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D E C I S I O N
of 5 July 2005

Case Number: T 1186/02 - 3.2.2

Application Number: 95925583.7

Publication Number: 0769078

IPC: C22C 38/42

Language of the proceedings: EN

Title of invention:
Free-machining austenitic stainless steel

Patentee:
CRS Holding, Inc.

Opponent:
Edelstahl Witten-Krefeld GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

Case Number: T 1186/02 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 5 July 2005

Appellant: (Proprietor of the patent)	CRS Holding, Inc. 209F Baynard Building 3411 Silverside Road Wilmington Delaware 19810 (US)
Representative:	Sutcliffe, Nicholas Robert Mewburn Ellis York House 23 Kingsway London WC2B 6HP (GB)
Respondent: (Opponent)	Edelstahl Witten-Krefeld GmbH Auestraße 4 D-58452 Krefeld (DE)
Representative:	Simons, Johannes COHAUSZ & FLORACK Postfach 330229A D-40435 Düsseldorf (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 4 October 2002 revoking European patent No. 0769078 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: T. K. H. Kriner
Members: R. Ries
H. Preglau

Summary of Facts and Submissions

I. The grant of European patent No. 0 769 078 on the basis of European patent application No. 95925583.7 was mentioned on 23 February 2000.

II. The granted patent was opposed by the present respondent on the grounds that its subject matter lacked novelty and did not involve an inventive step (Article 100(a) EPC).

III. With its decision posted on 4 October 2002, the opposition division held that the claimed subject matter of independent claims in all requests lacked novelty and revoked the patent.

IV. An appeal against this decision was filed by the patentee (the appellant) on 4 December 2002. The fee for appeal was paid at the same date, and the written statement setting out the grounds of appeal was filed on 12 February 2003.

V. Of the documents referred to in the opposition proceedings, only the following have been relied upon on appeal:

D1: EP-A-0 257 979 (& US-A-4784828), and

D2: E. Houdremont: "Handbuch der Sonderstahlkunde", volume 2, 1956, Springer Verlag, pages 1258 to 1261.

VI. In order to meet the request of all parties, oral proceedings before the Board were held on 5 July 2005.

The appellant (patentee) requested that the decision under appeal be set aside and the patent be maintained as granted (main request) or, in the alternative, to maintain the patent on the basis of the set of claims 1 to 14 filed with letter dated 11 August 2003 (auxiliary request).

The respondent (opponent) requested that the appeal be dismissed.

VII. Independent claims 1 and 13 as granted read as follows:

"1. An austenitic, stainless steel alloy having a good combination of machinability and a low magnetic permeability consisting of, in weight percent,

C	0.030	max
Mn	1.0 -	2.0
Si	1.0	max
P	0.2	max
S	0.15-	0.45
Cr	16.0 -	20.0
Ni	9.2 -	12.0
Mo	1.5	max
Cu	0.8 -	1.0
N	0.035	max
Se	0.1	max
Ca	0.01	max
B	0.01	max

the balance iron and incidental impurities."

"13. An austenitic, stainless steel alloy having a good combination of machinability and a low magnetic permeability consisting of, in weight percent,

C	0.01	max
Mn	1.0 -	2.0
Si	1.0	max
P	0.1	max
S	0.25-	0.45
Cr	17.0 -	19.0
Ni	9.5 -	12.0
Mo	0.75	max
Cu	0.5 -	1.0
N	0.035	max
Se	0.05	max
Ca	0.01	max
B	0.01	max

the balance iron and incidental impurities."

Independent claims 1 and 11 of the auxiliary request differ from the corresponding claims of the main request by restricting the upper limit of the Ni range to 10.0%.

VIII. The appellant argued as follows:

The composition of the austenitic stainless steel stipulated in the patent represented an inventive selection from the alloy disclosed in document D1. As to the nickel contents, the degree of overlap between the claimed alloy and D1 was only 10 - 15%, and with respect to the range for copper there was a 20% overlap. The claimed alloy was, therefore, a narrow selection from the alloys given in document D1. Turning to the examples of the known alloy, the copper content (about 0.28%) was far outside the claimed range of 0.8 to 1.0% Cu, and the levels of Ni between 8.50 to 8.74% were lower than the selected range of 9.2 to 12,0% in claim 1. Hence, the examples given in document D1 were sufficiently far removed from the claimed ranges. In addition, the claimed alloy did not represent an arbitrary selection, since D1 failed to disclose any pointer that (i) the machinability of the alloy could benefit from increased nickel contents and that (ii) the amounts of Ni and Cu, higher than typically used in these alloys, significantly improved both the machinability and the magnetic permeability. The novelty of the claimed alloy vis-à-vis D1 was therefore given.

As to inventive step, the present patent aimed at improving the machinability through reduced tool wear without adversely affecting the magnetic permeability. Given that Ni and Cu were expensive alloying elements, they were kept in document D1 in a tight range between 8.5 to 8.74% Ni and 0.27 to 0.29% Cu. The skilled person had therefore no motivation to select amounts of Ni and Cu higher than disclosed by the examples of document D1. In contrast, the present inventors found that by rebalancing the composition of low C and N in a resulfurized austenitic stainless steel with higher amounts of Ni and Cu, the claimed alloy not only provided a much lower magnetic permeability but also a significant and unexpected improvement in machinability on a commercial-type screw machine. To arrive at the steel within the scope of claim 1 of the patent when starting from D1, the skilled person would have to seriously contemplate an amount of Ni higher than the exemplified Ni amounts and simultaneously contemplate an amount of Cu much higher than the Cu amounts given in the examples. However, there was nothing in D1 that would give the skilled person any reason to seriously contemplate such radical changes to the Ni and Cu amounts of the exemplified steels of Table 1 of D1. Rather the narrowness of the distribution of the amounts of Ni and Cu in the exemplified steels would have prevented a skilled person from considering such significant changes to these amounts.

Document D2 merely taught that additions of 0.5% to 2% Cu to alloys containing 18% Cr and 8% Ni increased the stability of the austenite phase. This is, however, an even broader Cu range than described in document D1 and the alloy had less nickel than that claimed in patent. Hence document D2 did not add anything to the disclosure of document D1.

IX. The respondent argued as follows:

The disclosure of document D1 should not be confined to the exemplifying compositions which had been selected to elucidate the effect of C and N on the steel's machinability. Moreover, it was known to those skilled in the art that the magnetic permeability of the austenitic steel alloy was reduced the more the austenite phase was stabilised. This effect was essentially achieved by adding appropriate amounts of the strong stabilizers copper and nickel. If desired, Cu could be added up to 1.0% to the alloy, as described in D1, page 6, line 6, and according to document D2, page 1261, Cu should be not lower than 0.5% to achieve a non-magnetic behaviour even after heavy cold forming. Working in a nickel range that was mentioned as "most preferred" was obvious for a skilled person when putting in practice the teaching of D1. The selection of the elemental ranges of the alloy stipulated by the patent therefore amounted to nothing more than what was done by the skilled metallurgist when trying to improve at least the magnetic properties of the alloy known from D1.

Reasons for the Decision

1. The appeal is admissible.

2. *The closest prior art*

It has been common ground to the parties and to the Board that document D1 represents the closest prior art. Paragraph [0004] of the patent already acknowledges this document as "background of the invention" in the form of US patent No. 4 784 828 (Eckenrodt et al.). Like the patent at issue, document D1 is concerned with a resulfurized Cr-Ni austenitic stainless steel which exhibits improved free-machining characteristics exceeding those obtained solely by the use of Mn and S at levels conventionally employed for this purpose (cf. D1, page 2, lines 3 to 6, lines 14 to 16). In the following Table the elemental ranges of the alloy, which are rated as "most preferred" in document D1, page 2, lines 21 to 26, are compared with the corresponding ranges of the claimed austenitic stainless steel alloy:

EP 0 769 078 (MAIN REQUEST) CLAIM 1	EP 0769 078 (AUX. REQUEST) CLAIM 1	EP 0 257 979 D1 (PREFERRED)	D1, EX. V569
C max 0.030	C max: 0.030	C	0.021
C+N max 0.065	C+N max: 0.065	C+N max 0.040	0.038
Mn 1.0-2.0	Mn 1.0-2.0	Mn 0.75-2.0	1.61
Si max 1.0	Si max 1.0	Si max 1.0	0.65
P max 0.2	P max 0.2	P max 0.2	0.035
S 0.15-0.45	S 0.15 -0.45	S 0.25-0.45	0.33
Cr 16.0-20.0	Cr 16.0-20.0	Cr 17-19	17.58
Ni 9.2-12.0	Ni 9.2-**10.0**	Ni 6.5-10	**8.74**
Mo max 1.5	Mo max. 1.5	Mo max. 1.0	0.35
Cu 0.8-1.0	Cu 0.8 - 1.0	Cu up to 1.0	**0.28**
N max 0.035	N max 0.035	N	0.017
Se max 0.1	Se max 0.1	optionally Se,	
Ca max 0.01	Ca max 0.01	Bi, Te, Pb or P	
B max 0.01	B max 0.01		
		9	
Fe balance + impurities	Fe balance + impurities	Fe balance+ impurities.	Fe: balance + impurities

As taught in document D1, the control of carbon plus nitrogen, rather than carbon or nitrogen alone, is essential for obtaining the desired improved machinability of the austenitic stainless steel. Therefore, the total amount of (C+N) is restricted to not more than 0.065% and, more preferably, to not more than 0.040% (cf. D1, page 2, line 21 to 23). As is apparent from document D1, Table II, the best drill machinability rating is achieved by example V548A which among all examples actually exhibits the lowest total of (C+N). The problem of providing an improved machinability is, therefore, already successfully solved by the steel composition described in document D1.

According to the patent in suit paragraph [0004], the austenitic stainless steels in which the amounts of carbon and nitrogen are reduced as taught in document D1 provide however an undesirable high magnetic permeability, in particular in the cold drawn condition.

3. *Problem and solution*

Starting from this prior art, the problem underlying the patent at issue therefore resides in providing an austenitic stainless steel alloy which, in addition to an improved machinability, exhibits a better magnetic permeability in particular in the cold drawn condition. Put the other way, the patent at issue aims at finding an austenitic stainless steel alloy having a better combination of machinability and magnetic permeability than provided by the alloy known from document D1 (see the patent specification, paragraph [0008]).

This problem is solved by the composition of the austenitic stainless steel set out in claims 1 and 13.

4. *Inventive step*

It remains to be decided whether the claimed solution was obvious to a person skilled in the art.

4.1 The comparative table shows that the ranges for S, P, Si, Cr and Mo of the claimed alloy fully comply with the most preferred corresponding ranges of the alloy known from D1. Moreover, the ranges for Mn broadly overlap. In the claimed alloy, the total of C+N is restricted to not more than 0.65% by the amounts of C (≤ 0.030%) and N (≤ 0.035%) to benefit the machinabilty. As set out in paragraph [0013] of the patent, an even better machinability is obtained by restricting carbon and nitrogen to not more than 0.025% each, i.e. to C+N ≤ 0.050% or even lower, thus following exactly the technical teaching given in document D1 which proposes a preferred total of C+N ≤ 0.040% for obtaining a high machinability. Aside from contributing to this improvement, the drastically reduced amount of carbon plus nitrogen, each known as strong austenite stabilizing elements, entails the problem of a reduced stability of the austenite phase which adversely affects the magnetic permeability. This interrelationship between the steel's microstructure and the magnetic properties is known to the expert, e.g. from document D2, page 1261. To cope with this problem, it is however routine for the metallurgist to increase the amounts of other components which are known to exhibit a strong stabilizing effect upon the austenitic phase and which therefore could compensate for the reduced amounts of C and N. These components are in particular copper and nickel which are already comprised in the stainless steel alloy known from document D1.

4.2 As to the nickel content, it is noted that the broad range of 9.2 to 12% Ni in claim 1 according to the main request overlaps with the most preferred range of 6.5 to 10% Ni of the alloy specified in document D1. The appellant's view that the degree of overlap is small is not disputed. The patent at issue, however, states in paragraph [0015] that the best results are obtained when Ni is restricted to not more than 10.0%. Therefore nickel should preferably be selected to fall into the narrower range of 9.2 and 10% as is specified in claim 1 of the auxiliary request. However, no patentable distinction could be seen vis-à-vis the alloy known from D1 which likewise specifies an upper limit of 10% for the most preferred Ni-range. It is therefore obvious for the metallurgist to shift the nickel content within the most preferred range closer to the upper limit of 10% mentioned in document D1 to compensate for the alloy's reduced austenite stability resulting from the low amounts of C and N.

The appellant has pointed in this context to the nickel content in the examples of document D1 all comprising about 8.6 - 8,7% Ni which is below the claimed lower limit of 9.2% Ni. In its view, a skilled person would adhere strictly to theses values.

The teaching of document D1 is, however, not restricted to the examples in which the influence of carbon and nitrogen upon the machinabilty has been tested by varying the amounts of C and N while maintaining the other components unchanged. There is, however, nothing in document D1 that dissuades from choosing nickel contents other than 8.7%.

Thus with respect to the nickel content, the patent at issue follows the technical teaching given in document D1. Varying the amounts of the component of an alloy (i.e. nickel) in the most preferred range to further improve one of the alloy's properties does not involve an inventive step since it is the most preferred range of an alloy a skilled person would in the light of the technical facts seriously turn to when reproducing the alloy of the prior art. When working to a specification such as this, it is usual for the steelmakers to adopt their own narrower limits which are chosen with the object of biasing the properties to suit a particular application.

4.3 A further difference is seen by the appellant in the copper content selected in the claimed alloy and that in D1.

Although all examples in D1 actually comprise about 0.28% copper, this document underlines on page 6, line 6 that copper may be added, if desired, in an amount up to 1.00% to improve the austenite stability. This upper limit for copper exactly complies with that claimed in the patent at issue. Apart from the explicit disclosure in D1, the strong austenite stabilizing effect of copper additions in the same type of steels as claimed (i.e. the typical 18Cr-8Ni stainless steel) is well known to the metallurgist, e.g. from the textbook D2, page 1261, the paragraph below the table: the austenite stabilizing effect obtained by adding at least 0.5% Cu guarantees that the steel remains non-magnetic even after cold forming at high reduction rates. Given this clear pointer in the prior art, the addition of at least 0.5 up to 1.0% Cu to the steel alloy known from document D1 to improve its magnetic permeability is obvious for the skilled metallurgist.

4.4 The appellant has argued that although the alloy known from D1 provides an improved machinabilty in short term laboratory tests, it has less desirably machinability under production-type machining operations such as on an automatic screw machine.

This argument has, however, no bearing on the matter since claim 1 does not specify a particular type of machinability.

4.5 In the appellant's view, document D1 does not provide any technical information that by increasing the amounts of nickel and copper in combination, the machinability and the magnetic permeability of the stainless steel alloy could be simultaneously improved. This has been a surprising effect.

As has been previously shown, the austenite stability in the stainless steel represents the key feature for its magnetic permeability. Carbon, nitrogen, copper and nickel all contribute to generating an austenite structure even at 18%Cr. If in such an alloy the amounts of carbon and nitrogen are drastically reduced to optimize a particular property (in the present case the machinability), it is routine for the metallurgist to adjust the amounts of the other austenite forming elements in order to stabilize the austenite structure and, in consequence thereof, to improve the alloy's magnetic permeability. Both nickel and copper are well known to act in this way. Given this one-way street situation, the appellant's finding that increasing simultaneously the amounts of nickel and copper improves also the machinability rather than impairs it or leaves it unchanged is to be rated as a bonus effect. Even if the Board had accepted that this additional problem (the further improved machinability) had been effectively solved in a manner not suggested by document D1, this cannot be rated as an indication of the presence of an inventive step since the skilled metallurgist relying on his background general knowledge not only could but would have increased the alloy's contents of either Cu and Ni to enhance the austenite stability and to improve the alloy's magnetic permeability without knowing about the additional advantage in machinability provided by these compositional modifications.

5. In conclusion therefore, the subject matter of claim 1 of the main request and of the auxiliary request does not involve an inventive step, having regard to the technical teaching given in documents D1 and D2.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Magouliotis T. K. H. Kriner