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D E C I S I O N
of 15 September 2005

Case Number: T 1148/02 - 3.2.03

Application Number: 93918800.9

Publication Number: 0666783

IPC: B22D 23/00

Language of the proceedings: EN

Title of invention:
Particulate feedstock for metal injection molding

Patentee:
Thixomat, Inc.

Opponent:
Mannesmann Plastics Machinery AG
Norsk Hydro A.S.
Chuo-Kosan Co. Ltd.

Headword:
-

Relevant legal provisions:
EPC Art. 100(a)-(c), 52(1), 54, 56

Keyword:
"Novelty - implicit disclosure (no)"
"Inventive step - exclusion of hindsight"

Decisions cited:
T 0204/00

Catchword:
-

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Case Number: T 1148/02 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 15 September 2005

Appellant: (Opponent 1)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 7 November 2002 concerning maintenance of European patent No. 0666783 in amended form.

Composition of the Board:

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

Summary of Facts and Submissions

I. Following the grant of European patent EP 0 666 783 B1 to Thixomat Inc., opposition was filed by Mannesmann Plastics Machinery AG (Opponent I), Norsk Hydro ASA (Opponent II) and Chuo-Kosan Co. Ltd. (Opponent III). The patent was opposed in its entirety, on the basis of Article 100(a) EPC with respect to lack of novelty and/or inventive step, Article 100(b) EPC and Article 100(c) EPC. At the end of the oral proceedings held on 22 October 2002, the opposition division decided to maintain the patent on the basis of amended claim 1, in accordance with the main request of the patentee. The written decision was dispatched on 7 November 2002.

Opponent I filed an appeal (received 22 November 2002) against the decision, paying the appeal fee at the same time. Opponent II did not appeal the decision. Opponent III filed an appeal (received 12 December 2002), but failed to pay the appeal fee; he was informed in the communication dated 27 January 2003 of loss of rights pursuant to Rule 69(1) EPC, but the European Patent Office received no response to this communication. Consequently, the appeal of Opponent III has been deemed not to have been filed (Article 108, second sentence EPC).

In a communication dated 27 January 2005, the Board of Appeal issued a provisional opinion and summoned the parties to oral proceedings. Opponents II and III, in their letters of 1 August 2005 and 30 June 2005 respectively, stated that they would not be participating in the oral proceedings. The oral

proceedings were held on 15 September 2005 in the presence of the Appellant (Opponent I) and the Respondent (Patentee), at the end of which the Board of Appeal dismissed the appeal.

II. Claim 1 of the amended patent reads:

"1. A method for producing a thixotropic alloy comprising: providing a particulate material comprising particles of metal alloy or composite, wherein said particulate material has a tap density of at least 50% of the theoretical density, and wherein a portion of said particles is shaped such that each of said particles in said portion has a ratio of the length of its largest dimension to its effective diameter in the range of 1.2 to 4.0 and has a largest dimension in the range of 0.5 to 5 mm, and wherein said portion of said particles comprise at least 40% by weight of said particulate material; heating the particulate material and shearing the particulate material, thereby producing a substantially homogenous mixture of solid particles and liquid."

Claims 2-13 define preferred embodiments of the method of claim 1.

III. Prior Art

The following documents were cited during the opposition proceedings and are relevant for the decision.

D1a: US-A-4694881

D6a: Hoechst Data Sheet, "Karbid und Metallurgische Produkte", September 1978.

D8: Commercial brochure from Reynolds Metals Company, Louisville, USA, entitled "Atomized Powder and Granular Products".

D8bis: "Eidesstattliche Versicherung" a statutory declaration, cited with grounds of appeal, by Herr Hans-Klaus Neubing, testifying that D8 was made available to the public in 1989.

D18a: S. C. Erickson "A Process for the Injection Molding of Thixotropic Magnesium Alloy Parts", Proceedings of the 44th Annual World Magnesium Conference, "Magnesium in the Auto Industry: Prospects for the Future", Tokyo, Japan, 17 to 20 May 1987, pages 39 to 44.

D20a: K. Kurihara et al., "Cutting temperature of magnesium alloys at extremely high machining speeds", Keikinzoku, Volume 31, No.4, April 1981, pages 255 to 260, and English translation thereof.

D24: L. Pasternak et al., "Semi-Solid Processing of Magnesium Alloys by Thixomolding™ " published in the Proceedings of the Second International Conference on the Semi-Solid Processing of Alloys and Composites, Massachusetts, June 10 to 12, 1992, edited by S. B. Brown and M. C. Flemings, pages 159 to 169.

IV. Submissions of the Parties

Novelty

The Appellant submitted that the method of claim 1 lacks novelty with respect to D24. Although not expressly stated, the machined chips used as a feed material in the process of D24 would inherently have a tap density of at least 50% of the theoretical density. Examples of machined chips are shown D6a (second page) and D20a (page 257); in particular, D6a shows that machined chips can have different shapes, curved, spiral, straight, rectangular and that they come in different sizes. The expression "machined chips" thus does not refer to the geometry of the chips, but rather to the manner in which they are produced. D24 defines the machined chips as being approximately 1 mm square by 2 to 3 mm in length, it is thus indicating that they are of a generally rectangular shape, as indeed are the chips shown in Fig. 13 of the disputed patent, rather than the other shapes mentioned above. Machine chips having such a rectangular shape would inevitably have the defined tap density. Further evidence of this is provided in paragraph [0045] of the patent, where it is said that needle shaped particles have a tap density of 50 to 59% of the theoretical density.

The Respondent pointed out that it must be clear that a particular result is inevitable, and in this case there is no hint in D24 of the tap density of the feed powder. He explained that "machined chips" normally have a low tap density, because of inefficient packing; it can be seen from the shape of the particles shown in the photographs of D6a that they would pack loosely.

Table 1 of the disputed patent presents actual values for the tap densities of machined chips, and these are in the region of 8 to 11 % of the theoretical density. It is therefore not possible to conclude that the tap density of the machined chips of D24 are inevitably greater than 50% of the theoretical value.

Inventive Step

The Appellant submitted that the method of claim 1 lacks an inventive step in light of D24 and D8.

Problems associated with injection moulding of thixotropic alloys in the process of D24 include a tendency for the feed powder to block the hopper and seize the screw extruder, as indicated in the introduction to the disputed patent (paragraph [0008]). Faced with such problems, the skilled person would try to solve them in the first place by evaluating operating conditions and different types of powders, since these are the simplest and cheapest parameters to test.

This is also the approach adopted by the patentee, who merely tested different shapes and sizes of powder particles (see paragraph [0037]). These tests were carried out on aluminium materials and were not limited to thixotropic alloys. It should also be noted that the problem of blocking the hopper is not specifically related to the use of thixotropic alloys, but is a more general problem. Thus in seeking to solve these problems, the skilled person would not limit himself just to thixotropic alloy powders, but would consider metallic powders in general.

D8 describes aluminium powders that were commercially available before the earliest priority date of the disputed patent. Table C lists granular powders, which the photographs show as having an elongated form with size proportions that meet the requirements of claim 1. The apparent densities of these powders are about 50% of the theoretical density, and since the tap density is always greater than the apparent density, the tap densities must exceed the 50% value. It would be apparent to the skilled person that he should try these powders, and in doing so would discover that the posed problems are solved by powders having the claimed size proportions and tap densities. It would then be obvious to apply this knowledge to the thixotropic materials in question.

The Respondent maintained that it is not obvious to solve the problems of hopper blocking and screw seizure by changing the granulometry of the starting powders. Indeed, the most obvious way to avoid powders blocking a hopper would be to vibrate it. Further, there is no indication in the prior art that a high tap density is beneficial in solving the problem of temperature control in a thixotropic moulding process, as set out in paragraph [0034] of the patent. Prior art documents D1a (column 3, lines 5 to 6) and D18a (page 41, left-hand column, second paragraph) indicate that particle size and shape is not critical when injection moulding thixotropic materials. Regarding D8, this document provides no suggestion that the problems can be solved by using the powders of Table C; there is also no indication that these powders would be suitable for use in thixotropic injection moulding process, in fact the

only applications suggested for the powders of Table C are as drain cleaners and explosives.

V. Requests

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

The respondent requested that the appeal be dismissed, or that the patent be maintained on the basis of either one of the two auxiliary requests filed with the letter of 17 July 2003.

Reasons for the Decision

1. The appeal is admissible.

Novelty

2. The most relevant prior art document seems to be D24, which describes a process for injection moulding thixotropic alloys (see in particular page 162). According to D24, the feed material consists of machined chips of a magnesium alloy. The chips are approximately 1 mm square by 2 to 3 mm in length and thus have a ratio (LD) of the length of the largest dimension to the effective diameter of about 2 to 3. The LD ratio of the magnesium chips of D24 therefore lies in the range 1.2 to 4, and the largest dimension L, being 2 to 3 mm, lies between 0.5 to 5 mm, as defined in claim 1. The feed material of D24 is introduced into a barrel housing a reciprocating screw; it is then heated by an induction coil and band heaters and

sheared by a rotating screw to produce a substantially homogenous semi-sold mixture (a thixotropic mixture) containing 30 vol.% solids.

In dispute here is whether D24 discloses a feed material that has a tap density of at least 50% of the theoretical density. The Appellant submits that D24 requires generally rectangular shaped particles, and such particles inherently have the required tap density, as evidenced by the tap density quoted in the disputed patent for needle-shaped particles (50 to 59% of the theoretical value, see paragraph [0045]).

According to established case law of the Boards of Appeal, in assessing novelty there must be a high degree of certainty that implicit features are inevitably disclosed in a prior art document (see in this respect the decision T 204/00 (not published) and the discussion at 3.1). In this case, it is clear from the values set out in Table 1 of the disputed patent that in general the tap density of machined chips are well below the 50% value. Table 1 quotes the tap densities for four different types of machined chips having irregular shapes, and these range from 8.4% to 11.2% of the theoretical density. Although no value is given for generally rectangular machined chips, there is no evidence that it must be greater than 50%. The Appellant indicated that a value of 51% is given in Table 1 for needles, but these needles have an LD ratio of 6.9, which is outside of the range defined in claim 1, and they cannot be considered as "machined chips" within the sense of the patent. Even if needles were accepted as being "machined chips", it is still not possible for the Board to reach the conclusion that

the term "machined chips" always implies a tap density greater than 50% of the theoretical value.

Consequently the method of claim 1 is novel.

Inventive Step

3. The Appellant alleges lack of inventive step with respect to documents D24 and D8. Document D8 is a commercial brochure from Reynolds Metals Company concerning atomized powder and granular products. The publication date of D8 is not apparent from the document itself, however following the testimony of Herr Hans-Klaus Neubing in his "Eidesstattliche Versicherung" (D8 bis), it is assumed that D8 was made available to the public in 1989, before the relevant dates of the disputed patent, and this was not contested by the Respondent.

As set out above, the method of claim 1 differs from D24 in that the feed material is defined as a particulate material having a tap density of at least 50% of the theoretical density.

The underlying problems associated with injection moulding thixotropic alloys, which are addressed by the disputed patent, are set out in paragraphs [0008] and [0034], and are as follows:

- blockage of the feed material in the hopper;

- seizure of the screw extruder;

- difficulty in controlling the temperature.

The defined tap density is in particular linked to the problem of controlling the temperature. According to the patent specification (see paragraph [0034]), a particulate material having a tap density of at least 50% of the theoretical density ensures good particle to particle contact allowing good heat transfer rates to be achieved in the melting zone. This allows for relatively short heating times in the initial stages and provides a close control over the temperature, which is important for maintaining a thixotropic state.

None of the available documents, and in particular D8, mention the above problems or any possible solutions. The Appellant argues that routine experimentation would lead the skilled person to the powders of D8, which he would then realise would solve the problems. Although D8 is not concerned with thixotropic materials, the skilled person would apply the teaching of D8 to the required thixotropic alloys.

There must, however, be some indication in the prior art of the problem and/or its solution. Without such an indication, any conclusion regarding a lack of inventive step is made unfairly from the position of a skilled person having prior knowledge of the invention. In this case, D8 simply provides a list of non-thixotropic aluminium powders of given apparent densities; although the tap densities of these powders would be above 50% of the theoretical value, there is no hint whatsoever that tap density has an influence on temperature control. Without this hint, the skilled person must realise intuitively that the tap density of the powders of D8 would improve heat transfer, and in

addition that this could be applied to thixotropic powders where tight control of temperature is important for maintaining the balance of solid and liquid phases. Since this is too much to expect from the skilled person just using his general knowledge, it must be concluded that the method of claim 1 of the main request has an inventive step.

Since the main request of the Respondent is considered to be allowable, there is no need to consider his auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Counillon U. Krause