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**Datasheet for the decision
of 8 March 2021**

Case Number: T 1666/18 - 3.2.03

Application Number: 12720979.9

Publication Number: 2694226

IPC: B21B1/46, B21B13/22, B22D11/12

Language of the proceedings: EN

Title of invention:
ENERGY-SAVING STEEL PRODUCTION APPARATUS AND METHOD THEREOF

Patent Proprietor:
SMS Meer S.p.A.

Opponents:
Primetals Technologies Austria GmbH
DANIELI & C.
OFFICINE MECCANICHE SpA

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:



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Case Number: T 1666/18 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 8 March 2021

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Decision under appeal: Interlocutory decision of the opposition
division of the European Patent Office posted on
23 April 2018 concerning maintenance of the
European Patent No. 2694226 in amended form.

Composition of the Board:

Chair	D. Prietzel-Funk
Members:	G. Patton
	B. Goers

Summary of Facts and Submissions

- I. The two opponents 1 and 2 (hereafter "appellants I and II" respectively) lodged an appeal in the prescribed form and within the prescribed period against the decision of the opposition division maintaining European patent No. 2 694 226 in amended form.
- II. The two oppositions filed were to the patent in its entirety and were based on Article 100(a) EPC (lack of novelty and inventive step), Article 100(b) EPC (insufficiency of disclosure) and Article 100(c) EPC (unallowable amendments).

The opposition division held that the patent could be maintained on the basis of what was then auxiliary request II.

- III. In a communication pursuant to Article 15(1) RPBA 2020 dated 10 June 2020, the board provided its preliminary, non-binding opinion that neither auxiliary request II, considered allowable by the impugned decision, nor either of auxiliary requests III and IV (renamed first and second auxiliary requests respectively), filed by the patent proprietor (hereafter "respondent") with the reply to the statements setting out the grounds of appeal, fulfilled the requirements of Article 56 EPC. Consequently, the impugned decision was likely to be set aside and the patent revoked.

Oral proceedings were held on 8 March 2021. For matters that arose during the oral proceedings, in particular the issues discussed with the parties and their requests, reference is made to the minutes.

During the oral proceedings, the respondent withdrew the second auxiliary request.

The order of the present decision was announced at the end of the oral proceedings.

IV. The appellants requested

that the decision under appeal be set aside and that European Patent No. 2 694 226 be revoked.

The respondent requested

that the appeals be dismissed (**main request**); or, in the alternative, that the patent be maintained on the basis of the set of claims filed as auxiliary request III with the reply to the statements setting out the grounds dated 17 January 2019 (**first auxiliary request**).

V. The following documents from the opposition proceedings are relevant to the present decision:

E1: Bendzsak G. et al., "Induction Heating of Billets in Direct Rolling", published conference paper of the Proceedings of the International Symposium on Direct Rolling and Hot Charging of Strand Cast, ISBN 008036998, 1989, pages 95-106;

E2: Haldenwang U., "Inductive Intermediate Reheating in Rolling Mills", published conference paper of the Proceedings of the International Symposium on Direct Rolling and Hot Charging of Strand Cast, ISBN 008036998, 1989, pages 107-117;

E7: Advice of delivery dated 30 October 2015 of the Technische Informationsbibliothek, Hannover, to Primetals Technology Austria, Linz, regarding the

Proceedings of the International Symposium on Direct Rolling and Hot Charging of Strand Cast, ISBN 008036998, 1989, table of content, pages vii and viii.

Documents E1 and E2 do not bear any publication date. However, it is considered that, in view of E7, they were published in 1989 in the Proceedings of the International Symposium on Direct Rolling and Hot Charging of Strand Cast, see impugned decision, point 19.1 of the Reasons, which has never been contested by the respondent.

VI. The single claim, claim 1, of the **main request** reads as follows (the feature analysis here is that used by the parties):

- 2.1 Method for processing energy-saving steel, comprising the following steps:
- 2.2 a. taking the steel to a casting temperature and preferably to a temperature higher than 1500°C;
- 2.3 b. casting said steel in suitable molds for obtaining a semi-manufactured product (10);
- 2.4 c. transferring said casted [sic] semi-manufactured product (10) towards a rolling mill through fast transport means;
- 2.5 d. taking said semi-manufactured product (10) to a value of temperature corresponding to a maximum value of plasticity, preferably at a temperature higher than 1000°C;
- 2.6 e. subjecting said semi-manufactured product (10)

to a rolling process,

- 2.7 said phase d. occurring by means of intermediate rolls provided with an induction tunnel-type furnace,
- 2.8 wherein said intermediate rolls faces [sic] a finishing train,
- 2.9 which comprises a plurality of cages,
- 2.10 and wherein a direct connection from a continuous casting equipment to said intermediate rolls of the rolling mill, by means of said fast transport means, is provided;
- 2.11 wherein said phase c reduces the temperature of said semi-manufactured product (10) until about 800-900°C, allowing a complete solidification.

With respect to claim 1 of the main request, the only amendment is to feature 2.11 of claim 1 of the **first auxiliary request**, as follows (amendments are in bold, emphasis by the board):

- 2.11 wherein said phase c reduces the temperature of said semi-manufactured product (10) until **an average temperature of** about 800-900°C, allowing a complete solidification.

VII. The appellants essentially argued as follows (the arguments are discussed in more detail in the Reasons for the Decision below).

Starting from E1 as the closest prior art, the only distinguishing feature of claim 1 of the main request was the temperature range of feature 2.11.

The respondent's interpretation that the term "face" used in feature 2.8 excluded the presence of any device between the intermediate rolls and the finishing train had no basis in the contested patent.

The problem to be solved, which was identified in the impugned decision as the provision of a steel-making method achieving a balance between an energy-saving process and a process which delivers the required mechanical properties, could not be associated with the temperature range of feature 2.11.

Given this problem, the skilled person would consider E2, since, like E1 and claim 1, it concerned direct rolling of cast billets by means of hot charging in an induction furnace, and it had the same aim, of saving energy. They would find the solution to said problem in E2, arriving at the claimed subject-matter in an obvious manner on combining it with E1.

The expression "fast transport means" of features 2.4 and 2.10 did not exclude the "holding means" of E2.

The specific example given on pages 114 and 115 of E2 did not alter the explicit teaching of E2 on page 111, lines 1 to 5 and Figure 6 of a temperature falling within the claimed range of feature 2.11 in combination with the mechanical properties of the final product and the overall goal of saving energy.

The same applied to the subject-matter of claim 1 of the first auxiliary request.

VIII. The respondent essentially argued as follows (the arguments are discussed in more detail in the Reasons for the Decision below).

Document E1 did not disclose feature 2.8 or the temperature range of feature 2.11.

The term "face" used in feature 2.8 excluded the presence of the "temperature equalizer" and the corresponding step of temperature equalization applied in the method of E1.

On the basis of the technical effects associated with feature 2.11, the problem to be solved was to modify the method of E1 in order to reach a balance between energy saving and the mechanical properties of the finished product.

The skilled person would not think of combining E2 with E1, since E2 did not disclose fast transport means as claimed, but rather **hot storage via holding facilities** such as a holding structure or pre-heating furnace placed between the casting line and the rolling line. Thus, E2 concerned hot storage and taught away from the claimed solution of adapting fast transport means in order to reach the temperature range of 800-900°C. E2 did not disclose features 2.4, 2.10 or 2.11, and even failed to disclose **complete solidification** of the billets during the transporting step from the casting line to the rolling line.

Even if the skilled person considered the teaching of E2 in order to combine it with the method of E1, they would arrive at temperatures falling outside the claimed ranges, in view of the disclosure in the

section entitled "Induction Heating to Enhance Temperature Control During the Rolling Process", on pages 114 and 115, in the context of the problem to be solved.

Consequently, the skilled person would not arrive at the subject-matter of claim 1 of the main request in an obvious manner in view of documents E1 and E2.

The same applied to the subject-matter of claim 1 of the first auxiliary request.

Reasons for the Decision

1. Main request

Since the board considers that the subject-matter of the single claim, claim 1, of the main request lacks an inventive step starting from E1 as the closest prior art, in combination with the teaching of E2, there is no need to discuss the other objections raised by the appellants to this request.

1.1 Closest prior art

E1 can be considered as a suitable starting point for assessing the inventive step of claim 1 of the main request since, like claim 1, it relates to a steel-making method by direct rolling aiming at saving energy (page 95, last two paragraphs).

1.2 Disclosure of E1

E1 discloses a method for processing energy-saving steel (page 95 to page 97, fifth paragraph; page 99,

last paragraph to page 100, third paragraph; page 101, "CONCLUSIONS"; Figures 1 and 3), comprising the following steps:

- a. taking the steel to a casting temperature;
- b. casting said steel in suitable molds via a "caster" for obtaining a semi-manufactured product ("billet");
- c. transferring said cast semi-manufactured product ("billet") towards a rolling mill ("mill") through a "delivery system" regarded as falling within the broad meaning of fast transport means;
- d. taking said semi-manufactured product ("billet") to an average temperature of 1 064°C as shown in Figure 4, i.e. a temperature corresponding to a maximum value of plasticity, see contested patent, paragraph 9;
- e. subjecting said semi-manufactured product ("billet") to a rolling process,

said phase d. occurring by means of intermediate rolls provided with an induction tunnel-type furnace ("induction heating lines", "through the center of the coils", "induction heater"),

wherein said intermediate rolls face a finishing train, which comprises a plurality of cages, which are inherent in a rolling mill of billets,

and wherein a direct connection ("direct rolling") from a continuous casting equipment to said intermediate rolls of the rolling mill, by means of said fast transport means, is provided.

In E1, step c. reduces the temperature of the billet to an average of 992°C, ranging from 950°C for the skin

temperature to 1 000°C for the core, see Figure 3. The board agrees with appellant I's view that the steel is inevitably completely solidified at these temperatures.

1.3 Distinguishing feature(s)

1.3.1 Hence, undisputed by the parties, the temperature range specified in **feature 2.11** is a distinguishing feature of claim 1 of the main request over the disclosure of E1, see also impugned decision, points 23.3.2, 27.1 and 27.2 of the Reasons.

1.3.2 At the oral proceedings before the board, the respondent argued that **feature 2.8** should also be considered as a distinguishing feature over the disclosure of E1. It considered that the term "face" used in said feature excluded the presence of any device between the intermediate rolls and the finishing train. There was support for this interpretation in paragraph 34 and Figure 2 of the contested patent. This view was further confirmed by the priority document of the contested patent in Italian, which used the expression "in linea". As a consequence, the "temperature equalizer" and the corresponding step of temperature equalization that were applied in the method of E1 (see page 97, item f. and Figure 1) were excluded from claim 1 in accordance with feature 2.8.

The board does not share this view since, as put forward by the appellants, the respondent's interpretation of the term "face" is not supported by the contested patent. Nothing in claim 1 enables this term to be interpreted as the respondent does. Paragraph 34 of the description and Figure 2 do not hint, either explicitly or implicitly, at such an interpretation either. The priority document does not

form part of the application as originally filed, and cannot therefore be used for any interpretation of features in the contested patent, even if it was filed in a different language.

Furthermore, the intermediate rolls of feature 2.8 are neither described nor even mentioned in the description, hindering any interpretation of said feature on the basis of the contested patent. Consequently, the term "face" of feature 2.8 encompasses all plausible technical meanings, so the presence of any device between the intermediate rolls and the finishing train is not excluded according to claim 1.

1.4 Technical effect(s) - Problem(s) to be solved

- 1.4.1 The appellants criticise the way the problem to be solved is identified in the impugned decision, point 27.3.2 of the Reasons, which is based on the temperature range of feature 2.11 and is specified as the provision of a steel-making method achieving a balance between an energy-saving process and a process which delivers the required mechanical properties.

Appellant I considers that the claimed range of 800-900°C before the re-heating step d. is lower than that of the corresponding step in E1, with the result that it would amount to a deterioration in energy saving by comparison with the method of E1.

Still according to appellant I, the billet comprises a completely solidified austenitic microstructure at the claimed temperature range of 800-900°C according to step c., i.e. before the rolling steps. In view of the transformations in the microstructure, due *inter alia*

to the rolling steps and quenching after rolling, the claimed temperature range before the rolling steps would not influence the microstructure of the finished product. The alleged effect on the finished product would not be provided.

Similarly, appellant II argues that there is no clear technical effect associated with the temperature range of feature 2.11 in the contested patent taken as a whole. This already points towards a lack of inventive step in the claimed subject-matter. Other process parameters would be more appropriate for influencing the final mechanical properties of the finished product. Reducing the temperature after casting while seeking to save energy would be contradictory. The balance between saving energy and the mechanical properties of the final product, according to the problem to be solved as defined in the impugned decision, is not mentioned in the contested patent and would be an *ex post facto* assessment by the opposition division.

- 1.4.2 The board does not share the appellants' views. It agrees with the respondent that the contested patent provides a suggestion of the mechanical properties of the finished product, paragraph 37 and energy saving, paragraphs 12 to 14, on the basis of the temperature range of feature 2.11.

Even though the board shares the appellants' view that the temperature before re-heating is not the main factor influencing the mechanical properties of the finished product after rolling, it considers that the claimed temperature range nevertheless influences the austenite microstructure, e.g. grain size, of the

solidified steel before the rolling steps, and thus has an impact on the final microstructure and properties.

- 1.4.3 Hence, as also put forward by the respondent, the problem to be solved is seen as modification of the method of E1 in order to reach a **balance** between energy saving and the mechanical properties of the finished product, see also impugned decision, point 27.3.2 of the Reasons.

However, the mechanical properties referred to in this problem are not specified, nor is it explained how and to what extent they should differ from those of the steels of the prior art such as E1. The respondent admitted at the oral proceedings before the board that the mechanical properties in question could be any of those known in the prior art.

- 1.5 In combination with E2

The board is of the opinion that a skilled person faced with the problem defined above would consider E2, which concerns controlling the temperature of the billet during rolling in order to improve economic efficiency (saving energy) and product quality (mechanical properties), see abstract on page 107.

Product quality as defined in E2, pages 107 and 111, concerns obviating coarse grain formation and surface defects, which are known to affect the mechanical properties of the product.

E2 explicitly discloses a temperature of 900°C before re-heating in the case of hot charging, see Figures 5 and 6, which falls within the claimed range. This temperature, in conjunction with rapid induction

heating as in claim 1, is clearly associated with advantages in the product, such as reducing surface decarburisation and scale formation and obviating coarse grain formation and inter-crystalline corrosion, see page 111, lines 2-5. Hence, the skilled person would find an incentive in E2 to apply the disclosed temperature of 900°C to the hot-charging process disclosed in E1. They would have no technical difficulties in incorporating it into the method of E1 by adapting the transit time or modifying the covers of the delivery system, see page 97, first paragraph. In doing so, the skilled person would arrive at the claimed subject-matter in an obvious manner (Article 56 EPC).

The board notes that the "hot-charging" process of E2 is equivalent to the so-called "direct rolling" of E1. In the latter, the billet is also hot when charged in the induction furnace, as in the claimed process (see point 1.2 above).

- 1.5.1 The respondent submits that the skilled person would not think of combining E2 with E1, since E2 does not disclose fast transport means as claimed, but rather **hot storage via holding facilities** such as a holding structure or pre-heating furnace placed between the casting line and the rolling line.

In the view of the respondent, E2 does not disclose step c. as defined in features 2.4 and 2.10, namely a direct connection by fast transport means between the casting line and the rolling line with the temperature of the manufactured product set within the claimed range.

Rather, E2 discloses a re-heating station, a pre-rolling station and only subsequently an intermediate station. Such holding facilities as shown in Figures 6 and 7 (holding structure or pre-heating furnace) were excluded from claim 1.

Again according to the respondent, E2 does not disclose reducing the temperature of the billets to the claimed range during step c. **by the transport means**. Since E2 only concerns hot storage, it taugth away from the claimed solution of adapting fast transport means in order to reach the temperature range of 800-900°C. There is no hint in E2 of a transfer of the product from the casting plant to the rolling plant by fast transport means at a temperature range of 800 to 900°C. Hence, E2 did not disclose features 2.4, 2.10 and 2.11.

The respondent also argues that E2 discloses a reheating step of the billets so as to reach 600-900°C but fails to show that the billets would be **completely solidified** during the transporting step from the casting line to the rolling line in accordance with feature 2.11.

Finally, even if the skilled person considered the teaching of E2 in order to combine it with the method of E1, they would arrive at temperatures falling outside the claimed ranges, in view of the disclosure in the section entitled "Induction Heating to Enhance Temperature Control During the Rolling Process", on pages 114 and 115. This section of E2 was the only passage dealing with the problem to be solved of finding a balance between energy saving and the mechanical properties of the final product (avoiding surface cracks), see first paragraph of the section. Hence, the skilled person looking for a solution to

said problem would select the temperatures shown in Figures 10 and 11, of more than 950°C, i.e. far above the claimed upper limit of 900°C.

1.5.2 The board does not share the respondent's view.

The skilled person would consider the teaching of E2, since it is in the same technical field as E1 and claim 1, of direct rolling cast billets via hot charging in an induction furnace, and aims at the same problem of saving energy, as already mentioned under point 1.5 above (see abstract).

As also already discussed under point 1.2 above, E1 discloses features 2.4 and 2.10, i.e. the fast transport means of step c., and also the fact that the billets are completely solidified at the entrance of the induction tunnel-type furnace. The only distinguishing feature over E1 resides in the temperature range specified in feature 2.11.

Faced with the above-mentioned technical problem, the skilled person would immediately think of adapting the temperature in the method of E1 in view of the teaching of E2. The fact that the temperature of the billet before the induction furnace is achieved by other means in E2 does not alter the explicit teaching of expected benefits for the product with a temperature of 900°C, page 111, lines 2-5. In this respect, the boundaries of a range mentioned in a prior-art document are considered to represent an embodiment of the prior art (see Figure 5). E2 even discloses the specific value of 900°C, see Figure 6.

In addition, the board does not share the respondent's view that the expression "fast transport means" of

features 2.4 and 2.10 excludes the "holding means" of E2. As discussed at the oral proceedings, the term "fast transport means" is not further specified in the contested patent taken as a whole, and it cannot be ruled out that, in the claimed process, the billets could be held for a period of time before entering the induction furnace in order for them to reach the claimed temperature range. This corresponds to the "holding means" according to E2.

Finally, as put forward by the appellants, even though the specific example given on pages 114 and 115 of E2 discloses a temperature outside the claimed range, this does not alter the explicit teaching of E2 on page 111, lines 1 to 5 and Figure 6, in combination with the mechanical properties of the final product and the overall goal of saving energy, see abstract.

2. First auxiliary request

Since the board considers that the subject-matter of the single claim, claim 1, of the first auxiliary request lacks an inventive step, there is no need for this decision to discuss the other objections raised by the appellants to this request.

2.1 By comparison with claim 1 of the main request, feature 2.11 of claim 1 of the first auxiliary request has been amended in that, in phase c., the temperature of said semi-manufactured product is reduced to **an average temperature of** about 800-900°C, allowing a complete solidification (see point VI above, amendments in bold, emphasis by the board).

2.2 The board considers that merely specifying that the claimed temperature range is an average temperature

cannot justify an inventive step, since this interpretation was also applied when examining claim 1 of the main request.

- 2.3 At the oral proceedings before the board, the respondent declared that for the assessment of inventive step of the subject-matter of claim 1 of the first auxiliary request, it had nothing to add to what had already been provided for the main request. It also referred to its written submissions.
- 2.4 After re-considering the respondent's written submissions, which have already been discussed under point 1 above for the main request, the board comes to the conclusion that the subject-matter of claim 1 of the first auxiliary request does not involve an inventive step, for the same reasons as those given for the main request (Article 56 EPC).
- 2.5 Thus, the appeals are allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chair:



C. Spira

D. Prietzel-Funk

Decision electronically authenticated