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D E C I S I O N
of 18 January 1994

Case Number: T 0349/92 - 3.2.2

Application Number: 85301120.3

Publication Number: 0165651

IPC: B28B 3/20, B30B 11/22, C04B 35/00, C04B 38/00

Language of the proceedings: EN

Title of invention:
Process for mixing and extruding ceramic materials

Applicant:
Corning Glass Works

Opponent:
-

Headword:
-

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (yes) - after amendment"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0349/92 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 18 January 1994

Appellant: Corning Glass Works
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Representative: Boon, Graham Anthony
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Decision under appeal: **Decision of the Examining Division of the European Patent Office delivered on 24 October 1991 and dispatched on 14 November 1991 refusing European patent application No. 85 301 120.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: H. Seidenschwarz
Members: W.D. Weiß
J. Van Moer

Summary of Facts and Submissions

I. European patent application No. 85 301 120.3, filed on 20 February 1985 and published on 27 December 1985 under No. 0 165 651, was refused by a decision of the Examining Division, which was delivered at the end of an oral proceedings on 24 October 1991 and dispatched on 14 November 1991.

II. The reasons given for the decision were that all the versions of Claim 1 according to the main request as well as according to the first and second auxiliary requests lacked an inventive step with respect to the combination of the documents

(D3) DE-A-3 001 640,
(D6) American Ceramic Society Bulletin Vol. 62 (1983), No. 11, pages 1280 to 1284, and 1288, and
(D8) Prospectus "Twin-Screw Extrusion Technology" by Werner & Pfleiderer Corporation, imprint "WP G PTG 79 1".

III. A Notice of Appeal was filed against this decision by telecopy on 9 January 1992, and the appeal fee was paid simultaneously. The Statement of Grounds was filed via telecopy on 13 March 1992.

IV. In reply to a communication from the Board dated 12 November 1993, the Appellant filed an amended set of eight claims together with amended pages 5, 5a, 11, and 11a of the description on 10 January 1994.

Claim 1 in this version reads as follows:

"1. A method for making as-extruded ceramic articles of widely differing profiles and shapes having an axis

normal to a fixed cross-section in which a plastically-deformable batch, comprising a mixture of particulate ceramic material being a major portion of the batch, water, and a gel-type binder/plasticiser of a derivative of methyl cellulose, is charged into an extrusion apparatus, wherein it is mixed, de-aired, conveyed and forced through a die of desired configuration to form at least one of the articles, characterised in that the mixture is charged into is mixed, conveyed and forced through the said die by self-cleaning, intermeshing, and co-rotating twin screws in a twin screw extrusion apparatus and further characterised in that the gel-type binder/plasticiser is selected from the higher molecular weight derivatives of methyl cellulose and has a viscosity at 20°C in a 2% aqueous solution between 25,000 - 100,000 mPA.s (25,000 - 100,000 centipoise) and that the batch is forced through a die at working temperatures greater than 35°C."

V. Consequently, the Appellant requests grant of the patent on the basis of the following documents:

Claims: 1 to 8, filed on 10 January 1994 with letter dated 5 January 1994;

Description: pages 2, 4, 6 to 9, 14, 20, 21 as originally filed:
pages 1, 3, 10, 12, 13, 15 to 19, filed on 25 April 1990 with letter dated 23 April 1990;
pages 5, 5a, 11, 11a, filed on 10 January 1994 with letter dated 5 January 1994;

Figures: Sheets 1/6 to 6/6 as originally filed.

Reasons for the Decision

1. The Appeal is admissible.

2. *Amendments*

Claim 1 is based on the original Claims 1 to 3 as well as the disclosure in the paragraph bridging pages 14/15 of the original description.

Claims 2 to 6, and 8 are based on the original Claims 3, 4, 5, 6, 7, and 9 respectively. Claim 7 is based on the last paragraph of the original description.

Consequently, the Board has no objection with regard to Article 123(2) EPC.

3. *Closest State of the Art and Novelty*

The Board is in agreement with the Appellant that document (D6) (Sarkar) is the closest state of the art which discloses the combination of features forming the preamble of Claim 1 but not those in its characterising portion. The subject-matter of Claim 1 is, therefore, novel.

4. *Problem and Solution*

Methods of this known type have been used to produce the so-called green bodies which thereafter are transformed into ceramic articles by sintering. They particularly serve to produce thin-walled honeycomb-shaped products which are composed of a multitude of cells or passages separated by thin walls running parallel to the longitudinal axis of the structure. Such structures find an extensive use as filters for fluid, as heat

exchangers and as supports for catalysts capable of converting noxious fumes into harmless emissions.

Traditional methods to prepare green bodies of this type have comprised the steps of thoroughly mixing the wet batch composition, feeding the wet batch to a two-stage, single screw auger system to compact the batch material into billets, and ram pressing the billets through a die of a proper configuration to yield bodies of the desired structure. As shows the reference to the document US-A-3 919 384 (Cantaloupe) in document (D6) (page 1282, right-hand column, paragraph 5), the disclosure of this document is obviously also based on this traditional technology, the output of which is limited by the requirement that the extrusion barrel must be cooled to warrant that at least an outer layer of the billet is maintained below the gel point of its binder.

At the priority date of the present application, there was a need to replace this batch-type method by a more economic continuous method with a higher output. The technical problem of the present application consists in meeting this need.

The problem is solved by the combination of features in the characterising portion of Claim 1.

5. *Inventive Step*

Document (D6) does not give any hint pointing to this solution offered by the present application. On the contrary starting from the traditional method as represented by document US-A-3 919 384 (Cantaloupe), it reports exclusively about research performed on blends of methyl cellulose blends which, although containing a component having a viscosity in a 2% aqueous solution of 30 000 mPa.s, have a viscosity of the blend of only

about 1 400 mPa.s. Moreover, document (D6) contains the statement (page 1283, left-hand column, fifth paragraph) that the "gelation temperature has been found to be largely independent of molecular weight". Since viscosity is directly related to molecular weight, this statement indicates that, for a given binder type gelation temperature was independent of viscosity. Consequently, the skilled reader of document (D6) could expect that the binders tested there could be processed in the traditional manner using a ram extruder but not in the course of a method which, due to more intense kneading of the batch composition, resulted in working temperatures of greater than 35°C.

It has never been denied by the Appellant that document (D8) belongs to the state of the art and that this document discloses a twin extrusion apparatus with self-cleaning, intermeshing, and co-rotating twin screws. On page 5, middle column, this document, *inter alia*, suggests to use this known apparatus to treat powdery material, especially those with a low bulk density. Although the term "low bulk density" is a relative one and could, under certain circumstances, also be interpreted to embrace some ceramic powders, this general statement has to be read in the context of the exemplary applications which are disclosed elsewhere in this document. Such applications are (page 4): the incorporation of liquids into processed foods and the mixing of solids with water and solvents, extrusion cooking of starch and protein based food products, gelatinisation of food, chemical reactions crystallisation. Consequently, the term "powdery material with low bulk density" obviously refers to a material similar to those materials used in food products. There is, however, not any disclosure suggesting to use this extrusion apparatus to mix, de-air, convey and force through a die a plastically

deformable batch the major portion of which is a particulate ceramic material. Even in the case that a person would have envisaged to test the feasibility of this twin screw extruder for such an application, he would have done so with the usual binders/plasticisers as disclosed in document (D6) and consequently would have failed, because the present application is convincing in stating that the high viscosity binder/plasticiser is indispensable for the proper function of the method.

Neither document (D3) nor the other documents cited in the search report contain any relevant additional information in this respect.

Therefore, the subject-matter of Claim 1 is not rendered obvious for a skilled person by the available known art and hence also involves the required inventive step (Article 56 EPC).

This Claim 1 defines a patentable invention within the meaning of Article 52(1) EPC.

Dependent Claims 2 to 8 represent particular embodiments of the invention defined in Claim 1. They are, therefore, likewise allowable.

The description corresponds to the claims.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order that further prosecution be based on the text of the application as defined in point V of the Facts and Submissions and that the patent be granted on the basis thereof subject to the compliance with formal requirements of the EPC.

The Registrar: The Chairman:

S. Fabiani H. Seidenschwarz