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**Datasheet for the decision
of 3 December 2009**

Case Number: T 0041/08 - 3.2.03

Application Number: 01908489.6

Publication Number: 1259344

IPC: B22D 25/00, C22C 1/08

Language of the proceedings: EN

Title of invention:
A method and means for producing moulded foam bodies

Patentee:
Cymat Corporation

Opponent:
Hütte Klein-Reichenbach Gesellschaft m.b.H.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Late-filed documents - not admitted"
"Inventive step - (yes) exclusion of hindsight"

Decisions cited:
-

Catchword:
-



Case Number: T 0041/08 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 3 December 2009

Appellant: Hütte Klein-Reichenbach Gesellschaft m.b.H.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 13 November 2007
rejecting the opposition filed against European
patent No. 1259344 pursuant to Article 102(2)
EPC 1973.

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
I. Beckedorf

Summary of Facts and Submissions

I. European patent EP-B1-1 259 344 relates to a method and apparatus for producing moulded bodies of metal foam. Grant of the patent was opposed for lack of inventive step (Article 100(a) EPC), insufficiency of disclosure (Article 100(b) EPC) and extension of subject-matter beyond the original application (Article 100(c) EPC). During the oral proceedings before the Opposition Division the grounds under Articles 100(b) and 100(c) were withdrawn. The Opposition Division was of the view that the claimed subject matter of the granted patent had an inventive step, and thus took the decision to reject the opposition.

II. The above decision was posted on 13 November 2007. The Appellant (Opponent) filed notice of appeal on 8 January 2008, paying the appeal fee on the same day. A statement containing the grounds of appeal was filed on 12 March 2008. Oral proceedings were held on 3 December 2007.

III. Requests

The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent (patent proprietor) requested that the appeal be dismissed.

IV. Claims

Claim 1 of the granted patent reads as follows:

"1. A method for producing moulded bodies of a foamed metal, in particular an aluminium foam, comprising:

- providing said metal in a molten state (4);
- providing a foaming means (5,305) in said molten metal;
- providing a mould (1) having a cavity (8) and at least one entrance opening (3) and wherein said entrance opening (3) is maintained submerged in the molten metal and wherein the entrance opening (3) is positioned generally above said foaming means (5,305);

characterised in that the method further comprises the steps of:

- initially filling the mould (1) completely with the molten metal;
- generating a metal foam with said foaming means;
- filling the mould with the foam (9) by accumulation of bubbles rising through the molten metal (4), while keeping at least the entrance opening (3) submerged in the molten metal."

Independent claim 5 is as follows:

"5. A means for producing moulded bodies of a metal foam (9), in particular an aluminium foam, from a molten metal (4) comprising a mould (1) having a cavity (8) and at least one entrance opening (3) for filling the mould with a metal foam (9), the means further comprising a means for containing the molten metal (4)

and means (5,305) for injecting a gas into the molten metal (4) to cause foaming, where in the mould (1) is arranged at least with its entrance opening (3) submerged in the molten metal (4), characterised by having a means to raise and lower said mould during foaming while maintaining the entrance opening (3) submerged in the molten metal (4)."

Dependent claims 2 to 4 together with claims 12 to 14 and claims 6 to 11 with claims 15 to 17 concern preferred embodiments of the method and means respectively.

V. Prior Art

(a) The following documents, amongst others, were cited with the notice of opposition:

D1: DE-C1-43 26 982

D2: WO-A-92/21457

D4: J. Baumeister, "Überblick: Verfahren zur Herstellung von Metallschäumen", Metallschäume, Beiträge zum Symposium Metallschäume, Bremen 6-7 March 1997, pages 3 to 13.

(b) The Opponent filed the following documents late in the opposition proceedings. The Opposition Division considered them to be no more relevant than the documents already submitted, and hence did not admit them into the proceedings:

D7: "Streng Vertrauliche Versuchsaufzeichnungen", ARC
Leichtmetallkompetenzzentrum Fanshofen GmbH, 31
December 2002.

D8: DE-C1-198 32 794

(c) The following documents were filed together with
the grounds of appeal:

D9: H. Grothe et al. "Hüttentechnik", volume 1,
pages 34 and 35; volume 2, pages 238 and 239,
Rowolt Taschenbuch Verlag, 1972.

D10: WO-A-98/11264

VI. Submissions of the Parties

(a) Late-Filed Documents

The Appellant argued that documents D9 and D10 had been put forward merely to support its submission regarding the knowledge of the skilled person, and as such should be admitted into the proceedings.

In the view of the Respondent, documents D9 and D10 could have been submitted earlier ie during the proceedings before the Opposition Division. Since the Appellant has given no reasons for the late-filing of the documents and they are not *prima facie* highly relevant, they should not be admitted.

(b) Inventive Step

The Method of Claim 1

The Appellant's Case:

The Appellant referred to the introduction of the disputed patent, where the patent proprietor identifies the problems in prior art processes of pressing foam into the mould cavity as being the inhomogeneity of the foamed body and insufficient filling of the mould; these problems are said in the patent to be the result of restricted inflow, and frictional forces between the moving metal and the mould walls.

In the view of the Appellant, the claimed subject-matter does not provide solutions to these problems, hence lacks an inventive step. In particular, D1 and D2 disclose processes that lead to the production of homogenous mouldings. The problem of incomplete filling is not solved by creating the foam within the mould, as suggested by the disputed patent, because there is no guarantee that the foam bubbles will migrate to all corners of the mould.

(i) Document D1

D1 discloses a process in which foam is pressed into the mould cavity. According to D1, foam that is sensitive to shear forces can nevertheless be pressed into the mould without disturbing its structure, despite the presence of frictional forces. Consequently the problems of inhomogeneity and incomplete filling are already solved by the process of D1.

The objective problem to be solved must therefore be reformulated to be finding an alternative process for making moulded bodies of metal foam.

A review of different ways of making metal foamed articles is given in D4. In particular, D4 discloses moulding foam from liquid metal, for which the only options are to either create the foam and then transfer it to the mould, as in D1, or create the foam directly in the mould, as in the disputed patent. Selecting the second alternative from such a limited choice cannot be associated with an inventive step.

In addition, the embodiment of the apparatus of D1 shown in Figure 3 is suitable for carrying out this step. By increasing the pressure within the vessel (18), liquid metal is forced into the mould (25) via the central tube (17), where it can be foamed in the manner of claim 1.

The Respondent's Case:

The disputed invention sets out not to eliminate but to minimise the problems of inhomogeneity and insufficient filling of the mould. The Appellant has failed to prove that the advantages of the patent over the state of the art processes have not been realised.

The Respondent disputed the Appellant's submission that the process of D1 would be capable of obtaining complex foam shapes that are free of inhomogeneities. The metal foam of D1 is pushed into a mould and hence is subjected to frictional forces; the document fails to

recognise the necessity of avoiding friction between the foam and the mould wall.

The problem underlying the invention is to avoid certain problems that arise when metal foam is forced into a closed mould cavity, and given that D1 does not address these problems, reformulation of the objective problem is not justified. Nevertheless, even if the problem were to be reformulated as the provision of an alternative process, there is no hint of the claimed process in D1.

In particular, there is no indication in D1 that the metal is foamed in the mould, and the suggestion that the mould shown sitting on top of the foaming vessel of Figure 3 could be filled with metal prior to foaming is not an realistic proposition. In addition, document D4 which reviews the various techniques known before the priority date of the disputed patent for making foamed metal objects, makes no mention of *in situ* foaming, hence this is not part of the common knowledge of the skilled person.

(ii) Document D2

The Appellant's Case:

D2 concerns the moulding of metal foam in the fluid state and addresses the problem of inhomogeneity in the final product by producing a stabilized foam. Although D2 relates to the continuous casting of elongated products, this does not mean that it is excluded as suitable starting point for assessing the invention, as

it deals with the same problem as that of the disputed patent.

The claimed method differs from the disclosure of D2 only in that a closed mould is used. The problem to be solved is thus how to achieve complete filling of a mould for making complex shapes.

The adaptation of the apparatus of D2 to incorporate a closed mould is, according to the Appellant, an obvious step for the skilled person wanting to make more complex mouldings. In particular D4, in the first paragraph on page 4, discusses the moulding of elongated products (aluminium plate), and in the following paragraph discusses products made in a closed mould; the two ways of manufacture are very closely related in the mind of the skilled person. In addition, it only requires a simple modification to replace the open-ended die of D2 with a closed mould.

The requirement that the mould is filled completely prior to foaming is not inventive. According to the disputed patent, this feature reduces friction between the mould walls and the foam during the moulding process. The term "reduced" is vague and not defined in the patent; according to the process of D2, the mould is partially filled, which would also reduce the friction. Since the process of D2 also brings about a reduction, the alleged advantage is also achieved in D2.

The Respondent's Case:

The Respondent emphasised that D2 relates to a process for producing slabs of foamed metal that are continuously drawn off whilst being formed, and does not relate to a method for filling a mould cavity with metal foam. The processes of the invention and D2 are fundamentally different and, as such, D2 does not form a realistic springboard from which the invention of claim 1 could be attained.

The problem of incomplete filling is not relevant to D2, as there is no closed mould. Consequently, there is no discussion of the problem of friction that occurs when filling a closed mould. Likewise, the problem of insufficient filling of the mould is not relevant to the process of D2. Hence, the problems that form the basis of the claimed invention are absent from D2, emphasising lack of suitability of this document as a realistic starting point.

Even if it were possible to replace the continuous moulding die of D2 with a closed mould, it would be very unusual for the skilled person even to consider such a conversion. Therefore the argument of the Appellant can only be made with knowledge of the invention.

The Apparatus of Claim 5

Regarding the characterising feature that the apparatus has a means to raise and lower the mould during foaming, the Appellant submitted that all such moulds have some means of lifting, as it is always necessary to remove

the mould from the foaming apparatus. The Appellant also argued that the requirement that this takes place during foaming is a process feature and provides no limitation for the claimed apparatus. Support for this argument can be found in the patent itself (paragraph [0016]), where it is said that the required effect is only achieved if the mould is elevated so that the foam inside is always at the same depth, ie this refers to the manner in which the mould is raised. Consequently, the claimed apparatus lacks an inventive step with respect to the disclosure of D1.

The Respondent disputed the allegation that every apparatus has mould lifting means, especially of the claimed type. It is not obvious from the prior art that the lifting means would be arranged to raise and lower the mould during foaming whilst maintaining the entrance opening submerged in the molten metal. In particular, this clearly could not be achieved with the arrangement of mould and foaming vessel shown in Figure 3 of D1.

Reasons for the Decision

1. The appeal is admissible.
2. Late-Filed Documents

Documents D7 to D10 have all been filed late, as they were filed after the nine month period referred to in Article 99(1) EPC. Consequently, their admission into the proceedings is at the discretion of the Opposition Division or the Board of Appeal. Documents will

normally only be admitted at a late stage if they are considered *prima facie* to be highly relevant, ie will clearly have a bearing on the outcome of the case, and there are reasons for the late-filing. In the present case, the Board has decided for the following reasons not to admit any of the late-filed documents.

D7, submitted as evidence of routine experimentation, is a confidential experiment report, but there is a discrepancy concerning the date of the report. The Appellant has not submitted the document as prior art, but as evidence that the method of claim 1 can be derived by routine experimentation. The Board, however, considers that it is in a position from the documents cited with the notice of opposition to determine what can reasonably be achieved by routine experiments. Given the lateness of its filing, combined with the uncertainty of both its publication and content, D7 is not admitted into the proceedings.

D8 is not referred to in the statement of grounds of appeal and does not appear to be of any more relevance than the documents that have already been cited. D9 relates to the submission that it is within the common knowledge of the skilled person to design an appropriate gating system, which is accepted by the Board without the need to consult D9.

D10 was submitted as support for the argument that complete filling of a mould is well known in the art. D10 discloses the manufacture of porous and non-porous cast products in which the density is controlled by modifying the hydrogen solubility in the molten metal. D10 thus concerns a different technique from those of

D2 and the disputed patent, and does not *prima facie* appear to provide a solution to the objective problem. In addition, D10 appears to correspond to the method shown in Figure 1 of D4. For these reasons the Board has not admitted D10 into the proceedings.

3. Inventive Step (Article 56 EPC)

Method of Claim 1

3.1 Document D1

3.1.1 D1 discloses a method for producing moulded bodies of foamed metal, in which the foam is formed on the surface of the melt (Figure 1) and then forced upwards into the mould (Figure 2). The method of claim 1 differs in terms of the following features:

- the entrance opening to the mould is maintained submerged in the molten metal;
- the mould is initially filled with molten metal;
- the mould is filled by accumulation of bubbles raising through the molten metal, while keeping the entrance opening submerged in the molten metal.

3.1.2 Starting from D1, the Respondent sees the objective problems to be solved as being the same as the problems underlying the invention, as set out in paragraph [0004] of the patent, ie problems of inhomogeneity and insufficient filling of the mould, which are caused by friction between the mass of foam and the mould walls during filling. The Appellant defines the objective problem as merely being the provision of an alternative method for producing a body of foamed metal.

The important point here is that, irrespective of which objective problem is considered, there is no indication in the prior art that the differing features mentioned above would be obvious to the skilled person.

3.1.3 Firstly, it is not clear how the method of D1 could be adapted to carry out the method of the disputed patent. According to claim 1, the mould is initially filled with molten metal and the entrance is maintained submerged in the molten metal. The Appellant argued that this can be achieved with the apparatus shown in Figure 3. This embodiment shows a sealed vessel (18) containing molten metal, and a central tube (17), on top of which a mould (25) is positioned. The apparatus functions by creating foam within the tube, which is then pushed into the mould by increasing the pressure within the vessel. According to the Appellant, the initial step could equally be that molten metal is forced into the mould and then foaming takes place *in situ*.

The Board however agrees with the Respondent that this is not an obvious measure. There is no hint in D1 that first filling the mould of Figure 3 with molten metal and then allowing the foam to rise would be a viable, practicable alternative, particularly as the foam could not then be pushed into the mould under pressure. In addition, the mould sits on top of the tube and is outside the vessel, it would therefore not be possible to maintain the entrance opening submerged in molten metal during the foaming operation. Even if the skilled person had knowledge of the invention, it is not

apparent how this could be achieved for the apparatus of D1.

- 3.1.4 Secondly, the Appellant suggests the claimed method can be derived by routine experimentation, given the limited choice that metal foam has either to be made outside of the mould and then introduced into the mould, or be made *in situ*.

D4, which gives an overview of various methods for making foam castings, makes no mention of foaming *in situ*; it can not therefore be said that the skilled person is well aware of this alternative. In addition, the two alternatives concern two different techniques that are not simply interchangeable. The question remains whether it is obvious to go straight from the method of D1 where foam is made externally of the mould to one where it is made *in situ*, and the Board is of the view that this is not obvious without having prior knowledge of the invention.

3.2 Document D2

- 3.2.1 The expression "closest prior art" tends to imply that there is a single "best" starting point from which inventive step is assessed. This is not always appropriate if there are other disclosures from which the invention could possibly be made; in such a situation it is necessary to establish whether or not a document provides a promising starting point. In the present case the Appellant considers D2 to be an appropriate starting point.

D2 discloses a process in which a slab of metal foam is continuously drawn off the surface of the melt. Of particular relevance is Figure 7, which shows a mould in the form of a tapered insert (45) having an entrance opening that is maintained submerged in the melt. The mould, however, is open at the top so that the shaped slab can be withdrawn.

The disputed patent concerns problems associated with filling a closed mould with foamed metal, such as insufficient filling of the mould, and inhomogeneity resulting from restricted inflow and frictional forces. It is apparent that these problems are not so relevant to the making of a continuous slab of foamed metal by means of an open-ended mould.

The argument of the Respondent that D2 is not the right starting point as it concerns the manufacture of a completely different type of product and does not deal with the problems underlying the invention is therefore quite convincing.

- 3.2.2 Should D2 be considered to be a suitable starting point, then the objective problem would be, as formulated by the Appellant, to adapt the process of D2 so that complex shapes can be made. The proposed solution would be to replace the tapered insert by a closed mould. This, according to the Appellant, does not constitute an inventive step, as the skilled person is well aware of making foamed products using both open and closed moulds.

3.2.3 The Board agrees with the Appellant that once the skilled person has been given the incentive to make complex shapes, rather than the foamed metal slabs of D2, it would be routine, or at least obvious to try, to replace the open mould (45) by a closed mould. However, both the Respondent and the Opposition Division were right to question why would the skilled person take such a step. D2 is itself only concerned with making continuous elongated products, so the skilled person must first of all hit on the idea of using the technique of D2 as a possible way to make more complex shapes and, other than with knowledge of the disputed invention, there is no incentive to pursue this idea.

In support of its submission, the Appellant cites D4, which provides a review of techniques for making foamed metal. In particular, D4 (page 4) describes forming foamed metal in the context of metals containing hard particles; these particles act to stabilise the porous structure. According to D4, foam is created by means of an impeller, or by introducing gas into the melt; the foam is then either removed from the surface to make plate (as is the case in D2) or transferred to a mould (as in D1). The Appellant thus argues that the use of open and closed moulds are well known alternatives for the skilled person.

The Board does not disagree with the Appellant that these alternatives are well known to the skilled person, but the question nevertheless remains whether it is obvious to convert the process of D2 to one that uses a closed mould. The mere fact that the two techniques are mentioned on the same page of D4 does not necessarily mean that they are readily interchangeable. These

techniques are being discussed in the context of foam metals stabilised by hard particles. Because of the hard particles, slabs of this material are difficult to machine, so D4 recommends that the foam is moulded to near its final shape in a closed mould. Other than that, no comparison is made between the processes; they are referred to separately and there is no indication that going from one process to another simply involves an exchange of mould types. Consequently there is no hint in D4 that the process of D2 could be modified to make products in a closed mould.

3.2.4 In addition, as argued by the Respondent, even if the skilled person were to replace the tapered insert of D2 by a closed mould, there is still the missing step of ensuring that the mould is initially completely filled with molten metal, which is necessary in order to avoid the problems associated with air being present in the mould (see paragraph [0009] of the disputed patent).

3.2.5 In summary, it is doubtful if D2 forms a realistic starting point for the assessment of inventive step, and even if it did, it is not possible to derive the claimed subject-matter in an obvious way.

3.3 Apparatus of Claim 5

The above conclusions concerning the claimed process apply equally to the apparatus as defined in claim 5.

The view of the Appellant, however, is that the apparatus of D1 or D2 can be easily adapted to perform all the functions defined in claim 5. In particular, all casting equipment has a lifting means that is

suitable for raising and lowering the mould as defined in the characterising portion of the claim.

Claim 5 requires that the lifting means is arranged to raise and lower the mould during foaming while maintaining the entrance opening submerged in the molten metal. In particular, this clearly could not be achieved with the arrangement shown in Figure 3 of D1, as the mould opening located outside of the foaming vessel at the end of a relatively long tube. According to D2 the moulded product is capable of being raised or lowered, but there is no mechanism for lifting the mould (45). Consequently, the claimed apparatus cannot be derived in an obvious way starting from either D1 or D2.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

A. Counillon

U. Krause