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Aktenzeichen / Case Number / N° du recours : T 55/87 - 3.3.1

Anmeldenummer / Filing No / N° de la demande : 83 103 745.2

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Bezeichnung der Erfindung: Method for adding ingredients to steel as shot
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : C21C 7/00

ENTSCHEIDUNG / DECISION
vom / of / du 19 January 1989

Anmelder / Applicant / Demandeur : Inland Steel Company

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence : Shot addition/Inland Steel

EPO / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step (confirmed)"

Leitsatz / Headnote / Sommaire

Case Number : T 55/87 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 19 January 1989

Appellant : Inland Steel Company
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Representative : Leach, John Nigel et al.
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Decision under appeal : Decision of Examining Division 016
of the European Patent Office
dated 18 November 1986 refusing
European patent application
No. 83 103 745.2 pursuant to
Article 97(1) EPC.

Composition of the Board :

Chairman : K.J.A. Jahn
Members : R.W. Andrews
C.V. Payraudeau

Summary of Facts and Submissions

- I. European patent application No. 83 103 745.2, filed on 18 April 1983 and published on 2 November 1983 (publication No. 0 092 764) claiming priority of 22 April 1982 from a prior application filed in the United States of America was refused by a decision of the Examining Division 016 of the European Patent Office dated 18 November 1986. The decision was based on Claims 1 to 11 as filed. The only independent claim reads as follows:

"A method for adding alloying ingredients as shot to molten steel which is flowed from a ladle to a casting mould wherein to enhance the recovery and uniformity of distribution in said steel of said alloying ingredients, said method comprises employing a shot size within the range 0.5-2.0 mm (0.019-0.078 in.) with no more than about 1 wt.% outside said size range, and feeding said shot into said molten steel without mechanical hurling."

- II. The stated ground for the refusal was that the claimed subject-matter did not involve an inventive step in the light of the disclosure in, inter alia,

- (1) GB-A-520 227 and
- (2) EP-A-0 027 509.

The Examining Division considered that the particle size range of the shot disclosed in document (1) had been chosen to ensure that, when the shot was added to molten steel, the ingredients would be uniformly distributed and that malfunction of the shot-adding machine would be avoided. In view of economic considerations it must be assumed that a high recovery of the added ingredients was achieved using shot of this particle size range. Therefore, a slight

adjustment to the lower limit of the known particle size range to improve this known process cannot be regarded as being inventive. Moreover, if working within a known recommended range, it would be expected that an advantageous effect would be produced, an additional advantageous effect, possibly unforeseen, cannot be used to demonstrate the presence of an inventive step.

- III. An appeal was lodged against this decision on 8 January 1987 with payment of the prescribed fee. A statement of grounds of appeal was filed on 29 January 1987. In these grounds, the Appellant argued that the decision under appeal was based on the erroneous premises that uniform dispersion of alloying ingredient in an ingot mould is the same as uniform distribution of these ingredients in a heat from the beginning to the end of the heat and that expertise in the field of solids transport is the same as expertise in the field of making alloying additions to molten steel.
- IV. In response to objections raised by the Board, the Appellant filed an amended statement of claim and amended pages 1, 7 and 8 of the description. Claims 2 to 6, 8 and 9 of the amended statement of claim are identical with the originally filed Claims 2 to 6, 8 and 9. Claims 1, 7, 10 and 11 correspond to original Claims 1, 7, 10 and 11 respectively, apart from the deletion of certain redundant expressions.
- V. The Appellant requests that the decision under appeal be set aside and a patent granted on the basis of Claims 1 to 11 filed on 9 January 1989, pages 1 and 7 filed on 5 September 1988, page 8, filed on 24 May 1988 and pages 2 to 6 and 9 and Figure 1 as filed. Alternatively, as an auxiliary request, the Appellant requests that a patent be

granted on the basis of a subsidiary set of Claims 1 to 10 filed on 5 September 1988.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. There are no formal objections to the present claims since they are adequately supported by the original disclosure.

The phrases deleted from Claims 1, 7, 10 and 11 as originally filed related to the result to be achieved by the claimed method. However, these phrases are redundant since the area defined by these claims is clearly defined in terms of the technical features necessary to achieve the desired result.

The amendments to pages 1, 7 and 8 do not give rise to any formal objections since these correct obvious clerical errors in the original documents.

3. The application relates to a method for adding alloying ingredients as shot to molten steel as it is flowed from a ladle to a casting mould.

Document (1) discloses a method for introducing lead into steel during the pouring of the molten steel by directing a stream or shower of metallic lead, lead alloy or lead compound into the stream of molten steel (cf. Claim 1). The lead, lead alloy or lead compound is preferably added in finely sub-divided form of a size 0.3 to 2.0 mm (10-50 mesh) (cf. Claim 4). In the absence of any further detailed disclosure the Board considers that this document teaches the addition to molten steel of finely divided particles

whose sizes vary continuously within the range of about 0.3 to 2.0 mm. Therefore, in the Board's judgement a typical size distribution for such a particle size range is that referred to on page 1 filed on 5 September 1988 and Shot B of Table IV on page 6 of the published patent application; viz

> 1.0 mm (plus 18 mesh) 27.9 wt. %
> 0.85 mm (plus 20 mesh) 26.0 wt. %
> 0.425 mm (plus 40 mesh) 39.4 wt. % and
< 0.425 mm (minus 40 mesh) 6.7 wt. %.

However, it was found that when using shot of the above-mentioned size range, the distribution of the alloying ingredients from one part of the heat of molten steel to another was not sufficiently uniform and that there was a relatively low recovery of the alloying ingredients.

In the light of this prior art, the technical problem underlying the application may be seen in providing a method for adding alloying ingredients as shot to molten steel with an improved recovery of alloying ingredients and a more uniform distribution of the ingredients from one part of the heat to another.

According to the application in suit this technical problem is essentially solved by employing a shot-size within the range of 0.5 to 2.0 mm with no more than 1 wt. % outside this range.

In the light of the results in Tables V and VI of the application, the board is satisfied that the above-defined technical problem is credibly solved.

4. After examination of the cited documents, the Board has concluded that this technical teaching is not disclosed in

any of them and that the subject-matter of the disputed application is, therefore, novel. Since novelty is not in dispute it is not necessary to consider the matter in detail.

5. It still remains to be examined whether the requirement of inventive step is met by the claimed subject-matter.

As previously mentioned, document (1) discloses a method for introducing lead into steel during the pouring of the molten steel by directing a stream or shower of metallic lead, lead alloy or lead compound, preferably in finely divided form, into the stream of molten steel (cf. Claims 1 and 4). Alternatively, the lead may be introduced as a spray of molten metal (cf. page 2, lines 43 to 45). This procedure ensures that a proportion of the added lead is retained in the steel and is uniformly dispersed therein (cf. page 1, lines 12 to 18).

- 5.1. In analysing the teaching of document (1) it is of great importance to distinguish between the uniform dispersion of the lead in an ingot mould obtained by the process described in this document and the uniform distribution of lead (or any other alloying ingredient) from the beginning to the end of a heat provided by the present process. Thus, uniform distribution requires that the lead content be substantially the same in each ingot poured from a heat, i.e. a volume of molten steel from which a multiplicity of ingots are poured. Uniform dispersion, however, merely requires that whatever the lead content of an ingot, the lead be dispersed uniformly throughout that ingot. Therefore, dispersion in each of several ingots can exist without uniform distribution of lead among the ingots, and uniform distribution of lead among the ingots can exist without the lead being dispersed in any ingot. That is,

each ingot can have the same amount of lead, even if the lead is segregated in the ingot once the ingot solidifies.

Thus, the skilled person would perceive that the problem dealt with in this prior art document was different from one underlying the present application. Therefore, the teaching of this document would not have provided the skilled person with any indication that the solution to improving the uniformity of distribution and recovery of the alloying lay in controlling the amount of fines less than 0.5 mm in the shot to no greater than 1 wt.%.

- 5.2. Document (2) discloses a method for introducing lead and bismuth into steel comprising adding to the molten steel as discrete particles an alloy of lead and bismuth to which tellurium, sulphur or combinations thereof has been added with a view to increasing the melting point of the alloy (cf. Claim 1). The particulate form, which may be either shot or particles crushed from cast blocks of the alloy, should be finer than about 2 mm (10 mesh), preferably have a size in the range 0.85 to 0.425 mm (20 to 40 mesh) with up to 5% finer than 0.15 mm (100 mesh) (cf. first complete paragraph on page 6).

Thus, in contrast to the present application which requires the use of shot with a minimum particle size of 0.5 mm with no more than 1 wt.% below that size, document (2) allows the use of an unlimited amount of particles in the size range of 0.15 and 0.5 mm.

From this document, the skilled person would conclude that the solution to the problem of increasing the amount of lead and bismuth retained in the steel lay in increasing the melting point of the added bismuth-lead alloy by the addition thereto of tellurium, sulphur or mixtures thereof.

According to the second paragraph on page 7 of this document, the uniformity of distribution of inclusions formed by the alloy may be enhanced by stirring the molten steel, either in the ingot mould or in the tundish, after the alloy has been added.

Thus, from the teaching of this document, the skilled person would not have deduced that a restriction on the amount of fines present in the added shot would favourably influence the uniformity of distribution of the alloying ingredients from the beginning to the end of the heat or their recovery in the steel.

- 5.3. It is considered that the Examining Division's unsubstantiated allegation that it is a known fact that the flowability of a bulk material is changed for the worse by the presence of very fine grains or dust represents an oversimplification in view of the numerous other factors involved in solids transport. Even if one were to accept this allegation which has been made with the benefit of hindsight, the skilled person would still have to realise that a connection existed between the uniformity of distribution of the alloying ingredients from the beginning to the end of a heat and the amount of fines present and there was also a relationship between the recovery of the alloying ingredients in the steel and the amount of fines in the added shot. In the Board's view, these connections could not have been made without the exercise of inventive activity.
- 5.4. Therefore, in the Board's judgement, the subject-matter of Claim 1 involves an inventive step. Dependent Claims 2 to 10, which relate to preferred embodiments of the method according to Claim 1, derive their patentability from this claim.


6. In view of the above it is not necessary to consider the Appellant's auxiliary request.

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 on the basis of Claims 1 to 11 filed on 9 January 1989, pages 1 and 7 filed on 5 September 1988, page 8, filed on 24 May 1988 and pages 2 to 6 and 9 and Figure 1 as originally filed.

The Registrar:



The Chairman:

