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Aktenzeichen / Case Number / N° du recours : T 283/87 - 3.2.2

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Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Molding process

Klassifikation / Classification / Classement : B29D 3/02

## ENTSCHEIDUNG / DECISION

vom / of / du 27 April 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : UNION CARBIDE CORPORATION

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step - yes"

**Leitsatz / Headnote / Sommaire**

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Case Number : T 283/87 - 3.2.2

# D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 27 April 1989

Appellant : (Proprietor of the patent)
UNION CARBIDE CORPORATION
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Respondent :
(Opponent)

Representative :

Decision under appeal : Decision of the Opposition Division of the European Patent Office dated 20 January 1987 revoking European patent No. 0 019 149 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : G. Szabo
Members : C. Andries
W. Moser

## Summary of Facts and Submissions

I. European patent No. 0 019 149 comprising 33 claims was granted to the Appellant on 26 September 1984 in response to European patent application No. 80 102 354.0 filed on 30 April 1980.

II. The Respondent filed an opposition against the European patent and requested the revocation of the patent on the grounds that its subject-matter was not patentable (Articles 52 to 57 EPC) in the light of documents:

D1: DE-A-2 817 778; and
D2: DE-B-1 120 125.

During the further proceedings, the Respondent additionally cited the following documents:

D3: DE-A-2 135 181 (corresponding to document
D4: GB-A-1 325 707);
D5: DE-A-2 529 214; and
D6: DE-A-2 121 209.

III. In its decision dated 20 January 1987 and dispatched 12 May 1987 the Opposition Division revoked the patent. According to the decision, the subject-matter of the independent Claims 1 (process) and 29 (apparatus) lacked an inventive step and did therefore not fulfill the requirements of Articles 52(1) and 56 EPC. The same was stated for the auxiliary set of claims.

The decision was based on documents D1, D3 or D4 and D5.

IV. The Appellant lodged an appeal against this decision on 10 July 1987, paying the appeal fee on the same date and

requesting that the decision under appeal should be set aside. In his statement of grounds, filed on 21 September 1987, the Appellant requested the maintenance of the patent in an amended form, on the basis of newly filed Claims 1 to 23.

V. In reply to a communication of the Board pursuant to Article 110(2) EPC, the Appellant submitted on 27 February 1989 revised pages 10, 11, 13 and 17 to 23 of the description, and on 9 March 1989 revised pages 6 and 14 of the description.

Claim 1 reads now as follows:

"A process for fabricating fiber reinforced thermoset resin articles in which the fiber reinforcement comprises one or more fibers with a melting point or a glass transition temperature above about 130°C, which comprises the steps of (a) providing one or more of such fibers bonded to one another in the form of an interlocked mass in a heatable mold, (b) closing the mold containing the fibers, (c) injecting at least a portion of a liquid thermosettable organic material under a pressure from an accumulator zone into the mold to thereby fill the cavity in said mold, (d) initiating the curing of said material in said mold by subjecting the material to a temperature above the temperature at which the curing of said material is initiated, by heating the mold, (e) opening said mold and removing the cured thermoset molded article therefrom, characterised in that the fibers are placed in a matched metal die mold as an interlocked mass and in an amount such that the molded article comprises 15 to 80 weight percent of fibers, in that the injection pressure in step (c) is from about 2 to about 203 bar (about 2 to about 200 atmospheres), in that said liquid thermosettable organic material provided in the accumulator zone has a viscosity

of from about 5 to less than about 200 mPa.s at 23°C and has a viscosity determined at 120°C, in the absence of curing agents thereof, of less than about 50 mPa.s (50 cP), the viscosity of said liquid being maintained essentially constant in the accumulator zone by keeping its temperature below that at which curing of said material is substantial and in that the injection temperature of the liquid is maintained substantially below the temperature of the mold by cooling means associated with the means for controlling the injection in order to prevent premature thermosetting of the liquid, whereby molded articles are obtained which are essentially exact replications of one another, the variance from article to article being preferably less than about 5 per cent by weight."

VI. The Appellant requested the maintenance of the patent in an amended form on the basis of the following documents:

Claims: 1 to 23 filed on 21 September 1987;
Description: pages 2 to 5, 7 to 9, 12, 15 and 16 of the granted patent
pages 10, 11, 13 and 17 to 23 filed on 27 February 1989;
pages 6 and 14 filed on 9 March 1989;
Drawings: sheets 1 to 11 of granted patent.

The Respondent first contested the patentability of the newly filed Claims 1 to 9 and 13 to 23 and requested that the appeal be rejected. Then, the Respondent made it clear that he did not want to comment on said communication sent by the Board, and, finally, withdrew the opposition.

**Reasons for the Decision**

1. The appeal is admissible.

2. According to the Board's opinion, there are no formal objections under Article 123 EPC to the present text of the patent in suit since the proposed amendments in the description and in the claims are supported by the original disclosure and do not extend the protection conferred.

Since this has not been contested, it is not necessary to substantiate this further.

3. Novelty.

Examination of the cited documents has revealed that the process for fabricating fiber reinforced thermoset resin articles according to Claim 1 is not disclosed in any of them. It follows that the subject-matter of Claim 1, which is the sole independent claim, is novel within the meaning of Article 54 EPC. Since this was not challenged, it is not necessary to enter into details.

4. Inventive step.

4.1 The patent relates to a process for fabricating fiber reinforced thermoset resin articles according to the pre-characterising portion of Claim 1.

Such process is known from document D4 (or from corresponding document D3).

According to the teaching of document D4, while the fibers are in the mold and before the matrix material is injected to fill the mold, it is necessary to heat a portion of the fiber-coating in order to retain the fibers together (Claim 1). This process-step of pre-heating the fiber-coating while being in the mold is time consuming and does

not allow a simple, rapid and economical production of exactly reproducible fiber reinforced molded thermoset resin articles.

4.2 The technical problem to be solved by the invention is to provide a process which allows a simple, rapid and economical production of fiber reinforced molded thermoset resin articles, and which is suitable to produce molded articles which are essentially exact replications of one another. The solution of the problem comprises the specific conditions listed in the charactering part of Claim 1.

Indeed, due to the fact that the fibers are placed in the mold in the form of a pre-fabricated interlocked mass, allowing thereby not only a predetermined positioning of the fiber reinforcement in the mold (exact replications), but also the use of this mass of fibers without the need of pre-heating them while being in the mold, and that the well defined (cf. Claim 1) viscosity and temperature values for the liquid thermosettable organic material are used, allowing thereby the use of an injection pressure up to 203 bar, without considerable displacement of the interlocked mass of fibers, a simple and economical production of reproducible articles is possible.

The objection that, according to present Claim 8 of the patent in suit, the interlocked mass of fibers is also bonded by a thermoplastic resin, starch or a thermosettable resin only relates to a preferred process-step taking place prior to the fabricating process in the mold. Indeed, according to present Claim 1, it is essential that the fibers, which are placed in the mold, are already in the form of an interlocked mass, so that the fabricating process taking place in the mold is speeded up (rapid).

In view of the examples given in the description and more particularly in view of the time (between 2 and 10 minutes) after which the cured parts can be removed from the mold, the Board accepts that the object is obtained by the process-steps mentioned in Claim 1. This was not disputed either.

4.3 A person skilled in the art, starting from a fabricating process according to document D4, who would try to achieve the above mentioned objectives (cf. point 4.2) could not find, however, an indication in the cited documents of the critical conditions which characterise the invention.

4.3.1 Although in the process according to document D4 it is indicated to use an injection pressure of 3,45 to 13,8 bar (50 to 200 psi), and although in view of the indication in document D4 that curing of the resin only takes place after the mold is satisfactorily filled, it is obvious for a skilled person that in this process the resin temperature is kept below that of curing as long as the mold is not heated, i.e. also during injection, there are no hints in document D4 to obtain the object of the invention with the process-steps specified in Claim 1, namely the placing in the mold of the fibers in the form of an interlocked mass combined with the use of specific viscosity and temperature values for the liquid thermosettable organic material, which allow the use of an injection pressure up to 203 bar. There is no indication in document D4 which, in order to solve the problem of reproducibility, links the displacement of the reinforcing fibers, on the one hand, with the viscosity of the injected resin, on the other hand, so that a skilled person has no reason to try by way of mere experimentation to find suitable ranges for the viscosity of the resin and to obtain thereby the elimination of the displacement. Even the vague indication in the description, that in some cases the resin, prior to

curing, may be of low viscosity or that it is not necessary to use resins which are tacky at room temperature, cannot suggest to a person skilled in the art to experiment in order to obtain the peculiar viscosity as defined in Claim 1.

4.3.2 Document D5 teaches in the same technical field how to avoid slow fabricating processes and how to avoid the shifting of reinforcing fibers. Therefore, the fabricating process comprises a first step during which an interlocked mass of fibers is placed in a mold, whereafter a part of the resin material is injected into the mold before this mold is closed, and the rest of the resin material is injected into the mold after its closing.

This document teaches, in order to obtain a rapid fabricating process without the danger of shifting of the reinforcing fibers, to use a completely different method of fabricating articles as compared to the process defined in the present patent, so that a person skilled in the art cannot be led by the teaching of this document to come to the invention claimed here. Indeed, if a person skilled in the art wants to make use of this teaching in view of solving the indicated problems, he cannot select and transplant only one process-step (cf. use of interlocked mass) from this state of the art but would have to use the combination of this with the other process-steps of the teaching involved in view of their interrelation; that means an altogether different article-fabricating process.

4.3.3 Even if a skilled person considered document D5 as the closest prior art, it would not be obvious to modify the fabricating process of the said document in such a manner that the resin material should only be injected after the mold is closed, as it is done in documents D3 (or D4) and D6. This is particularly true having regard to the fact

that, according to document D5, the introduction of the resin material at a lower pressure before the closing of the mold is essential (cf. Claim 1) in order to avoid the shifting of the reinforcing fibers, the latter also being indirectly an object of the present opposed patent (cf. requirement for exact replications). A skilled person seeking such results would not change within a process a process-step already specially provided to obtain such a result, unless specific alternatives give equal results. The suggested alternative proposed in document D6 (cf. Claim 1) includes clamping of a fiber-entity between the mold parts, whereas a time consuming pre-heating has to take place in the mold according to document D3 (cf. Claim 1). They represent different kinds of fabricating processes which lead away from the solution according to present Claim 1.

4.3.4 Furthermore, document D5 does not suggest the use of materials with a low viscosity as required in the present claim. The indication in document D5 that the viscosity should be lower than 8 Poise (800 cP) discloses neither the selected specific range at 120°C, nor the specific range of 5 to 200 mPa.s (cP) at 23°C, which are in fact low for these materials and are not the normally used ranges. The rather vague hint, that the viscosity has to be low enough to allow injection, is self-evident. There is no suggestion there to modify the fabricating process according to document D5.

4.3.5 Neither does Document D1 give a hint to a skilled person to modify the fabricating process according to document D4, which involves fiber reinforced thermoset resin articles, since the latter discloses the treatment of a different kind of material, i.e. thermoplastic material. Furthermore, a skilled person searching for a rapid fabricating process would not use a process comprising a process-step of

heating, while the mold is closed, which takes, according to the examples, between fifteen minutes (page 27: Table IV) and two hours (page 18, third paragraph; pages 20 to 22: examples A to H; and page 27: Table IV). Document D2, on the other hand, teaches a solution to a different problem (uneconomical use of different dyes) and additionally discloses what is obvious knowledge for a skilled design engineer, i.e. the cooling before the injection point of the material to be injected. There is, however, no hint to use conditions as disclosed in present Claim 1.

Document D6 teaches to solve the associated time and fiber shifting problems with a different technique which comprises, among others, the step of clamping the fiber entity between the mold parts so that, in addition, a gap remains between these mold parts during the performance of further steps. Furthermore, no specific values with respect to the viscosity of the resin material have been disclosed. A skilled person cannot therefore be led by this document to a process according to Claim 1 of the opposed patent.

None of the further documents cited in the search report was found prejudicial to the patentability of the claimed subject-matter, neither alone, nor in combination with the documents cited above. Therefore, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.

5. Based upon the valid Claim 1 and dependent Claims 2 to 23, which concern preferred processes of the process according to Claim 1, the modified description and the drawings as published, the patent can be maintained.

**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 to maintain the European patent on the basis of the following documents:

Claims 1 to 23 filed on 21 September 1987;
Description: pages 2 to 5, 7 to 9, 12, 15 and 16 of the granted patent;
pages 10, 11, 13 and 17 to 23 filed 27 February 1989;
pages 6 and 14 filed on 9 March 1989;
Drawings: sheets 1 to 11 of the granted patent.

The Registrar: The Chairman: