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D E C I S I O N
of 12 May 2005

Case Number: T 0162/03 - 3.2.3

Application Number: 91302089.7

Publication Number: 0450775

IPC: B22D 11/06

Language of the proceedings: EN

Title of invention:
Strip casting

Patentee:
Castrip, LLC

Opponent:
Voest-Alpine Industrieanlagenbau GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
T 1037/99

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0162/03 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 12 May 2005

Appellant: (Opponent)
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Respondent: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 27 December 2002 rejecting the opposition filed against European patent No. 0450775 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
J. P. B. Seitz

Summary of Facts and Submissions

I. The grant of European Patent 0 450 775 B1, which concerns the casting of metal strip, was opposed by the present appellant to the extent that the subject-matter of claims 1 to 5 does not involve an inventive step (Articles 100(a), 52(1) and 56 EPC).

The opposition division concluded that the claimed subject-matter was inventive, in particular over AT-B-142 197 (D1), and consequently rejected the opposition. This decision was appealed by the opponent, who also cited document DE-C-3 311 090 (D5) with the grounds of appeal. During the appeal, designated T 1037/99, the board considered the following documents, these being in the language of the proceedings and equivalent to D1 and D5 respectively:

D1-US: US-A- 2 058 448
D5-US: US-A- 4 544 018

The board in T 1037/99 was of the view that D5-US was a highly relevant piece of prior art and admitted it into the proceedings; it issued a decision with the order to remit the case to the first instance for further prosecution in light of this document.

II. The opposition division duly considered further the question of inventive step in light of both D1-US and D5-US, and came to the conclusion at the end of the oral proceedings held on 10 December 2002 that the method of granted claim 1 is novel and inventive. Therefore, in its decision dispatched on 27 December 2002, the opposition division again decided to reject

the opposition. The opponent filed an appeal against this decision, together with the appeal fee, on 4 February 2003; a statement containing the grounds of appeal was filed on 23 April 2003. Oral proceedings were held on 12 May 2005.

III. Claim 1 of the granted patent reads as follows:

"1. A method of casting metal strip of the kind in which molten metal is introduced between a pair of parallel casting rollers (16) via a tundish (18) and a metal delivery nozzle (19), characterized in that at the commencement of a casting operation, the metal delivery nozzle (19) and the tundish (18) are preheated at preheating locations spaced from the rollers, the preheated delivery nozzle (19) and tundish (18) are moved into positions above the rollers, and molten metal is poured into the tundish to flow through the delivery nozzle to the rollers within a time interval no more than three minutes from the first of the movements of the delivery nozzle and the tundish from their preheating locations."

Dependent claims 2 to 5 describe preferred embodiments of the method of claim 1.

Method claims 6 to 10 and apparatus claims 11 to 18 of the granted patent have not been opposed.

IV. The appellant argued that preheating is standard practice for any continuous casting process, and in this sense there is no difference in the preparation of a twin-roll castor, as described in the disputed patent and in D1-US, and a twin-belt castor, as shown in D5-US.

Both the disputed patent and D5-US address the problems encountered when steel starts to solidify at the very beginning of the casting process, and both teach heating the nozzle and the tundish in order to prevent rapid cooling of the steel in these initial stages.

The pouring body (1) in D5-US is seen by the appellant to correspond to the metal delivery nozzle (19) defined in claim 1. According to D5-US, the pouring body (1) and the tundish (2) together with exit channel (6) are preheated at locations spaced away from their casting positions (see column 8, line 63 - column 9, line 11 and Figs. 5 and 6) and then moved together for casting. Having preheated these components at remote locations, the appellant argued that they must be brought together as quickly as possible in order to use the heat efficiently; thus, it would be expected that the time limit defined in claim 1 would be met by the method disclosed in D5-US.

The claimed method differs from the twin-belt method of D5-US only in that it is applied to a different casting method, namely twin-roll casting. The appellant is of the view that the statement in the description of the disputed patent (at column 5, lines 14 to 17), concerning the preheating of casting components, merely describes common practice that must take place otherwise such casting equipment will not function. D5-US provides a general teaching of this practice, namely to heat the components elsewhere then bring them together as quickly as possible for casting. The appellant argued that it is obvious to the skilled person that this teaching can be applied to a process based on twin-roll casting for the following reasons.

Since claim 1 of the disputed patent is directed to the steps taken before casting commences, the exact type of continuous casting equipment is immaterial. Both the disputed patent and D5-US essentially concern continuously casting a flat steel product between two moving surfaces, whereby a relatively large amount of heat must be extracted in order to solidify the metal. The appellant regards the casting rollers of claim 1 and the endless belts of D5-US, as well as the vertical and horizontal orientations of the respective processes, as being equivalents. Given the proximity of the techniques of twin-roll casting and twin-belt casting, the application of the teaching of D5-US to twin-roll casting, such as in D1-US, cannot be considered to be inventive.

V. The respondent argued that twin-roll casting and twin-belt casting are two very different processes, such that the skilled person would not readily transfer teachings from one to another. In order to emphasise the difference between these two processes, the respondent explained that in twin-roll casting the molten metal forms a casting pool above the nip between the rolls, and has only about 150 microseconds to form a solidified shell on the cooled surface of the roll. Twin-roll casting is used to produce strip having a thickness between 1 and 10 mm, which leaves the casting rollers at about 60 m/minute. On the other hand, a twin-belt casting machine, such as described in D5-US, is used to make much thicker slab of about 70 mm, with a lower speed of about 10 m/minute (see D5-US, column 1, lines 26 to 29); the metal spends a much longer time in the casting mould, which is defined between the upper

and lower cooling belts. Consequently, the heat flux and the solidification processes that take place in these two techniques are different; in particular, the twin-roll caster is more sensitive to variations and fluctuations occurring within the molten metal, whereas in a twin-belt caster, there is time for such variations to even themselves out.

Regarding claim 1, D5-US does not disclose the casting of metal strip, a method in which metal is introduced between casting rollers, and the preheating of the nozzle and tundish at a location spaced from the rollers.

The respondent emphasised that the disputed patent and D5-US address different problems. The disputed patent deals with the uneven effect due to localised cooling and variations in cooling, this being a problem confined to twin-roll casting. The proposed solution is to preheat the casting components at a location remote from the casting apparatus itself, which enables the casting components to be heated with a higher degree of uniformity. D5-US is concerned with the connection of a tundish to a horizontal twin-belt caster, and in particular how to prevent leakage of molten metal. The specific difficulty addressed in D5-US is that differing thermal effects during casting bring the components out of alignment, and the solution proposed in D5-US is to include a pouring body in between the tundish and the twin-belt castor.

The respondent submitted that the pouring body (1) and the tundish (2) of D5-US do not correspond to the delivery nozzle (19) and tundish (18) respectively of

claim 1. The pouring body (1) is a large piece of equipment of complex construction that is able to compensate for changes in dimensions occurring at the tundish. The tundish (2) is itself a large heavy storage vessel for molten metal, whereas that of the disputed patent is a smaller vessel for controlling the flow and distribution of molten metal to the delivery nozzle. The preheating in D5-US is in essence an in situ heating, since the pouring body and tundish are only moved short distances just enough to allow the burners to be moved into place; it is only applied to prevent the metal freezing and blocking the delivery system before it reaches the twin-belt caster, rather than to prevent uneven and localised cooling. According to D1-US, the preheating is carried out in order to release gases trapped in the molten metal (see page 4, left-hand column, lines 16 to 31). In addition, D1-US teaches that when using a twin-roll castor, preheating is carried out in situ, not at a remote location.

D5-US and D1-US concern fundamentally different pieces of equipment and address different problems. Such are the differences between these techniques that a person skilled in one would not take on board the teachings of the other. The method of claim 1 cannot therefore be derived in an obvious manner from the disclosures made in D1-US and D5-US.

VI. Requests

The appellant requested that the decision under appeal be set aside and the patent be revoked to the extent of claims 1 to 5 as granted.

The respondent requested that the appeal be dismissed and that the patent be maintained as granted. He further requested that the decision under appeal be set aside and the patent be maintained on the basis of one of the six auxiliary requests, all filed with the letter dated 11 April 2005.

Reasons for the Decision

1. The appeal is admissible.

2. *Inventive Step*

2.1 The disputed patent relates to the casting of metal strip, especially steel strip, using twin-roll casting. At no stage in the procedure has novelty been questioned. It is clear that the main issue here is that of inventive step, and in particular with respect to D1-US, which also concerns twin-roll casting, and D5-US, which concerns twin-belt casting. It is appropriate at this point to give a brief summary of the techniques described in these two documents.

D1-US, as with the disputed patent, is directed to a method of casting metal strip, in which molten metal is introduced between a pair of casting rollers. As is shown in Fig. 6, the metal flows from a tilted furnace (51) along trough (62) into distributor (63) and from there it forms a lake (49) between the rollers. D1-US at page 4, left-hand column, lines 24 to 31, also discloses the preheating of trough (62) and distributor (63) by means of heaters (76, 77), which are positioned above the trough and distributor respectively.

D5-US concerns twin-belt casting, in which strip is formed horizontally between endless casting belts (20). According to D5-US (see Fig. 6), molten metal is supplied from tundish (2) by means of a pouring body (1) to the gap between casting belts (20). Prior to casting, the tundish (2) and the pouring body are moved, so that burners (52 and 53) can be inserted into the space between the twin-belt caster (10) and pouring body (1) and between the pouring body (1) and the tundish (2) (see Fig. 5). The burners are then used to preheat the pouring body (1) and the exit channel (6) from the tundish (see D5-US, column 8, line 3 to column 9, line 7).

2.2 Inventive Step Starting from D5-US

It is clear to the Board that D5-US is not directed to twin-roll casting, and in particular does not disclose a method of casting metal strip of the kind in which molten metal is introduced between a pair of parallel casting rollers, and that the preheated delivery nozzle and tundish are moved into position above the rollers. The question to be answered is whether, starting from D5-US, these differences would be obvious to the skilled person.

The Board concurs with the argument of the respondent, as set out in V above, that the disputed patent and D5-US are directed to different problems. The problem underlying the disputed patent concerns uneven cooling and solidification of ferrous metals at the start of twin-roll casting on account of the high temperatures involved (see the description, column 1, lines 12 to

17). D5-US addresses the problem of maintaining a good seal between the mould and the delivery nozzle during twin-belt casting. As pointed out by the appellant (see IV above), some preheating is always necessary in order for any continuous casting process to function properly. The preheating mentioned in D5-US is to avoid freezing at the beginning of casting, and the submission of the respondent that this is merely the usual preheating required to prevent the flow of molten metal from being disrupted seems reasonable. There is thus no hint in D5-US of the difficulty encountered at the start of casting thin steel strip or of any possible solution.

D1-US describes the casting of thin strip using a twin-roll caster, but there is no mention of metals used, and especially of the difficulties in casting ferrous alloys. According to D1-US, the nozzle and tundish are preheated in situ, there is no indication that the preheating should take place at some remote location. Thus, D1-US does not provide the solution to the posed problem, and only teaches the skilled person wishing to adapt the method of D5-US, that preheating is carried out in situ.

The appellant submitted that the method claim 1 is directed to the initial stages prior to casting, and hence the exact type of continuous casting machine is of less relevance. The Board is not persuaded by this argument, since the problem underlying the invention actually arises from casting thin strip using a twin-roll caster. Given the differences described by the respondent in V above, it appears that this problem would not arise when casting thicker slabs using a twin-belt caster of the type described in D5-US.

Thus, starting from D5-US, and even having knowledge of D1-US, the method of claim 1 cannot be derived objectively.

2.3 Inventive Step Starting from D1-US

D1-US discloses a twin-roll casting process of the type described in the disputed patent. The trough (62) and the distributor (63) in Fig. 6 of D1-US correspond to the tundish (18) and nozzle (19) of claim 1, and these components are preheated by heaters (76 and 77). The method of claim 1 differs from that of D1-US in that the preheating takes place at locations spaced from the rollers, after which the tundish and nozzle are quickly moved into position for casting, whereas in D1-US the preheating is carried out in situ.

The Board is of the view that, since D1-US is silent regarding the metals that can be cast using the twin-roll caster, the problem to be solved starting from D1-US can be seen as how to optimise the process for casting ferrous alloys, especially at the start of the casting operation.

The appellant argued that D5-US teaches that when access to the components is restricted, preheating should be carried out at remote locations, after which the components are moved back into their casting positions. Since D5-US is from a neighbouring field to that of D1-US, the skilled person would readily apply the teaching of D5-US to D1-US, thereby deriving the subject-matter of claim 1.

Notwithstanding the fact that problem of accessibility does not appear to arise in the process of D1-US (in Fig. 6 the heaters (76 and 77) appear to have access to the trough (62) and the distributor (63) respectively), the problem set out in the disputed patent concerns the difficulties that arise when commencing twin-roll casting ferrous strip. Since this problem is not mentioned either explicitly or implicitly in D5-US, it cannot be said that the skilled person is provided with a solution to it.

2.4 Consequently, the method of claim 1 of the granted patent is inventive over the disclosures of D1-US and/or D5-US.

Since it considered that the granted patent can be maintained in accordance with the main request of the respondent, it is not necessary to consider the auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Counillon U. Krause