entirely silent in this

respect. Therefore, the skilled person, seeking to obtain silicon steel sheets having superior surface properties, would be unable to derive any information concerning this problem from these documents. In particular, there is no suggestion whatsoever that the addition of the elements in the amounts specified in Claim 1 and the process parameters of Claim 1 would provide improved surface properties. For this reason, having regard to documents D1 to D6, the claimed method is not obvious to a person skilled in the art.

Moreover, there is no incentive for the skilled person to combine the teaching of one of these documents with that of another one leading to an effect which could be considered as an unexpected additional effect in the sense of a bonus effect, of the kind which is not to be regarded as an indication of inventiveness. Document D2 is the only one of the cited documents which discloses both the heating and cooling rates of at least 5°C/s in the intermediate annealing. However, there is no reason why the skilled person should take this feature out of its context in a method, which contrary to the invention requires the presence of Mn as a grain growth inhibitor (see page 15, lines 9 to 28), and incorporate it into the teaching of any of the other documents. Even if this were to be done, the claimed method would not be arrived at. Further modifications would be necessary, e.g. as to the final gauge (cf. documents D1 and D6 which disclose a final gauge of not lower than 0.3 mm) or the composition of the steel (cf. document D3 which does not mention Mo). Concerning document D5, the content of Si ranging from 0 to 4% and that of Mo ranging from 0 to 1% would in addition need narrow restriction.

4.3 For the reasons given above, the Board is satisfied that none of the cited prior art makes the subject-matter of Claim 1 obvious. There is thus an inventive step as defined in Article 56 EPC.

5. Hence, the invention according to Claim 1 is patentable having regard to Articles 52(1), 54 and 56 EPC.

Dependent Claims 2 and 3 are directed to modifications of the method defined by Claim 1. Their patentability is supported by that of Claim 1.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent in the following version:
 - Claims 1 to 3 as filed during the oral proceedings (however, the expression "or 2" in Claim 3 is to be deleted),
 - Description pages 3 with insert A, 9, 14 and 16 as filed during the oral proceedings, and pages 2, 4 to 8, 10 to 13, 15 and 17 of the patent specification,

- Drawings as mentioned in the communication under Rule 51(4) EPC dated 27 February 1990, i.e. sheets 1/3 to 3/3 of the published patent application.

The Registrar:



S. Fabiani

The Chairman:



H. Seidenschwarz