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Aktenzeichen / Case Number / N<sup>o</sup> du recours : T 17/83

Anmeldenummer / Filing No / N<sup>o</sup> de la demande : 79302938.0

Veröffentlichungs-Nr. / Publication No / N<sup>o</sup> de la publication : 0 014 292

Bezeichnung der Erfindung: Method of compounding melt-forming  
Title of invention: resins and mica particles  
Titre de l'invention :

Klassifikation / Classification / Classement : C 08J3/20

### ENTSCHEIDUNG / DECISION

vom / of / du 17 December 1984

Anmelder / Applicant / Demandeur : Ford Motor Co. Ltd.

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence : "Inventive Step"

EPÜ / EPC / CBE Art. 52(1) and 56

Leitsatz / Headnote / Sommaire

*Version 1 U1PA*

Europäisches  
Patentamt

Beschwerdekammern

European Patent  
Office

Boards of Appeal

Office européen  
des brevets

Chambres de recours



Case Number: T 17 / 83

**DECISION**  
**of the Technical Board of Appeal 3.3.1**  
**of 17 December 1984**

**Appellant:** Ford Motor Company Ltd.  
Eagle Way  
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CM13 3BW

**Representative:** Drakeford, Robert William  
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**Decision under appeal:** Decision of Examining Division 013 of the European Patent  
Office dated 25 October 1982 refusing European patent  
application No 79302938.0 pursuant to Article 97(1)  
EPC

**Composition of the Board:**

**Chairman:** G. Szabo  
**Member:** H. Robbers  
**Member:** O. Bossung

Summary of Facts and Submissions

- I. European patent application 79 302 938.0 filed on 18 December 1979 and published on 20 August 1980 with publication number 14 292 claiming the priority of the prior applications of 18 December 1978 and 13 December 1979 in the United States of America, was refused by the decision of the Examining Division 013 of the European Patent Office dated 25 October 1982. The decision was based on claims 1 to 16. The main claim was worded as follows:

"A method for compounding a melt forming resin with mica particles and a heat sensitive chlorinated hydrocarbon additive, characterised by contacting a mass of molten resin with a blend of the mica and additive and mixing the molten resin and the blend by kneading."

- II. (a) The reason given for the refusal was that the main claim did not involve an inventive step having regard to the state of the art known from FR-A-2 385 768. The cited art was also concerned with the compounding of melt-forming resins with silicates, e.g. mica, and chlorinated hydrocarbon additives. In one preferred embodiment, a blend of mica additive was first prepared and was then mixed with the resin. The mixture was subsequently kneaded non-intensively in an extruder. However, the resin was not molten at the time of contact with the mixture of mica and the additive, but was a powder.
- (b) The Examining Division stated that the above mentioned difference ensured the novelty of the

applicants claim 1. Nevertheless, the use of molten resin had no apparent significance or advantage. The processing time was not significantly shorter than that obtained according to the cited document. Since it was known that the additives were heat sensitive, the reduction of processing time and the avoidance of high shear mixing, causing uncontrollable temperature rises, had been obvious measures.

- (c) The cited art showed how this could be done. Within the given temperature range for processing, i.e. 170-300°C, the higher ranges were said to result in a shorter processing time. Yet the properties of the product so obtained were good and no mentioning was made of any degradation of the additives.
- (d) The decision emphasises that no improvement of the properties of the product had been convincingly demonstrated in comparison with the cited state of the art. Whilst there might have been some improvement in tensile strength the applicant's product had a poorer flexural strength.

III. On 3 January 1983 the Applicants filed an appeal against the decision of 25 October 1982, together with a statement of grounds. The circumstances of the payment of the appeal fee resulted in an interlocutory decision of 20 September 1983 by the Board, which ordered the appeal fee to be debited. (T17/83, "Debit order II/FORD, OJ 7/1984, 306).

IV. A communication from the Board was answered by the Appellants in due time and an oral hearing took place

on 12 October 1984. The Board decided that it would favourably consider a new main claim which was to be limited to the provision of the molten resin by a high shear treatment. On continuation of the proceedings in writing the appellants had submitted a new main claim (received on the 18 October 1984) which was then further amended by letter dated 21 December 1984 (received 24 November 1984) to read as follows:

1. A method for compounding a melt forming resin with mica particles and a heat sensitive chlorinated hydrocarbon additive, characterised by melting the resin whilst subjecting the resin to high shear, contacting the molten resin with a blend of the mica and the additive, and mixing the molten resin and the blend by subjecting the resin and the blend to low shear kneading.

V. The appellants submitted the following arguments in support of the appeal:

- (a) The low shear mixing or kneading step is an essential and novel feature of the process according to the invention. Low-shear mixing is only recommended for the pre-mixing step for mica and the additive in the cited art, and the Examples in that document suggest machines which utilise a single screw mechanism providing high shear.
- (b) As a result of the initially high shear step to melt the resin and the subsequent step of kneading the resin and the blend after admixture, the components are only exposed to elevated temperatures for less than a minute. In the prior art fast processing is not envisaged at all and the tabula-

ted results suggest that substantially longer periods than a minute are needed for optimum results. It appears from Table 2 of the document that flexural strength is at its best after blending of 10 to 15 minutes. The general description in the same document expressly prefers to blending period of 5 to 15 minutes within a maximum range of 1 to 30 minutes (page 7, lines 8 to 11).

- (c) At the worst, the claimed process according to the present invention provides material with substantially unchanged quality, in spite of the significantly reduced processing time. This is notwithstanding the fact that the example closest to the cited method in the state of the art runs the process at a temperature of 227°C, i.e. 27°C higher than that in FR-A-2 385 768 (Example 1, Composition 4).
- (d) There is no suggestion in the prior art to melt the resin under high shear before any contact with the other components and then to change to low shear kneading. The latter is really reserved for the dry tumbling of the components in a powder form. Whilst there was some scope for reducing the processing time by increasing the temperature, this must be balanced against the known risk of deterioration by the additive. No one would have suspected that the separation of the melting step from the admixing step would result in a substantial improvement and should lead to a reduction of total time below the limits recommended for the process according to the state of the art.

- II. The appellants request that the decision be set aside and the patent be granted on the basis of the 16 claims on file.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. There are no formal objections to the current version of the claims since it is adequately supported by the application as filed. New claim 1 is based on the original claim 1 and on page 3, lines 6 to 12 and page 6, lines 14 to 21. Claim 3 has been amended on the basis of page 5, line 14.
3. The state of the art is represented by FR-A-2 385 768 which describes the preparation of composite materials from a resin, mica particles and a chlorinated additive by admixing the components and keeping the blend at a temperature and for a time sufficient to improve its mechanical properties. The components are either mixed non-intensively (low shear kneading) as a dry powder first (page 5, lines 35 to 40) followed by kneading through extrusion, or the mica particles are first coated with the additive (page 6, lines 14 to 37) before adding the resin (page 6, line 37 to 39). The blend is kept at 190 to 210°C preferably for 65 to 10 minutes. Apparently the machinery recommended for the purpose (Examples 1 and 4) is either an injection moulding machine or an extruder-compounder having in both cases a single screw for high shear blending according to the submissions of the appellants (see Statement of Grounds, page 2, para 6).

4. The problem with which the present application was concerned is the need to reduce the processing time at elevated temperatures and thereby to increase the efficiency of the compounding of the material without loss of quality for the product. The claimed solution involves melting the resin separately by subjecting the same to high shear, introducing a blend of mica and a heat sensitive chlorinated hydrocarbon additive therein, and admixing the components by low shear kneading. The time between introducing the resin and removing of strands of the material from the extruder-end of the appropriate apparatus need not be more than 15 seconds according to the examples in the application.
  
5. The FR-A-2 385 768 suggests a dependency of mechanical properties on processing time (see main claim on page 15). When the relevant compositions of those listed in Table 2 are considered, it is apparent that the optimum of flexural strength lies within the range of 5 to 15 minutes processing time. This is confirmed by the general statement suggesting the same preferred range within the total range of 1 to 30 minutes (page 7, lines 8 to 11). Whilst there is some encouragement for reducing processing time somewhat by increasing the temperature (page 7, lines 1 to 6), any enthusiasm is discouraged by a warning that a serious decomposition of its strengthening effect could be expected at elevated temperatures (page 6, lines 23 to 25).
  
6. The total dwelling time for melting the resin and for compounding at high temperatures is about or less than 1 minute with the claimed process, whilst the unmodified technique according to the cited art requires at



least one minute but preferably more than 5 minutes to obtain the best results (page 7, lines 8 to 11). Prior to suggesting this, the disclosure in the prior art states that "advantageously, the additives according to the invention permit the subsequent realisation of stable mechanical properties at the usual temperature of melting during long time periods, for instance 30 minutes or longer". This and the information content of Table 2 in the citation would not encourage the skilled person to increase the temperature of processing nearer to the limit and thereby to reduce the throughput time in the molten state.

7. The selection of a very short admixing time also involved risks of inadequate homogenisation. Moving below the lower limit of the range suggested in the prior art is difficult to justify in circumstances when better mechanical properties may be obtainable with longer mixing periods. The quality of the molten resin at the time of contact with the separately prepared mixture of mica and adhesive may have had its role in avoiding deterioration of quality. This is why the feature of providing the molten resin by a high shear treatment acquires significance. Such condition not only implies very rapid heating but guarantees the uniformity of the material. Neither the choice of such conditions nor the sudden use of low shear processing was recommended or implied by the cited art as something which would enable the processing time to be reduced drastically below the former limits of preference.

8. Since there was reasonable doubt about the wisdom of reducing compounding time on the basis of information available from the most relevant state of the art, neither the degree nor the quality of the result could have been fully appreciated and expected. The subject matter of claim 1 therefore involves an inventive step and the same applies to all other claims in view of their dependency.

Order

It is decided that

1. The decision of the Examining Division dated 25 October 1982 is set aside.
2. The case is remitted to the first instance with the order to grant a European patent on the basis of the following documents:
  - (1) Description:  
Pages 2,3,3a, 4 to 7, 9,11,12,14 and 15, received on 18 October 1984.  
Pages 2a,8,10,13 received on 24 November 1984
  - (2) Claims:  
Nos. 1 to 8, received on 24 November 1984  
Nr. 9 to 16, received on 18 October 1984.

The Registrar:

The Chairman:

B A Norman

G. Szabo