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Datasheet for the decision of 19 April 2018

Case Number: T 2187/14 - 3.2.03

Application Number: 04737866.6

Publication Number: 1638715

IPC: B22D11/103, B22D11/00

Language of the proceedings: EN

Title of invention:
METHOD FOR CASTING COMPOSITE INGOT

Patent Proprietor:
Novelis, Inc.

Opponent:
Hydro Aluminium Deutschland GmbH

Headword:

Relevant legal provisions:
EPC Art. 54, 56, 100(b), 13
RPBA Art. 12(4)

Keyword:
Novelty - (yes)
Inventive step - (yes)
Grounds for opposition - fresh ground for opposition (yes)
Late-filed evidence - request could have been filed in first instance proceedings (yes) - submitted shortly before oral proceedings

Decisions cited:
G 0010/91

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 2187/14 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 19 April 2018

Appellant: (Patent Proprietor)	Novelis, Inc. 3560 Lenox Road, Suite 2000 Atlanta, GA 30326 (US)
Representative:	Weickmann & Weickmann PartmbB Postfach 860 820 81635 München (DE)
Appellant: (Opponent)	Hydro Aluminium Deutschland GmbH Aluminiumstrasse 1 41515 Grevenbroich (DE)
Representative:	Cohausz & Florack Patent- & Rechtsanwälte Partnerschaftsgesellschaft mbB Bleichstraße 14 40211 Düsseldorf (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 11 September 2014 concerning maintenance of the European Patent No. 1638715 in amended form.**

Composition of the Board:

Chairman	G. Ashley
Members:	C. Donnelly
	E. Kossonakou

Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division to maintain European Patent no. 1 638 715 in amended form.

The notice of opposition referred to the grounds of opposition according to Article 100(a) and (c) EPC. The opposition division refused to admit the opposition ground pursuant to Article 100(b) EPC as being late-filed.

II. Both the patent proprietor and the opponent lodged appeals against this decision. The patent proprietor subsequently withdrew its appeal during oral proceedings before the board. Since both parties initially appealed, they will continue to be referred to as patent proprietor and opponent.

III. State of the art

The opponent referred to the following documents already cited in the opposition proceedings:

E3: DE740827 C
E5: US4567936 A
E6: DE844806 C
E7: EP0150670 A
E8: "Handbuch des Stranggiessens" (Handbook of Continuous Casting) by Dr Erhard HERRMANN, 1958, p.276 - 281 + Title/Cover page, published by Aluminium Verlag GmbH, Dusseldorf, West
E9: US3206808 A

It also cited the following documents in its grounds of appeal:

E4*: Gießerei-Lexikon, Schiele and Schön, Berlin 2001, page 350;
E10: JP 2002-263799
E10*: Machine translation of E10;
E11: JP 61-289947 Abstract;
E12: DE 277 292;
E13: US 2 128 941 A
E14: SU 1 447 544 A1;
E14*: Translation of E14

With letter of 8 July 2015 it also referred to:

E15: F. Iversen, Meniscus dynamics in Aluminium Extrusion Ingot Casting, PhD thesis, NTNU Trondheim (2002): Pages 4 to 5 and 10 to 11.

In a communication dated 24 November 2017, pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), annexed to the summons to oral proceedings, the Board informed the parties of its provisional opinion.

In response to the Board's communication and the patent proprietor's further submissions, the opponent submitted further documents:

E10**: A 2nd computer translation of JP 2002-263799 A (E10);
E15: F. Iverson, "Meniscus Dynamics in Aluminium Extrusion Ingot casting ", PhD thesis, NTNU Trondheim (2002): pages 38 to 40;
E16: "Complete Casting Handbook" by John Campbell, Elsevier 2015, page 555;
E17: "Aluminium Cast House Technology", TMS 2001, pages 200 to 201;

E18 Djurdjevic et al., "Determination of Dendrite Coherency Point Characteristics using First Derivate Curve versus Temperature", J Therm. Anal. Calorim. 109:875-882, 2012.

IV. Oral proceedings were held on 19 April 2018. At the end of the debate the parties confirmed the following requests:

The opponent requested that the decision under appeal be set aside and the patent be revoked in its entirety.

The patent proprietor withdrew its appeal.

V. The following feature numbering of claims 1 and 27 in the version that the opposition division considered could be maintained as used in the contested decision will also be referred to by the Board:

Claim 1:

1a - A method for the casting of a composite metal ingot
1b - comprising at least two layers formed of one or more alloys compositions,
1c - which comprises providing an open ended annular mould (10) having a feed end and an exit end
1d - wherein molten metal (18, 21) is added at the feed end and a solidified ingot is extracted from the exit end, and
1e - divider walls (14, 14a, 14') for dividing the feed end into at least two separate feed chambers,
1f - the divider walls terminating at bottom ends (35) thereof positioned above the exit end of said mould,
1g - with each feed chamber adjacent at least one other feed chamber,

1h - wherein for each pair of the adjacent feed chambers
1ha - a first stream of a first alloy (18) is fed to one of the pair of feed chambers to form a pool of metal in the first chamber and
1hb - a second stream of a second alloy (21) is fed through the second of the pair of feed chambers to form a pool of metal in the second chamber,
1j - the pools of metal each having an upper surface, contacting the first alloy pool with the divider wall between the pair chambers to thereby cool the first alloy pool to form a self-supporting surface (27) and allowing the second alloy pool to contact the first alloy pool such that the upper surface (34) of the second alloy pool
1ib - contacts the self-supporting surface of the first alloy pool at a point where the temperature of the self-supporting surface is between the solidus and liquidus temperatures of the first alloy,
whereby the two alloy pools are joined as two layers (20, 23), and
1j - cooling the joined alloy layers to form a composite ingot.

Claim 27:

27a - Casting apparatus for the production of composite metal ingots,
27b - comprising an open ended annular mould (10) having a feed end and an exit end and a moveable bottom block (17) adapted to fit within the exit end and movable in a direction along the axis of the annular mould,
27c - wherein the feed end of the mould is divided into at least two separate feed chambers,

27d - each feed chamber being adjacent at least one other feed chamber, and

27e - where adjacent pairs of feed chambers are separated by a temperature controlled divider wall (14, 14a, 14') terminating above the exit end of the mould,
27f - a means (15, 16) for delivering metal (18, 21) to each feed chamber,
27g - a means (31,32) to control the flow of metal to each feed chamber, and
27h - a metal level control apparatus (51, 52, 53, 56) for each chamber such that in adjacent pairs of chambers the metal level in the first chamber can be maintained at a position above the lower end (35) of the said temperature controlled divider wall and in the second chamber can be maintained at a different position relative to the metal level in the first chamber,
wherein a closed channel (33) for temperature control fluid having an inlet (36) and an outlet (37) is connected with the temperature controlled divider wall (14,14a,14'), and
wherein a temperature measuring device (40) is provided at the fluid outlet (37)."

VI. Claims 1 and 27 in the version the opposition division considered could be maintained.

(a) Opponent's case,

Consideration of documents not filed during the opposition proceedings

These documents should be taken into consideration in the appeal proceedings since they have been filed in response to the patent being maintained on the basis of

a claim filed for the first time during oral proceedings before the opposition division.

Article 100(b) EPC, sufficiency of disclosure

The patent indicates that the temperature of the dividing wall plays a critical role in the formation of the self-supporting surface. However, the patent gives no indication of what temperature the dividing wall should be maintained at, nor what the flow-rate or temperature of the cooling medium should be. Furthermore, the patent does not explain how a self-supporting surface of any significant length can be created over the whole range between the solidus and liquidus temperatures for all the arrangements shown. Therefore, the invention is insufficiently disclosed and the opposition division erred in not admitting this ground in the opposition proceedings.

Article 54 EPC, novelty

The subject-matter of claim 1 is not new in view of the embodiments shown in figures 4 and 5 of E3, the embodiment shown in figures 1 and 1A of E5 and figure 921 of E8.

As regards E3, the expression "In der Estarrung begriffen" can only be understood to mean that the temperature of the alloy is between the liquidus and the solidus temperature. Further, from figures 4 and 5 it can be seen that the cladding alloy extends between the side-walls 20,21 and builds a layer towards the bottom. This is only possible when the molten cladding alloy exhibits a self-supporting surface in the sense of the patent. Otherwise the molten cladding alloy

would simply flow away and the method of E3 could not work.

A similar argument applies to E8.

From figures 1 and 1A of E5, it appears that at the contact point of the alloys 18" and 19', the alloy 18" is in the solid state. However, it is clear from the description at column 6, lines 43 to 57, that the alloy 18" can also be in the mushy zone.

Article 56 EPC, inventive step

The subject-matter of claim 1 does not involve an inventive step in view of E3 in combination with

(i) the skilled person's general knowledge; or
(ii) E9 (see in particular column 3, lines 59 to 62 and figure 1); or
(iii) E12 (see in particular page 1, lines 27 to 36) or E13 (see in particular page 1, lines 16 to 20) (both cited in E3); or
(iv) E10 or E11; or
(v) E6.

The subject-matter of claim 27 does not involve an inventive step in view of:
(i) E5 in combination with the skilled person's general knowledge;
(ii) E14 in combination with the skilled person's general knowledge;.

(b) Patent proprietor's case

Admissibility of documents not filed during the opposition proceedings

These documents should not be taken into consideration since they have been filed more than six years after the expiry of the opposition period. In particular, the first reference to E15 was filed after the statement of grounds of appeal was submitted and is not even concerned with the same type of casting method. The second reference to E15, E10**, E16 and E17 were filed after the summons to oral proceedings.

Article 100(b) EPC, sufficiency of disclosure

The opposition division exercised its discretion correctly in not admitting this late-filed ground of opposition into the proceedings. In particular, during the opposition proceedings, the opponent did not submit that the self-supporting surface could not be achieved over the whole range between the solidus and liquidus temperatures. No consent is given for it to be admitted into the appeal proceedings.

Claim 1, novelty

E3 relates to an apparatus for the production of plated plates or blocks. Figures 1 to 3 of E3 disclose a first embodiment in which the bottom of the mould is closed. Therefore, feature 1d "wherein molten metal is added at the end and a solidified ingot is extracted from the exit end" and feature 1c "open ended mould" are not disclosed.

As regards the second embodiment shown in figure 5, E3 explicitly teaches that the cladding plates are already solidified before the core melt is introduced. (see page 3, lines 14 to 31). Therefore, feature 1ib is not disclosed in E3.

E8 is a review of several different processes in none of which one or other of the alloys is already solidified before contact or both are in the mushy state. In particular, figure 921 corresponds to figure 5 of E3.

Inventive step

Claim 1

E3 consistently teaches that it is necessary for the plate alloy to be solidified before it is brought into contact with the molten core alloy. The skilled person has no reason to go against this teaching. None of the available prior art documents provide any suggestion that contact should be made within the specific temperature range claimed.

Claim 27

The skilled person finds no hint or incentive in the available prior art to modify the devices known from E5 or E14 by providing a temperature measuring device at the fluid outlet of the closed fluid channel cooling the divider wall.

Reasons for the Decision

1. Consideration of late-filed documents (Articles 12(4), 13 RPBA)

1.1 Documents E4* and E10 to E14* were filed for the first time with the opponent's grounds of appeal. Therefore,

it is necessary to assess whether they should have been submitted earlier (Article 12(4) RPBA).

1.2 E4* is a response to the opposition division's interpretation of the term "Erstarrung" given in the decision under appeal. Thus, it has been filed at the earliest possible point in time, and as such can be taken into consideration, particularly since this is an important aspect when considering the content of E3.

1.3 E10* is a barely understandable machine translation of E10. E10** is a second and allegedly improved machine translation submitted in response to the Board's criticism of E10*. However, the Board does not see it as appropriate to allow a party to file numerous machine translations throughout the procedure until it comes up with one that conveys the nuance that supports its case. A certified translation should have been filed at the earliest opportunity. Therefore, these documents will be considered only to the extent that they might help in understanding the figures of E10.

1.4 E11, E12 and E13 have been cited to support alternative attacks on inventive step which should have been made before the opposition division; therefore these documents will not be taken into consideration.

1.5 E14, together with the English translation E14*, are very relevant to the question of novelty (see below) of the amended apparatus claim 27 filed during the oral proceedings before the opposition division. Since these documents were filed at the earliest opportunity and are relevant, the Board will take them into consideration.

1.6 References to E15 were submitted after the grounds of appeal were filed. Further, since E15 was only cited as evidence that a meniscus is present on the upper surface of the molten metal which is no longer a subject of debate in the proceedings, it will not be taken into consideration.

1.7 The opposition division did not admit E7 into the proceedings since it only concerns an apparatus for determining the surface level of molten metal in casting processes. The Board considers the opposition division exercised its discretion correctly and will not take E7 into consideration.

2. Article 100(b) EPC, sufficiency of disclosure

2.1 The opposition division decided not to admit this ground of opposition into the proceedings since it was filed after expiry of the opposition period and was not on the face of it prejudicial to the maintenance of the patent.

2.2 The opponent's submissions during the opposition proceedings made in its letter of 27 January 2014,(see page 8) and during the oral proceedings (see the minutes page 3, item 6) were limited to the feasibility of adjusting the temperature of the divider wall. The opposition division considered that the skilled person would know how to adjust the temperature of the divider wall, and therefore, that the ground was not prima facie relevant.

2.3 During the appeal proceedings, the opponent submitted that the "self-supporting" surface could not be achieved over the whole range between the solidus and liquidus temperatures. However, this had not been

argued during the opposition proceedings. Therefore, this is not an argument showing that the opposition division erred in its discretionary decision and that this opposition ground should have been admitted into the proceedings, but rather a new line of argument to support a ground that is not in the proceedings.

2.4 In conclusion, the opposition division exercised its discretion correctly under Article 114(2) EPC since it fully took into account arguments submitted by the opponent at that stage of the proceedings.

2.5 Since the patent proprietor has not given its consent for this ground of opposition to be admitted into the proceedings, the Board is not in a position to consider the matter any further (see G10/91, Headnote, paragraph 3).

3. Article 123(2) EPC, extended subject-matter

3.1 The opponent made no objections under Article 123(2) EPC with respect to claims 1 and 27 of the version which the opposition division considered could be maintained.

4. Claim 1, Novelty

4.1 With respect to the disclosure of E3

4.1.1 There is no explicit mention in E3 of either of the first alloy pool forming a "self-supporting" surface or of contact of the second alloy pool with this self-supporting surface at a point where the temperature of the self-supporting surface is between the solidus and liquidus temperatures of the first alloy. Therefore, it

must be assessed whether these features are unambiguously and directly disclosed.

4.1.2 The Board agrees with the patent proprietor that in the first embodiment of E3, illustrated in figures 1 to 3, features 1c and 1d of claim 1 are not realised, since an open-ended mould is not provided and an ingot cannot be extracted from the exit end.

4.1.3 In the arrangements shown in figures 1 to 3, in order that the alloy forming the cladding plates undergoes a certain pre-solidification ("gewisse Vorestarrung" see page 2, lines 105 to 107) before coming into contact with the core alloy, the side-walls of the lower container 7 are provided with extensions 9 which are long enough to ensure that the cladding alloy is "bereits in Erstarrung begriffen" (see page 2, lines 108 to 113) before contact. The Board understands this expression to mean that solidification of the cladding alloy is in progress, but not completed.

4.1.4 In both of the embodiments illustrated in figures 4 and 5 of E3, the molten core surface is always below the already cooled cladding alloy such that a self-supporting surface is not formed on the side of a molten core pool since it will always be supported by the cladding alloy. Therefore, the situation in figures 4 and 5 corresponds to that shown in figure 4 of the contested patent which is no longer part of the invention.

4.1.5 The embodiments shown in figures 4 and 5 of E3 are provided with various arrangements and geometries of cooling members 15, 16; 20, 21. These cooling members are positioned directly below the crucibles 12; 19

respectively containing the molten cladding alloy in each embodiment.

4.1.6 The additional presence of these cooling members indicates that the intention is to ensure that solidification of the cladding alloy is accelerated. This would seem particularly so in the apparatus of figure 5 where the cladding alloy is placed between two cooling members of either circular (20) or rectangular (21) cross-section such that the cladding alloy solidifies ("die Plattierschmelze erstarrt" - see page 3, line 25).

4.1.7 This supports the patent-proprietor's submission that in all the embodiments of E3 emphasis is placed on the necessity for the cladding alloy to be already solidified before contact with the core alloy.

4.1.8 With reference to the embodiment of figure 5 of E3, this is borne out by the passage on page 3, lines 26 to 28 stating:

"The core alloy material only flows out the floor of chamber 18 once an already solidified cladding alloy is present" ("Die Kernstoffschmelze tritt aus dem Boden, der Kammer 18 erst aus, wenn die bereits erstarrten Plattierschichten vorliegen").

4.1.9 The expression "bereits in Erstarrung begriffen ist" (see page 3, lines 9 to 11), used in connection with the apparatus of figures 1 to 3, is again employed to describe the situation in the case of the apparatus shown in figure 4. This expression needs to be seen in its full context of:

"Auch bei dieser Ausführung ist sichergestellt, daß die Plattierschmelze bereits in Erstarrung begriffen ist" ("Also in this embodiment it is ensured that solidification of the cladding alloy has started/is in progress").

4.1.10 It is evident from figure 4 of E3 that solidification of the cladding alloy will commence on the side which is in contact with the cooling member, and lower down makes contact with the molten core material (in a similar fashion to that shown in figure 4 of the patent). In the context of the patent, the skilled person would understand the above expression to mean that whilst the cladding alloy might not be completely solidified across its whole section, it must be ensured that at least the side contacting the core alloy is. This interpretation is not in contradiction with the definition of "Erstarrung" given in E4* which confirms that solidification usually takes place from the outside to the inside of an ingot since cooling takes place at the outside surface.

4.1.11 The opponent's assertion that the dashed lines in figure 4 indicate that the cladding has not completely solidified and therefore the surface contacting the molten core alloy must be in the mushy state is not persuasive. The figures of a patent document are purely schematic and any attempt to identify specific boundaries between molten, semi-solid and solid states on the basis of approximately applied dashed lines is not possible.

4.1.12 In conclusion, feature 1ib is not directly and unambiguously disclosed in E3.

4.2 With respect to the disclosure of E5

4.2.1 As regards E5, it is apparent from figures 1, 1A and 3 that the contact point of the alloys 18" and 19' lies well below the solidus line or solidification level S of the alloy 18". The critical indication in the description is the passage from column 6, line 68 to column 7, line 3 which states:

"Thus, by the time the molten metal material 19 for the core 19' makes contact at about level X with the combined cladding and tubular mold 18', mold 18" will be a strong solid impervious structure."

4.2.2 The Board does not accept the opponent's assertion that it is clear from the description at column 6, lines 43 to 57, that the alloy 18" can also be in the mushy zone. Figure 1A leaves no doubt as to when solidification occurs and indicates that both the solidus line S and the initial freezing level or liquidus level F lies well above the contact point X with the molten core.

4.2.3 Similarly for the apparatus illustrated in figure 1D, it is ensured that:

"in any event, the metal 18' forming cladding 18'' will still be substantially fully solidified across its width or for its full thickness as it clears the bottom 37 of baffle 14' at about level 38 and prior to contact with the molten core metal 19' containing lithium"

4.2.4 Thus, similarly to E3, the emphasis in the methods disclosed in E5 is to ensure that the cladding alloy is solidified before contact with the molten core such that the molten core is poured into and contained by the surrounding cladding.

Thus, feature 1ib is also not disclosed in E5.

4.3 With respect to the disclosure of E8

4.3.1 As pointed out by the patent proprietor, Figure 921 and the related text of E8 correspond to figure 5 and text of E3, thus, the same arguments apply.

In conclusion, the subject-matter of claim 1 is new with respect to E3, E5 and E8 and therefore meets the requirements of Article 54 EPC.

5. Claim 27, Novelty

Novelty of the subject-matter of claim 27 was not contested by the opponent.

6. Claim 1, Inventive step

6.1 When account is taken of the fact that E11, E12 and E13 will not be taken into consideration under Article 12(4) RPBA, the following attacks against inventive step remain:

E3 in combination with:

(i) the skilled person's general knowledge; or
(ii) E9 (see in particular column 3, lines 59 to 62 and figure); or
(iii) E10; or
(iv) E6

6.2 As reasoned above when examining novelty, the subject-matter of claim 1 differs from the method known from E3 by feature 1ib:

- allowing the second alloy pool to contact the first alloy pool such that the upper surface of the second alloy pool contacts the self-supporting surface of the first alloy pool at a point where the temperature of the self-supporting surface is between the solidus and liquidus temperatures of the first alloy.

6.3 The technical effect of this feature is to improve the bond between the two alloys of the composite ingot.

The objective technical problem can therefore be defined as one of providing an improved connection between the cladding and the core.

6.4 E3 in combination with the skilled person's general knowledge

6.4.1 The Board does not accept the opponent's submission that since E3 indicates that the solution to overcome the problems associated with contacting two molten alloys (see page 1, lines 20 to 29) when casting a composite ingot, is to pre-solidify the cladding alloy, the skilled person would immediately understand from E3 that it was sufficient to cool the cladding alloy such that it was not in a liquid state, but not necessarily completely solidified. As already discussed in relation to novelty, the constant emphasis in E3 is to ensure that the portion of the cladding alloy contacting the molten core alloy is solidified.

6.4.2 As the patent-proprietor has argued, the presence of a self-supporting surface between the solidus and liquidus temperatures is not a trivial feature, and in order to achieve one the skilled person would have to provide the apparatus of E3 with the appropriate

cooling control systems, as opposed to just simply ensuring that enough cooling is provided to ensure that the cladding material is solidified at the contact point.

6.5 E3 in combination with E9

6.5.1 E9 discloses a method for casting a composite ingot in which two alloys 26 and 30 are separated by a divider wall 16 and brought together when both are in the mushy state at point 18 (see column 2, lines 68 to column 3, line 6). However, E9 fails to disclose a self-supporting surface in the mushy state, since the alloy surfaces at the contact point 18 are mutually supporting and the exterior surfaces of the alloys are contained within the mould shell 2. E9 also relates to the contact of two mushy surfaces rather than a molten pool with a self-supporting mushy surface.

6.5.2 Therefore, the teachings of E9 would not lead the skilled person seeking a solution to the above problem to modify the method of E3 in order to arrive at the subject-matter of claim 1 in an obvious manner.

6.6 E3 in combination with E10

6.6.1 From the figures of E10 it is apparent that an alloy sheet 21 is pressed by cooling rollers 5A, 5B onto a second alloy 11A which has a molten core 11. Therefore, E10 concerns a process in which an alloy in a solid state is initially contacted with a molten alloy and which is subjected to constant pressure. Consequently, there is no suggestion of providing a self-supporting surface in the mushy state which is contacted by a molten alloy since the process relies on the pressure applied.

6.7 E6 in combination with E3

6.7.1 In the method disclosed in E6, the temperature of the self-supporting surface at the contact point is not between the solidus and liquidus lines since solidification has taken place (see page 2, lines 34 to 37 and lines 107 to 114). The essential idea behind the method according to E6 is to avoid oxidation of the surfaces by bringing the first molten alloy into contact with the second molten alloy as soon as this has solidified. There is no suggestion that this should occur when the second alloy is in the mushy state.

Therefore, a combination of E6 with E3 would also not lead to the subject-matter of claim 1.

7. Claim 27, Inventive step

7.1 A suitable starting point for the assessment of inventive step is either of the devices disclosed in E5 or E14. It is common ground between the parties that neither of these documents discloses the feature of claim 27 according to which:

"a temperature measuring device (40) is provided at the fluid outlet (37)."

7.2 Contrary to the opinion of the opponent this feature does have a technical effect as explained in paragraph [0080] of the patent which states:

"It has been found in particular that at a fixed coolant flow through the channel 33, the temperature of the coolant exiting the divider wall coolant channel measured at the outlet 37 correlates well with the

temperature of the self supporting surface of the metal at predetermined locations below the bottom edge of the divider wall, and hence provides for a simple and effective means of controlling this critical temperature by providing a temperature measuring device such as a thermocouple or thermistor 40 in the outlet of the coolant channel."

7.3 Further, as the patent-proprietor pointed out in the oral proceedings, measurement of the coolant outlet temperature is also advantageous in that it is less prone to oscillations caused by local mould conditions and correlates with the global average temperature of the divider wall, as opposed to a punctual value which would be provided by a thermocouple fixed to the divider wall.

7.4 The objective technical problem can therefore be seen as one of providing a casting apparatus which can be reliably controlled to provide an improved connection between the cladding and the core.

7.5 There is no hint in any of the available prior art documents or accepted general knowledge which would prompt the skilled person faced with this problem to modify the apparatus of E5 or E14 by introducing this feature.

7.6 In the embodiment shown in figure 1 of E5, the water jacket 17', comprising chamber 26, separates the molten cladding alloy from the refractory lining 23 surrounding the pouring spout 34 for the molten core alloy. Coolant can enter and exit from chamber 26 by way of passages 23' or piping in lining 23 and acts to cool the interior of jacket and mould assembly 14 (see column 6, lines 11 to 15). Cooling is also carried out

by spraying water from spray-box 30 around the outside of the mould assembly (see column 6, lines 18 to 27).

7.7 Since cooling is carried out by a combination of water circulating in the chamber 26 and by spraying, the skilled person would realise that the intention in E5 is simply to provide sufficient cooling to ensure solidification of the cladding alloy before contact with molten core. In view of this, there is no incentive for the skilled person to modify the apparatus of E5 by measuring the outlet temperature of the water flowing through chamber 26 since this would only provide information on part of the cooling system and would serve no clearly useful purpose.

7.8 As regards E14, the divider wall ("partition 2") is cooled by running water (see E14*, page 4, line 25). The thermocouples 5 and 6 placed in the inclined surfaces 3 and 4 of the partition 2 measure the surface temperature of the inclined shells 8 and 9 of the two alloys being cast (see page 5, lines 16 to 17). The difference in temperature values (delta t_1) obtained is used to calculate the distance l_1 corresponding to the length which the non-inclined portion of the partition wall is set at for various casting processes.

7.9 There is no deliberate control of the temperature of the partition 2 which is simply cooled. Since it is the temperature difference delta t_1 between the two shells being cast which is the important parameter for the process of E14, there is no incentive for the skilled person to modify the apparatus by measuring the temperature at the outlet of the cooling water running through the partition 2 instead of on the inclined surfaces 3 and 4 because this value would serve no purpose.

7.10 In conclusion, taking either E5 or E14 as the most realistic starting point, the subject-matter of claim 27 in the version the opposition division considered could be maintained involves an inventive step and meets the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal of the opponent is dismissed.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated