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Datasheet for the decision of 28 February 2007

Case Number: T 0145/04 - 3.2.03

Application Number: 01120905.3

Publication Number: 1184107

IPC: B22F 1/02, B22F 1/00, C22C 33/02

Language of the proceedings: EN

Title of invention:
Alloyed steel powder for powder metallurgy

Applicant:
JFE Steel Corporation

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0145/04 **-** 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 28 February 2007

Appellant: JFE Steel Corporation
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Tokyo (JP)

Representative: Grünecker, Kinkeldey
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 11 August 2003 refusing European application No. 01120905.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
K. Garnett

Summary of Facts and Submissions

I. European patent application 01120905.3, which concerns an alloyed steel powder, was refused by the examining division for lack of inventive step in light of either EP A 0 334968 (D2) or JP A 61130401 (D4); the decision was posted on 11 August 2003. The applicant filed notice of appeal, together with the appeal fee, on 20 October 2003; a statement containing the grounds of appeal was filed on 19 December 2003.

II. Requests

The appellant requests that the decision be set aside and a patent be granted on the basis of the following documents:

Claims 1 to 3 filed with the letter dated 24 June 2003;

Description pages 1 to 5, 12, 17 to 25, as originally filed, and pages 6, 6a, 7 to 11, 13 to 16 filed with the letter dated 30 November 2005;

Figure sheets 1/2 to 2/2, as originally filed.

III. Claims

Independent claim 1 reads as follows:

"1. An alloyed steel powder for powder metallurgy, comprising:

an iron-based powder, said iron-based powder comprising 1.0% by mass or less of prealloyed Mn based on the

entire amount of said alloyed steel powder with the balance of the iron-based powder consisting of iron and inevitable impurities; and

from 0.2 to 10.0% by mass of Mo based on the entire amount of said alloyed steel powder in the form of a powder being partially diffused into and bonded to a surface of said iron-based powder particles; and the balance of the alloyed steel powder consisting of iron and inevitable impurities."

Dependent claims 2 and 3 concern preferred embodiments of the powder defined in claim 1.

IV. Summary of the Arguments of the Examining Division and the Appellant

According to the examining division, the steel powder of claim 1 differs from the closest prior art (D2) in that nickel is not present. It is well known that nickel in the alloy increases the hardness of the compacts, but the disadvantage is that this makes the compacts more difficult to machine and size. The problem to be solved by the claimed powder is therefore how to decrease the hardness of a body obtained by compaction and preliminary sintering as in D2, and thereby minimise the load required for re-compaction. Given that the molybdenum in the powder of D2 will provide adequate hardness when the compact is subsequently subjected to carburising treatment, the examining division concluded that it is obvious to eliminate nickel to solve the problem whilst accepting a decrease in mechanical properties that would result from the absence of nickel.

The appellant argued that avoiding nickel leads to a compact having a higher density than one containing both nickel and molybdenum, and reduces the load required for the re-compaction stage. The examining division compared the densities disclosed in the application and D2, and, observing that they are similar, held that the effect had not been demonstrated. However, the appellant submits that this comparison is not correct, as the examining division had compared the densities of the preliminary sintered compacts of the application with those of the re-sintered compacts of D2.

Since neither D2 nor D4 contain a pointer to omit totally nickel in order to reduce the load required for re-compaction while maintaining high strength and high density, the claimed powder has an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Inventive Step (Article 56 EPC)*

The examining division refused the application for lack of inventive step with respect to either D2 or D4.

Considering firstly D2, both the application and D2 disclose the compaction of iron-based powders to form a green compact that is sintered, then re-compacted and sintered a second time in order to further increase density and strength. D2 discloses a steel powder

containing manganese at impurity level, ie within the claimed range, to which powders of nickel and molybdenum are bonded; the molybdenum content is also within the claimed range.

The claimed powder composition differs from that of D2 in that it does not contain nickel.

It is known from D2 that, whilst nickel has a beneficial effect on toughness (see page 12), it also increases hardness (D2, page 8 and the also the published application, paragraph [0013]). The compacts are compressed and sintered a second time in order to size the component and increase its density by reducing the number of pores, which has a beneficial effect on the mechanical properties. However, the increase in hardness as a result of the nickel content makes this step more difficult. The examining division held the view that it would be obvious for the skilled person, observing the detrimental effects of nickel, to eliminate it completely from the alloy, especially as the molybdenum could provide an acceptable level of hardness after a carburising treatment.

According to the appellant, avoiding nickel leads to compacts having higher densities whilst being able to reduce the load required for the re-compaction stage (see also paragraph [0001] of the published application). However, the examining division referred to Table 7 of D2, which discloses density values ranging between 7.41 and 7.46 g/cm^3 and compared this with the application, which discloses (see page 7, lines 5 to 6 of the published application) that the density of the sintered body is 7.4 g/cm^3. The examining

division therefore concluded that the densities obtained in D2 and the application are to all extent the same, hence the alleged effect had not been substantiated.

However, as the appellant points out, this is not a comparison of like with like, since the compact of D2 has been subjected to two sintering and compacting steps (see paragraph bridging pages 32 and 33), whereas the density value given in the application was measured only after initial compaction and preliminary sintering (see page 7, lines 2 to 10 of the published application). The compact of the application is subsequently compressed and sintered a second time, and it would be expected that after this second stage of compacting and sintering, the density would increase further. Alternatively, in order to achieve a given density, a lower compaction pressure is needed in the second stage for the powders of the application compared with those of D2.

The appellant has provided experimental evidence with the grounds of appeal (see the Table and Figure) which shows that, when powders according to the application are used, lower re-compaction loads (2653 and 2893 MPa compared with 3081 MPa for powder containing nickel) are required for obtaining similar densities, and that the hardness of the preliminary sintered body is lower (92 and 120 Hv compared to 112 and 147 Hv respectively). None of the cited documents provide any indication that this effect can be achieved by the omission of nickel. In particular, D2 recognises the disadvantages and advantages of nickel in the alloy powder (see page 2, second paragraph and page 12), but seeks to find a

compromise by reducing the nickel content rather than by eliminating it. Document D4 also describes a steel powder containing nickel and molybdenum for making sintered bodies, and hence the arguments above are equally applicable to this document. The conclusion reached by the examining division could only be reached with the benefit of hindsight.

Since it is not obvious that omitting nickel from the compositions of either D2 or D4 would solve the problem of reducing compacting loads whilst maintaining high density, the claimed steel powder composition has an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent in the following version:

   Claims 1 to 3 filed with the letter dated 24 June 2003;

   Description pages 1 to 5, 12, 17 to 25, as originally filed, and pages 6, 6a, 7 to 11, 13 to 16 filed with the letter dated 30 November 2005;

   Figure sheets 1/2 to 2/2, as originally filed.

The Registrar: The Chairman:

A. Counillon U. Krause