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D E C I S I O N
of 12 March 2002

Case Number: T 0178/99 - 3.2.3

Application Number: 92118038.6

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Language of the proceedings: EN

Title of invention:

Crystallizer, or inner portion, of a mould having a lengthwise curvature for continuous curved casting of thin slabs

Patentee:

Danieli & C. Officine Meccaniche S.p.A.

Opponent:

SMS Schloemann-Siemag AG

Headword:

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Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - (yes) after amendment"

Decisions cited:

-

Catchword:

-



Case Number: T 0178/99 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 12 March 2002

Appellant: SMS Schloemann-Siemag AG
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Respondent: Danieli & C. Officine Meccaniche S.p.A.
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Representative: Petraz, Gilberto Luigi
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 11 December 1998
rejecting the opposition filed against European
patent No. 0 539 861 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: C. T. Wilson
Members: F. Brösamle
J.-P. Seitz

Summary of Facts and Submissions

I. With decision of 11 December 1998 the opposition division rejected the opposition against European patent No. 0 539 861 in the light of

(D1) JP-A-58-97466

(D2) US-A-4 716 955 and

(D4) EP-A-0 300 953.

II. Against the above decision the opponent - appellant in the following - lodged an appeal on 16 February 1999 paying the fee on the same day and filing the statement of grounds of appeal on 21 April 1999.

The appellant argued that the subject-matter claimed is not based on an inventive step.

III. Following a Communication pursuant to Article 11 (2) RPBA in which the board set out its provisional opinion on the case with respect to the issues of novelty and inventive step oral proceedings were held on 12 March 2002 in which the patentee - respondent in the following - submitted new claims 1 and 2 according to his **main and an auxiliary request**.

IV. Claim 1 of the main request reads as follows:

"1. Crystallizer, or inner portion, of a mould having a lengthwise curvature for continuous curved casting of thin slabs (20), the crystallizer comprising an outer, or extrados, plate (12), an inner, or intrados, plate (11) and lateral narrow plates (13s-13d) having inner faces (16) defining a casting section (14), the lateral narrow plates (13s-13d) having their inner faces (16)

inclined in such a way as to impart to the downflow channel a tapered conformation which reduces the width of the casting section (14) in the direction of feed of the thin slabs (20), both the extrados (12) and intrados (11) plates being curved lengthwise, the crystallizer being characterized

- in that both the extrados (12) and intrados (11) plates contain in their inner upper central portion respective frontal extrados (15) and intrados (115) hollows, the extrados hollow (15) being deeper than the intrados hollow (115), and
- in that the upper part of the inner face (16) of the lateral narrow plates (13s-13d) comprises a bevel (17) which faces towards the intrados plate (11) and is progressively reduced to zero in the vicinity of the level of the lower end of the extrados (15) and intrados (115) hollows."

V. The arguments of the parties presented in the oral proceedings can be summarized as follows:

(a) appellant

- novelty of the claimed crystallizer is not disputed, however, inventive step;
- (D1) has to be seen as the nearest prior art disclosing according to its Figures 3 to 5 narrow plates converging downwardly;
- (D4) relating also to casting thin slabs in an arc arrangement discloses the use of a shroud whereby the main plates "8, 9" are equipped with

hollows to provide for the necessary space of the shroud;

- to provide for a deeper hollow on the extrados of the main plate in comparison to the hollow of the intrados of the opposing main plate is trivial because of the arc form of the cast strand;
- as a consequence of the provision of opposing hollows the narrow plates have to compensate for the variation of the strand perimeter leading automatically to bevelled narrower plates, see also (D2), column 2, lines 40 to 42;
- as a result of the foregoing observations the subject-matter of claim 1 of the main request has to be seen as being obvious.

(b) respondent:

- it is admitted that the provision of a hollow for any shroud in one main plate can be derived from (D4), however, not in both main plates simultaneously;
- the problem dealt with in the opposed patent specification can therefore not exist in (D4) so that the claimed features that the opposing hollows are different in depth and the narrow plates are provided with an upper bevel extending downwardly and being reduced to zero at the level where the hollows terminate are not derivable from the combination of (D1), (D2) and (D4);

- (D2) only discloses inclined plates but not hollows of different depths; in addition (D2) is restricted to equal cross sections in contrast to constant perimeters of the strand;
- the provision of a bevel as defined in claim 1 of the main request in its **characterising clause** is not the result of a one-way situation since other possibilities for achieving a constant strand perimeter are conceivable, namely by varying the inclination of the narrow plates mentioned in the **precharacterising clause** or also by curved narrow plates;
- the advantage of the claimed configuration of the upper region of the narrow plates is seen in their easy production simply by cutting away one edge thereof;
- summarizing, the subject-matter of claim 1 (main request) is not rendered obvious by the revealed prior art.

VI. The appellant requested that the decision under appeal be set aside and that the European patent No. 0 539 861 be revoked.

VII. The respondent requested that the decision under appeal be set aside and that the patent be maintained , either on the basis of the main or on the basis of the auxiliary request, both filed during the present oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Amendments*

- 2.1 Claim 1 is based on all features of granted claim 1 plus the feature "extrados hollow ... being deeper than the intrados hollow ..." derivable from EP-B1-0 539 861, column 2, lines 29 to 31.

- 2.2 Claim 1 is therefore not open to objections under Article 123 (2) and (3) EPC. This is also true for claim 2 which corresponds to granted claim 2.

3. *Novelty*

The issue of novelty was not disputed by the appellant or the board so that it is not necessary to deal with this issue in detail. The crucial issue to be decided is thus the issue of inventive step.

4. *Inventive step*

- 4.1 Nearest prior art is (D1) over which document claim 1 is clearly delimited. According to this piece of prior art a thin slab caster in arc form is known equipped with opposing main and narrow plates to define the cross section of the cast strand, the narrow plates being adjustable in a horizontal plane and in their inclination to meet the requirements of a versatile thin slab caster.

- 4.2 From (D1) no arrangements can be seen for allowing a shroud/immersion nozzle to be used in combination with a fully curved crystallizer so that the object to be solved by the invention can be seen in amending the known crystallizer in this respect.
- 4.3 The solution to this object is achieved with the **combination of features** laid down in claim 1, namely by providing
- (a) opposing hollows in the main plates of the crystallizer, the hollow in the extrados being deeper than the hollow in the intrados of the main plates and
 - (b) a bevel in the upper part of the inner face of the lateral narrow plates which faces towards the intrados plate and is progressively reduced to zero in the vicinity of the level where the opposing hollows terminate.
- 4.4 With this solution of the object of the invention it is achieved that there is enough space for a shroud/immersion nozzle to be applied without interfering with the **wholly** curved main plates and that the effects of shrinking of the cast strand are clearly observed, namely **by compensating the perimeters** of the hollows **by the bevel** in the upper part of the inner face of the lateral narrow plates at each cross section. In addition it is achieved that the lateral narrow plates provide a suitable lateral taper of the downflow channel of the slab being formed to continuously support the cooling/shrinking slab and to avoid undue heating of the slab's skin which could otherwise cause break-out of liquid metal.

- 4.5 (D1) is irrelevant in respect of the object to be solved since in (D1) no immersion nozzle is disclosed and since a skilled person considering the teaching of (D1) is not led to an immersion nozzle.
- 4.6 It is true, however, that the use of immersion nozzles in continuous casters **per se** is clearly known, see for example (D2) and its Figure 2a, reference sign "11" and column 4, lines 26 to 30. What can be derived from (D2) is moreover that the crystallizer has enlarged portions in its central upper region to allow the insertion of the immersion nozzle, see Figures 6 to 8 in particular. (D2) not being restricted to vertical and straight crystallizers, see column 11, lines 6 to 11, does not offer a solution for curved molds in the direction of the claimed hollows being deeper on the extrados with respect to the intrados of the main plates so that the feature of claim 1 linked to the claimed hollows cannot be realized in (D2).
- 4.7 The teaching of (D4) is similar to (D2) since again a space is shaped in the upper area of the crystallizer to allow the insertion of an immersion nozzle, see Figures 2 to 4; as far as a central hollow is concerned the teaching of (D4) is, however, see **Figures 3 and 4**, in contrast to claim 1, since the hollow is provided in either the one or the other main plate but not in both simultaneously. This is clear not only from Figures 3 and 4, but also from column 1, lines 58 to 63, specifically pointing out that Figures 3 and 4 relate to distinct alternatives of the invention **not to be combined**, namely by stating "Fig. 3 eine weitere Ausführungsform" und "Fig. 4 eine weitere Ausführungsform". Likewise claims 2 and 3 are both related to claim 1 of (D4).

Even if in (D4) a **pair** of opposed hollows were suggested the information of their **different depth** (the outer hollow being deeper than the inner hollow) would be missing so that there would not be a reliable basis for providing the directly related feature of present claim 1, namely the provision of bevels foreseen on the lateral narrow plates, according to above remark 4.3 feature (b).

- 4.8 Summarizing the above considerations the prior art teaches the use of an immersion nozzle and the creation of a space in the upper part of the crystallizer to allow its insertion.

What is not rendered obvious by the prior art is the teaching that the hollows must be of different depths and that this measure has to be compensated for by an adaption of the lateral narrow plates according to the feature (b) set out in above remark 4.3. It is admitted that (D2) deals already with the provision of constant perimeters of the strand in all its cross sections, see for instance (D2), column 2, lines 40 to 42 and 62/63 and that countermeasures are necessary.

The claimed invention goes, however, in a way different from (D2) since according to present claim 1 the lateral narrow plates carry out the compensation needed - by "cutting away one corner of the inside face of the narrow plates" - whereas (D2) teaches to vary the angle of inclination of the narrow plates, as can be seen from Figures 2a) and 2b) in that according to Figure 2b) **the mold is diverging** in the casting direction being clearly in contrast to the subject-matter of claim 1, see preamble thereof, teaching that the narrow plates **are tapered to reduce the width** of the strand.

- 4.9 Appellant's contrary findings appear to be the result of an inadmissible ex post facto analysis. The first characterising feature (differing opposing hollows in the main plates) not being rendered obvious by the available prior art any arguments of a "trivial compensation" are clearly without a basis and again the result of an argumentation knowing the claimed invention.
- 4.10 Under these circumstances the board comes to the conclusion that the subject-matter of claim 1 of the **main request** is not rendered obvious by (D1), (D2) and (D4) and general technical knowledge even seen in combination.
- 4.11 Claim 1 is therefore valid and suited for maintaining the patent in amended form. The dependent claim 2 is likewise valid since it relates to an embodiment of the crystallizer according to claim 1.

Auxiliary request

5. The **main request** already being allowable it is not necessary to deal with the merits of the **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 first instance with the order to maintain the patent in the following version:
 - Claims 1 to 2 of the main request filed during the oral proceedings,
 - Description and drawings: as granted.

The Registrar:

The Chairman:

A. Counillon

C. T. Wilson