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Datasheet for the decision of 16 September 2008

Case Number: T 1465/06 - 3.2.02

Application Number: 99912105.6

Publication Number: 1028172

IPC: C22C 38/14

Language of the proceedings: EN

Title of invention:
Cold rolled steel sheet excellent in baking hardenability

Applicant:
Nippon Steel Corporation

Headword:
-

Relevant legal provisions:
EPC Art. 54, 84

Keyword:
"Novelty of a selection: main request - (no); auxiliary request - (yes)"

Decisions cited:
-

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1465/06 **-** 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 16 September 2008

Appellant: Nippon Steel Corporation
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 24 April 2006 refusing European application No. 99912105.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: T. Kriner
Members: R. Ries
C. Vallet

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 24 April 2006 to refuse European patent application No. 99 912 105.6.

The application was refused on the ground that the subject matter of claim 1 as originally filed according to the main request and claim 1 according to the first auxiliary request then on file lacked novelty with regard to the documents

D1: Patent Abstracts of Japan, volume 1995, no. 10, 30 November 1995 & JP-A-07 188856 A (Nippon Steel Corporation) 25 July 1995, and

D1a Translation of document D1 into English.

In its decision the examining division held that the composition of the cold rolled steel sheet disclosed in document D1a exhibited quantitative elemental ranges which overlapped with those claimed in the application. D1 disclosed also specific examples of the claimed Ti-Nb-steel sheet, among which sample 7 was considered as coming close to the claimed composition. The examining division concluded that a skilled person putting into practice the technical teaching of D1 would seriously contemplate working within the range of overlap. Hence, the composition of the claimed steel sheet did not meet the criteria for the novelty of a selection from the steel sheets given in D1a.

II. On 27 June 2006 the appellant (applicant) lodged an appeal against the decision, and the appeal fee was

paid on the same date. The statement setting out the grounds of appeal was received on 4 September 2006.

III. The Board's provisional view on the case was communicated in the annex to the summons to oral proceeding which took place on 16 September 2008. At the oral proceedings, the appellant requested that

- the decision under appeal be set aside and

- a patent be granted on the basis of
  claim 1 according to the main request filed with the letter dated 13 August 2008 or
  claim 1 according to the auxiliary request filed at the oral proceedings.

Claim 1 of the main request reads as follows:

"1. A cold rolled Nb-Ti-IF steel sheet having improved bake hardenability, delay aging property, press workability and platability, comprising by weight
carbon: 0.0013 to 0.007%
silicon: 0.001 to 0.08%
manganese: 0.01 to 0.9%
phosphorus: 0.001 to 0.10%
sulfur: not more than 0.030%
aluminum: 0.001 to 0.1%, and
nitrogen: not more than 0.01%,
said steel sheet further comprising
titanium: 0.001 to 0.025% and
niobium: 0.001 to 0.040%,
the titanium and niobium contents satisfying k value defined by the following formula:

k = %C - 12/93 x %Nb - 12/48 x (%Ti - 48/14 x %N) ≥ 0.0008 wherein %Ti - 48/14 x %N > 0,

said steel sheet containing molybdenum as an additive for forming a dipole of molybdenum and carbon at a level satisfying the following formulae:

0.005 ≤ %Mo ≤ 0.25 and 0.1 x √k ≤ %Mo ≤ 5 x √k wherein k is as defined above,

optionally containing boron on a level satisfying the following formulae:

0.005 x √k ≤ %B ≤ 0.08 x √k wherein k is as defined above,

%Mo/300 ≤ %B ≤ %Mo/4, and the balance being iron and unavoidable impurities,

wherein the cold rolled Nb-Ti-IF steel sheet has a bake hardening value of not less than 50 MPa which is the difference between an yield point strength after being pulled by 2% and held at 170°C for 20 min and the strength measured by the 2% pulling, and a yield point elongation of not more than 0.02% in a tensile test after being held at 40°C for 70 days."

The wording of claim 1 according to the auxiliary request differs from claim 1 of the main request in that

- the terms "..having improved bake hardenability, delay aging property, press workability and platability.." and "..for forming a dipole of molybdenum and carbon.." have been deleted and
- it includes the technical feature (in bold letters) "... at 40°C for 70 days **and a dislocation density of 50 to 3.000 dislocation lines per μm² of plane field."**

IV. The appellant's arguments are summarized as follows:

The claimed steel sheet represented a novel selection from the composition of the cold rolled steel sheet described in document D1a. In its broadest aspect the teaching of this document encompassed three types of steel: Ti-IF steel, Nb-IF steel and Ti-Nb-IF steel, which were commonly known to a person skilled in the art at the priority date of the patent, as it was pointed out in the appellant's letter of 13 August 2008, point 2.1.2. The latter steel category was selected in the present application in order to provide an excellent match in bake-hardenability (BH), delayed ageing characteristics and workability. Insofar, the composition of the claimed steel sheet represented a narrow selection from the steel sheets disclosed in D1a.

The three types of steel were also reflected by the examples given in Table 1 of D1a among which only the examples 5 to 7 related to Mo-Ti-Nb steels which were addressed in the present application.

Except for the Ti-content of 0.030%, the composition of heat Nr. 7 as the closest example satisfied the elemental ranges and the k-relationship inequation featuring in the present application. However, the upper limit of 0.025% Ti of the claimed steel was sufficiently far removed from the 0.030% Ti in example 7 of D1a for the following reasons:
Document D1a taught the determination of above mentioned categories of steel on the basis of the formulae:

a) $Ti^* = Ti^{**} + (48/93)\%Nb$

b) $Ti^{**} = Ti - (48/14)\%N - (48/16)\%S$

c) Ti** = 0 if Ti** was < 0.

It was evident from formula a) that Ti* = (48/93)%Nb if Ti** = 0 which meant that nitrogen dissolved in the steel [N] remained without being combined with Ti, but formed AlN which impaired workability. A person skilled in the art would categorize such as steel is a Nb-IF steel rather than as a Ti-Nb-IF steel. Since Ti-Nb-IF steels and Nb-IF steels were different in workability to such an extend that both steels were classified as two different steel types, those skilled in the art would, when looking to example 7 of D1a, have never considered lowering the Ti-content to 0.025% or even less (i.e. in the range where Ti** ≤ 0), as it was done in the present invention. Rather more, the skilled person would have been concerned that such low amounts of Ti (the sub-stoichiometric amounts of Ti necessary for binding all [N]) would result in a degradation of the steel type into Nb-IF like steels which were inferior in workability. Based on these considerations the skilled person would be deterred from working in the range of overlap.

Moreover, it was found in the application that molybdenum and carbon formed a dipole so that C was not dissolved in solid solution. This prevented carbon from being fixed onto the dislocations and provided good delay ageing properties (see also Annex H, page 6/8). The composition of the claimed steel sheet thus was a purposive rather than an arbitrary selection.

The criteria for the novelty of a selection over the disclosure of D1 (D1a) were therefore satisfied.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments, Article 123(2) EPC*

The subject matter of claim 1 of the main request derives from claim 1 as originally filed and the passages given on page 2, lines 20 to 24; page 5, lines 1 to 5; page 8, lines 33 to 37; page 9, lines 21 to 23; page 11, lines 1 to 11 of the application as filed.

Hence there are no formal objections under Article 123(2) EPC.

3. *Novelty, Article 54 EPC, main request*

3.1 Like the present application, document D1a aims at providing a cold rolled steel sheet exhibiting a high and stable bake-hardenability (BH generally >50 MPa), delayed aging characteristics and excellent workability (see D1a, e.g. abstract, paragraphs [0003] and [0006]). As to improve these properties, the composition of the known steel sheet comprises, as essential elements, specific amounts of Mo and either or both Ti and Nb as well as B, as does the claimed steel sheet.

An overview of the composition of the claimed steel sheet and of that disclosed in document D1a is given in the following comparative table:

element	application claim 1; wt%	D1a, claim 1, wt%	D1a ex. 7 wt%	
C	0.0013-0.007	≤ 0.008	0.058	o
Si	0.001-0.08	≤ 0.8	0.081	o
Mn	0.01-0.09	≤ 1.5	0.45	o
P	0.001-0.10	≤ 0.15	0.089	o
S	≤ 0.030	≤ 0.02	0.004	o
Al	0.001-0.01	0.01-0.1	0.066	o
N	≤ 0.01	≤ 0.1	0.0045	o
Ti	0.001-0.025	≤ 0.13 and/or Nb	**0.030**	↑
Nb	0.001.0.040	≤ 0.05	0.008	o
Mo	0.005-0.25	0.012-0.30	0.15	o
	$0.1\sqrt{k} \leq \%Mo \leq 5\sqrt{k}$		yes	
Ti-48/14%N	≥ 0		0.0146	o
k-value	≥ 0.0008		0.00092	o
B (optional)	$0.005\sqrt{k} \leq \%B \leq 0.08\sqrt{k}$	10 ppm (optional)		o
Fe	balance	balance	bal.	o
Nb-Ti-IF-steel	yes	yes	yes	o
BH	≥ 50 MPa after being held at 170°C/20min	≥ 50 MPa	74 MPa	o
YP elongation	≤ 0.02% when held at 40°/70 days	0% when held at ±20°C/180 days	0%	

As can bee seen, an overlap exists between the composition of the claimed steel and that disclosed in document D1a. As in the claimed steel composition, specific amounts of Ti and/or Nb added alone or in

combination are effective to impart to the known steel sheet a BH value of 50 MPa or higher without impairing the delay ageing characteristics and workability. Moreover, as believed in the application, the addition of Mo is said in D1a to provide for better delayed aging characteristics at ordinary temperature, since it prevents the diffusion of C at ordinary temperature and delays the anchoring time of C to a movable dislocation (see D1a, paragraphs [0012],[0013]). In that respect the objects and also the metallurgical means resorted to in document D1a in order to achieve the desired combination of properties are essentially the same as in the application.

Turning to the examples in Table 1 of D1a, the skilled reader realizes that the steel sheet can comprise either Mo-Ti (samples 1 to 4) or Mo-Nb (samples 8, 9) or even Mo-Ti-Nb (samples 5 to 7) as scavenging elements for binding nitrogen and carbon. The Board concurs with the appellant's position given in its letter of 13 August 2008, point 2.1.2, page 6 that the composition of examples 5 to 7 falls within the category of Ti-Nb-IF steel claimed in the application, and particular reference is made to heat number 7. Except for the titanium content 0.030%, which is 50 ppm outside the claimed range of 0.01 to 0.025% Ti, the composition of example 7 completely falls within the claimed elemental range and satisfies the claimed correlation rules for the k-value, the Mo content and even for boron. According to D1a, paragraph [0014], boron can be added in an amount of 10 ppm to improve the secondary workability. It is also concluded from the general explanations given in D1a, paragraph [0013] that in the exemplifying Ti-Nb-IF steel Nr 7 the

interaction of C with Mo corresponds to the Mo-C dipole formation that is believed to occur in the claimed steel and addressed in the application on page 5, lines 1 to 11. In addition thereto, sample 7 meets the claimed correlation rule of Ti - (48/14)%N ≥ 0 which means that no free nitrogen [N] is dissolved in the steel to form AlN. Given the single and very small difference of only 50 ppm Ti referred to above, the composition of example 7 is not considered as being sufficiently far removed from the claimed composition, and it can be assumed that the physical and chemical properties of the claimed steel sheet and that described in sample 7 of D1a are actually the same. Hence, at least the second criterion for the novelty of a selection is not met.

3.2 The appellant argued that the skilled reader of document D1a would not envisage the production of Ti-Nb-IF steel sheet having a value of Ti** < 0 since such a steel sheet would provide an impaired workability. In his view this position was confirmed by the examples 5 to 7.

This approach is however not convincing to the Board. Contrary to the appellant's position, paragraph [0012] of D1a specifically takes into account the possibility of producing steel compositions exhibiting a calculated value of Ti** ≤ 0. Nothing can be found anywhere in document D1a that would prompt a skilled person to conclude that such steels are to be avoided or even excluded, or that a value of Ti** > 0 is preferred. For instance, a value for Ti** = -3.4×10^{-4} (i.e. Ti** = 0) is calculated for sample 5. It is also noted that the formula for Ti** in D1a encompasses the amount of

sulfur [S] dissolved in the steel. By contrast, [S] is disregarded in the claimed formula %Ti - (48/14)%N ≥ 0 which thus results in lower amounts of Ti necessary to meet this condition. The examples given in Table 1 of D1a show that all three categories of steels have been successfully produced and exhibit a proper balance of the properties aimed at in the application. Hence, in the absence of any warning or hint to the contrary, the skilled person would seriously contemplate working in the range of overlap and produce steel sheets having a composition which falls within the claimed range and inevitably exhibits all the properties set out in claim 1.

The subject matter of claim 1 of the main request therefore lacks novelty over the technical disclosure of document D1a.

4. *Auxiliary request*

4.1 Amendments, Articles 123(2), 84 EPC

The additional technical feature specifying to the dislocation density which is included in claim 1 of the auxiliary request is supported by claim 3 as originally filed and is also found on page 6, line 24 to page 7 line 5 of the application.

The deletion of the term "*having improved bake-hardenability, delay aging property, press-workability and platability*" and "*for forming a dipole of molybdenum and carbon*" represents a permissible clarification of the wording of claim 1 since these

terms merely express the result to be achieved by the claimed sheet rather than a patentable limitation.

The requirements of Articles 123(2) and 84 are therefore met.

4.2 Novelty, Article 54 EPC

Document D1a neither explicitly nor implicitly discloses the dislocation density featuring in claim 1 of the auxiliary request. Hence the novelty of the subject matter of claim 1 vis-à-vis D1a cannot be disputed.

4.3 Since, however, the question of inventive step has not yet been considered in the impugned decision, the case is remitted to the examining division for further substantive examination.

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 for further prosecution on the basis of claim 1 according to the auxiliary request filed at the oral proceedings on 16 September 2008.

The Registrar: The Chairman:

V. Commare T. Kriner