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File Number: T 47/91 - 3.2.3

Application No.: 83 105 575.1

Publication No.: 0 098 968

Title of invention: Two piece casting wheel

Classification: B22D 11/00, B22D 11/06, B21B 27/08

# D E C I S I O N
of 30 June 1992

Proprietor of the patent: ALLIED-SIGNAL INC.

Opponent:
I : Sundwiger Eisenhütte Maschinenfabrik GRAH & Co
II : VOEST-ALPINE AG
III : VOEST-ALPINE Industrieanlagenbau Ges.m.b.H.

Headword:

EPC Article 56 EPC

Keyword: "Technical field to be considered by a skilled person; inventive step (denied)"

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 47/91 - 3.2.3

# D E C I S I O N
## of the Technical Board of Appeal 3.2.3
## of 30 June 1992

Appellant : (Proprietor of the patent)
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Decision under appeal :
**Decision of Opposition Division of the European Patent Office dated 9 October 1990, posted 22 November 1990, revoking European patent No. 0 098 968 pursuant to Article 102(1) EPC.**

Composition of the Board :

Chairman : F. Brösamle
Members : H. Andrä
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 83 105 575.1, filed on 7 June 1983 and published on 25 January 1984 under publication No. 0 098 968, was granted on 3 June 1987 with ten claims.

II. The European patent No. 0 098 968 was opposed in due time and form by

Opponent I : Sundwiger Eisenhütte Maschinenfabrik GRAH & Co.

Opponent II : VOEST-ALPINE AG and

Opponent III : VOEST-ALPINE Industrieanlagenbau Ges.m.b.H.

whereby Opponent II with letter of 22 April 1988 withdrew his opposition.

Opponents I and III requested to revoke the patent in its entirety for reasons of lack of novelty and inventive step, inter alia citing the following documents:

(D1) SU-A 445 512 (Urheberschein) (with translation)

(D2) SU-A 184 398 (Urheberschein) (with translation)

(D3) EP-A-0 033 063 (corresponding to US-A-4 307 771).

III. In the oral proceedings of 9 October 1990 the Appellant requested to maintain the patent in amended form on the basis of claims filed with a letter of 20 September 1990 and entitled "subsidiary requests I and II" - versions "A" and "B" in the following.

The independent Claims 1 and 2 of the versions "A" and "B" read as follows (linguistic errors rectified):

"1. A chilled casting wheel adapted to directly receive a stream of molten alloy onto the outer surface thereof and capable of providing a quench rate of at least about $10^4$ °C/sec comprising

a) an annular wheel core member (7) having axially extending channels (8) formed about a circumferential, outer peripheral surface (11) thereof and being adapted to rotate about a concentric axis of rotation (28),

b) a cylindrical, axially extending wheel rim member (10) concentrically connected to said core peripheral surface (11) and having a preselected interference fit therewith to provide a preselected residual, circumferential tensile stress within said rim, and

c) coolant means for directing a fluid coolant to the interior surface of said rim and through said channels.

2. A chilled casting wheel adapted to directly receive a stream of a molten alloy onto the outer surface thereof and capable of providing a quench rate of at least about $10^4$ °C/sec comprising

a) a hub shaft member (1) having a concentric axis of rotation (28) and two axial end portions (2), each end portion delimiting an axial coolant chamber (3, 4) having at least one coolant

supply (5, 6) passage communicating radially therefrom,

b) an annular wheel core member (7) concentrically connected to said hub shaft (1) and adapted to rotate therewith, said wheel core having axially extending channels (8) formed about an outer peripheral surface (11) thereof and two axially facing side portions (9),

c) a cylindrical, axially extending wheel rim member (10) concentrically connected to said peripheral core surface (11) having a preselected interference fit therewith to provide a residual, circumferential tensile stress within said rim, and

d) two annular flange members (12) connected concentric with said hub shaft (1) and adjacent to each of said core side portions (9) to delimit an annular coolant chamber (13, 14) at each side of said wheel core which communicates with its respective coolant supply passage (5, 6)."

and

"1. The use of a chilled casting wheel for the production of thin filaments or ribbons by quenching at a rate of at least about $10^4$ °C/sec, said casting wheel comprising

a) an annular wheel core member (7) having axially extending channels (8) formed about a circumferential, outer peripheral surface (11)

thereof and being adapted to rotate about a concentric axis of rotation (28),

b) a cylindrical, axially extending wheel rim member (10) concentrically connected to said core peripheral surface (11) and having a preselected interference fit therewith to provide a preselected residual, circumferential tensile stress within said rim, and

c) coolant means for directing a fluid coolant to the interior surface of said rim and through said channels.

2. The use of a chilled casting wheel for the production of thin filaments or ribbons by quenching at a rate of at least about $10^4$ °C/sec, said casting wheel comprising

a) a hub shaft member (1) having a concentric axis of rotation (28) and two axial end portions (2), each end portion delimiting an axial coolant chamber (3, 4) having at least one coolant supply (5, 6) passage communicating radially therefrom,

b) an annular wheel core member (7) concentrically connected to said hub shaft (1) and adapted to rotate therewith, said wheel core having axially extending channels (8) formed about an outer peripheral surface (11) thereof and two axially facing side portions (9),

c) a cylindrical, axially extending wheel rim member (10) concentrically connected to said peripheral core surface (11) having a

preselected interference fit therewith to provide a residual, circumferential tensile stress within said rim, and

d) two annular flange members (12) connected concentric with said hub shaft (1) and adjacent to each of said core side portions (9) to delimit an annular coolant chamber (13, 14) at each side of said wheel core which communicates with its respective coolant supply passage (5, 6)."

At the end of the oral proceedings the Chairman gave the decision that the European patent No. 0 098 968 is revoked under Article 102(1) EPC. The reasoned decision is dated 22 November 1990. In this decision the version "A" was dealt with in detail, but not version "B", since the Appellant requested that version "B" should only be dealt with in the case that the subject-matter of Claims 1 and 2 of version "A" was felt to be not novel. Novelty being, however, accepted, version "B" was no longer considered by the Opposition Division. The findings are based on the combination of (D2) and (D3), which combination would render obvious the subject-matter of Claims 1 and 2 of version "A", Article 56 EPC.

IV. With letter of 10 January 1991 received on 14 January 1991, the Appellant lodged an appeal against the reasoned decision of the Opposition Division paying the appeal fee on 14 January 1991 and filing the Statement of the Grounds of Appeal with letter of 22 March 1991, received on 26 March 1991.

The Appellant requests to set aside the impugned decision and to grant a patent on the "basis of the papers filed during the oral proceedings of October 9, 1990". The

Appellant argues that the Opposition Division has mixed up two different technologies - "melt spinning method" and "Stranggußverfahren" - and has therefore come to the wrong conclusion. To support this argumentation two documents were cited

(D4) "Meyers Lexikon Technik und exakte Naturwissenschaften" - page 2461 and

(D5) "Römpp, Chemielexikon" page 4014.

Opponents I and III (Respondents I and II) contest this argumentation and request to dismiss the appeal, arguing that the skilled person would not be a foundry specialist, but an expert for casting wheels, since a casting wheel would be defined by its structural features and not by its use. It is moreover contested that "continuous casting" as such would be a technical field not to be considered by a person who deals with casting of amorphous metals (glassy metals).

V. With the communication pursuant to Article 11(2) RPBA dated 25 February 1992 the Board gave its provisional opinion of the case concerning the questions of the nearest prior art document, the objective problem to be solved by the invention and the technical field to be considered by a skilled person confronted with this objective problem, whereby reference was made to the decision T 176/84, published in OJ EPO 1986, 50.

VI. In the oral proceedings before the Board held on 30 June 1992 the parties upheld their requests:

- the Appellant requested to set aside the impugned decision and to maintain the patent either with the claim-version "A" or with the claim-version "B";

- the Respondents I and II requested to dismiss the appeal.

The arguments of the Respondents were the following:

- the functional term "adapted to directly receive .. and capable of providing ..." of Claims 1 and 2 of the claim-version "A" is not limiting the claimed casting wheel, since this wheel has to be defined by its structural features and not by its function respectively its use as defined in Claims 1/2 of the claim-version "B";

- (D2) is a novelty destroying document to Claim 1 in its version "A";

- the subject-matter of Claim 2 in its version "A" is rendered obvious by the combination of (D2) and (D3);

- Claims 1 and 2 of the version "B" are not acceptable for reasons of Article 56 EPC since the claimed use of a non-patentable casting wheel cannot be inventive;

- the objective problem to be solved by the invention cannot be to avoid "crowning", since this problem is already dealt with and solved in (D3);

- the attacked patent itself relates simultaneously to forming of polycrystalline and to amorphous, glassy materials, see column 3, lines 38 to 43;

- (D2) does not disclose a roll for rolling metal, but a casting wheel on which metal solidifies;

- (D2) and (D3) would be considered in combination by a skilled person confronted with the problem to be solved;

- the interference fit is not clearly defined in the independent claims since "preselected" does not give a clear technical teaching;

- the skilled person in the present case is the expert for the production of wheels respectively rolls and not the casting expert, so that (D3) and (D2) would be documents from neighbouring technical fields.

The arguments of the Appellant can be summarised as follows:

- the functional term of Claims 1 and 2 in both claim-versions is more than an indication of a result to be achieved by the invention, since the patent specification gives the details how it can be carried out by a skilled person; this functional term is a differentiating feature between the invention as claimed and the documents originating from normal continuous casting;

- the Appellant has a right to claim the basic idea as broad as possible, since detailed features for achieving for instance a specific quench rate would lead to a useless patent for the Appellant;

- (D2) and (D3) relate to technical fields where significantly different quenching rates and casting speeds are realised so that these documents cannot be combined when assessing the inventive step;

- (D2) is no novelty destroying document, since the functional term of the independent claims relating to

the quench rate is differentiating, so that this document and (D1) are irrelevant;

- objections were raised against the problem-solution-approach, since the inventor was not biased in a specific direction of improving the nearest prior art casting wheel;

- though "crowning" is dealt with in (D3) it is argued that this negative effect should be excluded by the invention and the questions of economic machining and refurbishing of the casting wheel are only side aspects of the claimed invention;

- the interference fit of (D2) has nothing to do with the crowning effect.

**Reasons for the Decision**

1. The appeal is admissible.

2. In the Statement of Grounds of Appeal dated 22 March 1991 reference is made, see page 4, last paragraph, to the "papers filed during the oral proceedings of October 9, 1990". As can be seen from the minutes of these oral proceedings two versions of claims have been filed so that the following decision considers version "A" and version "B" set out under remark III above.

3. Formal aspects under Article 123 EPC

3.1 Version "A"

3.1.1 Claim 1 combines the features of originally filed Claim 1 plus the feature of originally filed Figure 1 that a

stream of a molten alloy is directly received by the outer surface of the chilled casting wheel; the claimed quench rate is disclosed in originally filed page 1, lines 8 to 11 thereof.

Claim 2 combines the features of originally filed Claim 2 and of originally filed Figure 1 and page 1, lines 8 to 11.

Claims 1 and 2 are therefore not open to an objection under Article 123(2) EPC.

3.1.2 Claims 1 and 2 have been restricted in respect of granted Claims 1 and 2 by the term "to directly receive ... at least about $10^4$ °C/sec" so that they also meet the requirements of Article 123(3) EPC and are as a consequence not open to an objection under Article 123 EPC.

3.2 Version "B"

3.2.1 Claims 1 and 2 refer to "the use of a chilled casting wheel for the production of ..." and are nearly identical in their technical teachings except for the information "production of thin filaments or ribbons". This information being given in originally filed page 10, lines 2 to 4, thereof or page 4, lines 30 to 32, the requirements of Article 123(2) are met.

3.2.2 Since the claimed use defined in Claims 1 and 2 does not extend the protection conferred vis-á-vis the granted Claims 1 and 2 the requirements of Article 123(3) EPC are also met so that version "B" is also not open to an objection under Article 123 EPC.

4. Starting point of the invention, problem to be solved and its solution

4.1 Nearest prior art document is (D3), i.e. EP-A-0 033 063 or US-A-4 307 771, whereby the European version is dealt with in the following. In this known casting wheel, see Figure 2 of (D3), channels "24" are drilled in the stiffening member "18a" to achieve a good quenching effect of the outer surface "25" of the casting wheel, since this is a prerequisite for obtaining cast products of uniform thickness, see "Example I" on page 9 of (D3), line 25 and page 8, lines 34 to 37, thereof or see page 2, lines 10 to 13 and page 4, lines 5 to 7 of (D3). The uniform thickness of the cast product implies a crown resistance and uniform quenching effects.

4.2 The Appellant argued, however, that the teaching of (D3) is not relevant when wide filaments greater than 5 cm in width have to be cast, see attacked patent column 1, lines 37 to 40, since then the stiffened casting wheels do not provide sufficient crowning resistance.

4.3 The Board cannot accept this argument for the following reasons:

It is obvious that the independent claims of versions "A" and "B" are not limited to casting wheels casting filaments wider than 5 cm. Secondly the teaching of (D3), see page 9, lines 25/26 in particular, and the discussion of that document in the attacked patent, see column 1, lines 27 ff., are contradictory, since in (D3) a uniform thickness is set out, whereas the attacked patent sees problems in this respect. Thirdly it is not clear from the patent in suit why the "casting wheel of the present invention was approximately eight times more resistant to

crowning than ...", see column 7 of the attacked patent, since a multitude of parameters not mentioned in this respect have an influence on the result under discussion, such as the material of the wheel surface, the cooling fluid and so on.

4.4 Summarising, the Board is of the opinion that the problem of "crowning" has been recognised already in (D3), whereby a solution to overcome this negative effect is also set out in (D3). To avoid crowning can as a result not be the objective problem to be solved by the invention when using the problem-solution-approach. The Appellant has expressed reservations insofar, since it was felt that this approach could lead to wrong conclusions. This argument can, however, not be accepted since this approach when assessing the question of inventive step in particular avoids the ex-post-facto analysis and safeguards the assessment of inventive step on an objective basis.

4.5 The objective problem to be solved by the invention can therefore - in contrast to the impugned decision, page 7, paragraph 1 and attacked patent, column 2, lines 2 to 5 and the arguments of the Appellant - only be seen in the possibility to provide a chilled casting wheel, which is economical to manufacture and to be refurbished, since the aspects of crown resistance and of uniform quenching effects are already known from (D3) and solved by its subject-matter.

4.6 The objective problem of the invention is solved by the features of Claims 1/2 according to versions "A" and "B", basically by the provision of a two-part construction, i.e. of a core member with axially extending channels and of a wheel rim member which covers the channels and offers its outer surface to the molten metal to be applied to it,

whereby the core member and the rim member are assembled by providing a preselected interference fit.

4.7 The effects of this solution to the objective problems can be seen in the possibility to easily manufacture the casting wheel and in the possibility to easily refurbish the casting wheel should any necessity arise in this respect, for instance by wear.

The advantageous effects of the claimed invention as set out in the attacked patent, see column 2, line 40 to column 3, line 2, have to be seen as side effects, since they are not directly related to the objective problem of the invention, but to the casting wheel known from the nearest prior art document (D3).

Claim - version "A"

5. Novelty

5.1 The Respondents have raised an objection under Article 54 EPC in view of (D2), since it was argued that the functional term of Claim 1 has to be disconsidered when examining its subject-matter with respect to novelty.

5.2 It is true that a product - in the present case a casting wheel - has to be defined by its structural features and not by a result to be achieved. It is obvious that (D2) is a novelty-destroying document to the casting wheel of Claim 1 if the functional term thereof is disconsidered, since in (D2) a casting wheel is disclosed with a wheel rim member "1" out of copper, whereby the classification of that document in "B22D" and the term "Walzen-kristallisator" (German text of (D2)) are further elements which support the existence of a casting wheel (Article 54 EPC).

If the functional term is accepted, however, as a restricting feature, then it is not justified to interpret (D2) as a novelty destroying document, since from (D2) it cannot be seen unambiguously that the quenching rate is as claimed.

Whether or not the subject-matter of Claim 1 is novel has no influence on the question of patentability of the subject-matter thereof, see remark 6, inventive step.

5.3 Novelty of the subject-matter of Claim 2 was not disputed so that this issue needs no further argument.

6. Inventive step

6.1 The patentability of the subject-matter of Claims 1/2 according to versions "A" and "B" depends therefore on the question whether or not it is based on an inventive step.

The Board is of the opinion that in this respect the principles laid down in the fundamental decision T 176/84, published in OJ EPO 1986, 50, have to be applied. In this decision it is clearly set out that a skilled person would consider a technical field either neighbouring the specific technical field or being a broader technical field of the specific technical field, that is to say any technical field in which the same problem or one similar to it arises and of which the skilled person in the specific technical field must be expected to be aware.

It is quite clear that chilled wheels or rolls are used in different technical fields where the outer surfaces are in direct contact with hot metal be it in solid or molten form, whereby the cooling fluid firstly protects the

wheels or rolls and secondly extracts energy from the hot metal. Under these circumstances casting rolls and casting wheels when continuously casting molten metal represent neighbouring technical fields, so that the knowledge from one technical field is likely to be transferred to the other technical field.

6.2 In this context it has to be considered that the attacked patent itself, see column 6, lines 57 to 64, emphasises that not only casting wheels but that roller-type wheels (rolls) are envisaged, so that the patent itself points to the technical field where cooled casting rolls are used i.e. to the technical field of normal continuous casting of metals. The actual patent discloses a second link between the technology of casting glassy metals and of normal continuous casting, see column 3, lines 38 to 43, so that it cannot be denied that (D2) and (D3) relate to neighbouring technical fields in the meaning of T 176/84.

Since there exists thus a link between (D3) - casting of glassy metals - and (D2) - normal continuous casting of metals - it appears justified to combine the teachings of (D2) and (D3) for assessing the inventive contribution of Claims 1/2 over the prior art as disclosed in (D3); the argument of an ex-post-facto analysis of the relevant prior art is therefore rejected, since not supported by the facts.

Linked to this argument of the Appellant was the reservation against the problem-solution-approach of the Board. The background of this approach is to assess the inventive contribution of any invention on an objective basis, so that one applicant is dealt with as another is dealt with. It is no contradiction in itself that for wording the objective problem to be solved by the

invention the knowledge of the invention is indispensable.

6.3 Starting from (D3) and being confronted with the objective problem to be solved it would appear obvious for the skilled person to consider (D2) from the technical field of "rolls" in combination with the continuous casting of metals. The outer shell "1" being made of copper leaves no doubt at all that liquid metal is directly applied to the casting roll. (D2) discloses therefor a roll used for casting purposes and being chilled. The parts "1" and "2" of (D2) are fitted by way of an interference fit, since in (D2) it is mentioned that the outer shell is assembled in a hot condition with the core, (see its first paragraph), so that it must follow that a residual circumferential tensile stress is achieved in the outer shell which counteracts any thermally induced stresses.

With the roll known from (D2) the problems of an easy manufacture and of the possibility to refurbish the outer shell are favourably solved and what remains to be done by a skilled person is the transfer of this teaching from a casting roll to a casting wheel, possibly to a casting wheel in combination with rapid quenching of metals, without, however, any necessity to make rearrangements in its function.

6.4 Claim 1 can therefore in the light of the combination of (D3) and (D2) not be considered as defining inventive subject-matter within the meaning of Article 56 EPC, so that this claim cannot form the basis for maintaining the patent in amended form.

6.5 In Claim 2 further features are given which define the coolant chambers, the coolant supplies, the channels for cooling the wheel rim member and so on. The basic features

of Claim 1 remain, however, unchanged, see annular wheel core member and wheel rim member connected to it by an interference fit, as well as the axially extending channels about an outer peripheral surface of the wheel core member.

6.6 With regard to the objective problem to be solved by the invention the features of Claim 2 add nothing inventive to the unallowable subject-matter of Claim 1, since no specific effect can be seen by the provision of the two annular flange members and the two axial end portions of the hub shaft member in particular, since in (D2) similar parts are realised, see Figures 1/2 thereof, whereby the technical effect of these features is also to enable an economical machining and to offer the possibility to easily refurbish the rim member (i.e. objective problem to be solved).

Claim 2 is as a result of the foregoing also not allowable for reasons of Article 56 EPC.

6.7 The Appellant has cited (D4) and (D5) and has "constructed" substantial differences between (D3) and (D2). As a result of the foregoing considerations it is, however, not justified to do so, since the only difference may be seen in the existence of a "roll" instead of a "wheel" and in the way in which metal is applied to the outer chilled surfaces thereof either by impact as in the attacked patent, see Figure 1 in particular, or in the way of "continuous casting".

Basically the wheel of Claims 1 and 2 has to be defined, however, by its **structural features**. It has been explained that these structural features are known per se and that the transfer to a casting wheel is obvious. From the casting roll or wheel per se, it cannot be seen in which

way the molten metal is applied in their use. This is on the other hand of no great interest, since the structural features of (D2) already offer the possibilities to solve the objective problem of the invention and to obtain quenching rates needed for the creation of amorphous alloys.

The arguments brought forward by the Appellant can as a result of the foregoing not be accepted and cannot justify setting aside the impugned decision which it is admitted is not convincing in all respects, but which is to be followed, however, in its general findings.

6.8 Claim version "A" has therefore to be rejected.

7. Version "B"

7.1 The considerations set out above in combination with version "A" are largely applicable to version "B", since the structural features of Claims 1/2 remained unchanged and since the only difference is the "use ... for the production of thin filaments or ribbons".

7.2 From (D3) it is, however, already known, see page 1, lines 16/17 thereof, to cast thin filaments or ribbons, with the aid of chilled casting wheels, see Figures 1 to 3 of (D3) in particular.

7.3 For these reasons Claims 1/2 of version "B" cannot render inventive the subject-matter claimed, since again the combination of (D3) and (D2) renders obvious that subject-matter.

7.4 Claim version "B" has therefore to be rejected as well for reasons of Article 56 EPC, so that no allowable claim version is on file.

8. With (D4) and (D5) the Appellant attempts to demonstrate that a tundish is used in continuous casting processes (Kokille). This prior art process is obviously not followed in (D2), since in the (D2) technology the cristallisation takes place on a chilled casting roll ("Walzenkristallisator"). (D2) is therefore by far closer to the claimed subject-matter than (D4) and (D5) so that these documents - if they are to be admitted to the proceedings, Article 114 EPC - are irrelevant and need no further consideration. Whether or not in (D2) any statement exists expressis verbis for the assumption that the metal crystallises on the chilled roll is also not relevant, since the existence of copper as the material for the outer shell is a clear information for a skilled person that molten metal is in direct contact therewith ("Gießrad"). Appellant's arguments can therefore not be followed by the Board, since a chilled surface contacted with molten metal must achieve the same results as in Claims 1/2 of versions "A" and "B".

**Order**

**For these reasons, it is decided that:**

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer F. Brösamle

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