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D E C I S I O N
of 26 January 1999

Case Number: T 0274/96 - 3.3.3

Application Number: 90120539.3

Publication Number: 0426019

IPC: C08J 3/215

Language of the proceedings: EN

Title of invention:
Precoagulation process for incorporating organic fibrous fillers in SBR

Applicant:
E.I. du Pont de Nemours and Company (a Delaware corporation)

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
T 0246/91, T 0495/91

Catchword:
-

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Case Number: T 0274/96 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 26 January 1999

Appellant: E.I du Pont de Nemours and Company
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 3 November 1995 refusing European application No. 90 120 539.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
J. A. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 90 120 539.3, entitled "Precoagulation process for incorporating organic fibrous fillers in SBR", with six claims, filed on 26 October 1990, and published under No. 0 426 019, was refused by a decision of the Examining Division dated 3 November 1995, for lack of inventive step. The decision was based on a set of Claims 1 to 3, filed on 30 May 1995, with a letter dated 29 May 1995. Claim 1 of this set reads as follows:

"A process for incorporating fibrous filler into a styrene-butadiene rubber which comprises:
(a) mixing a styrene-butadiene rubber latex and 1-30 parts by weight synthetic fibrous filler per 100 parts styrene-butadiene rubber,
(b) contacting the mixture with a coagulant for the styrene-butadiene rubber latex to form a coagulated fiber-filled rubber,
(c) feeding the coagulated fiber-filled styrene-butadiene rubber to a dewatering extruder and through a flow restriction in the extruder that applies back pressure sufficient that water present in the coagulated fiber-filled styrene-butadiene rubber is forced out of a vent provided in the extruder upstream from the flow restriction, and
(d) discharging the fiber-filled styrene-butadiene rubber from the extruder."

Claims 2 and 3 are dependent claims directed to elaborations of the process according to Claim 1.

II. According to the decision, in which *inter alia* the following documents were referred to:

D2: US-A-4 136 251; and

D3: US-A-4 263 184

the closest prior art was D3, which related to a process for dispersing fibres into rubber compositions. Whilst it was desirable to increase the concentration of fibrous material as much as possible, nevertheless the concentrations of fibrous material and polymer latex were not critical. After following a procedure for determining the optimum solids content, corresponding to the most homogeneous fibre predispersion, a mixture of the fibrous material and elastomer latex was coprecipitated with a solution of a coagulant and the predispersed fibre composition dried by suitable means. The use of a de-watering extruder for the drying step, by which the claimed subject-matter differed from this state of the art, had not, however, been shown to give rise to a technical effect, so the technical problem arising was simply to provide a further process for incorporating fibrous filler into an elastomer. It was well-known that mixtures of polymer and fibrous filler could be extruded, the use of such an extruder was taught by D2, and the extruder had not been shown to be unsuitable for processing mixtures of polymer and fibrous filler. Consequently, the subject-matter of Claim 1 was an obvious combination of the process described in D3, with the teachings of D2 and the general knowledge of the skilled person.

III. On 19 December 1995, a Notice of Appeal was filed against the above decision, the prescribed fee being paid on the same day.

In the Statement of Grounds of Appeal, filed on 5 March 1996, the Appellant argued substantially as follows:

(a) No worker of ordinary skill, starting from the disclosure of D3, would use such a low concentration of fibres as used in the process as claimed, since the more specific disclosure of D3, including the examples, emphasised the desirability of maximising the fibre concentration.

(b) There was no teaching in D3 to use an extruder; on the contrary, the instruction was to decant off the serum of the coagulation and the water after washing.

(c) The application in suit required that the coagulant be added to a mixture of latex and fibres, which was not taught in either of the documents cited.

(d) The disclosure of D2 did not relate to polymer/fibre mixtures. In any case, D2 required the coagulation at the introduction of the latex into the extruder, whilst the application in suit required that the fibres and the latex to have been coagulated prior to such introduction.

In summary, the suggested combination of references was based on a selection of elements corresponding to the claimed subject-matter, using the disclosure of the application in suit as a guide, whilst ignoring those elements which did not so correspond. Consequently, the claimed subject-matter was not obvious.

IV. The Appellant requested that the decision under appeal be set aside and a patent granted, on the basis of the set of Claims 1 to 3 filed on 30 May 1995.

Reasons for the Decision

1. The appeal is admissible.

2. The text on which this decision is based comprises:

Claims:
Claims 1 to 3 as filed on 30 May 1995, with letter dated 29 May 1995;

Description:
Pages 1, 3, 5 to 9 and 11, filed on 24 November 1994, with a letter dated 22 November 1994; and
pages 2, 4, 10 and 12 filed on 30 May 1995, with a letter dated 29 May 1995;

Drawings:
Sheets 1/3 to 3/3 as originally filed.

3. *Allowability of the amendments*

3.1 Claim 1 is based on Claim 1 as originally filed, read in conjunction with the description as originally filed on page 3, line 34 to page 4, line 2; page 4, line 29 to page 5, line 2; and page 5, lines 6 to 34 (printed specification, column 3, lines 2 to 6 and 30 to 45; and column 3, line 46 to column 4, line 18).

3.2 Claims 2 and 3 correspond to Claims 2 and 3, respectively, as originally filed.

3.3 The description contains no amendments which, in the Board's view, would contravene the requirements of Article 123(2) EPC.

3.4 Thus, the Board confirms the finding in the decision under appeal that the requirements of Article 123(2) EPC are fulfilled.

4. *The application in suit; the closest state of the art*

The application in suit is concerned with a process for incorporating fibrous filler into styrene-butadiene rubber (opening paragraph; Claim 1). According to the description, this has been done by heating the polymers to soften them and thoroughly mixing the polymer and filler on a mill or internal mixer (page 1, lines 14 to 17).

Such a process is illustrated by D3, which according to the decision under appeal represents the closest state of the art, a view shared by the Board.

4.1 According to D3, problems encountered in obtaining uniform dispersion of the fibres throughout the rubber matrix during a reasonable and practical mixing cycle are solved in that fibrous filler material is coprecipitated with a latex of a rubber or plastic polymer to form a homogeneous predispersion of fibres. Such predispersed fibre compositions are mechanically mixed with the rubber or plastic compound stock, whereby the greater the homogeneity of the fibre predispersion, the more rapid, uniform and thorough will be the dispersion of the fibrous material into the rubber or plastic compound stock to be reinforced (column 1, lines 27 to 30; column 2, lines 8 to 12 and 14 to 27).

Whilst the concentrations of fibrous filler material and the binder comprising the polymer latex are not critical, it is desirable to maximise the concentration of the fibrous material, firstly since the composition of the rubber latex may not be the same as that of the rubber stock to be reinforced, and secondly to reduce the cost of a given amount of predispersed fibres to be introduced into the rubber stock (column 4, lines 4 to 38).

In order to obtain a predispersed fibre composition having the greatest possible degree of homogeneity, a total amount of water has to be present in the mixture, prior to coagulation, which is not less than that required completely to wet the fibrous material, but also not so much that the polymer is coagulated independently of the fibres (column 2, lines 28 to 43).

To ascertain the relevant solids content, a curve is plotted of the standard deviations, derived from a sufficient number of samples taken from each one of a series of coagulated, test wetted fibre compositions having different percents of total solids, decreasing in equal increments from the point required completely to wet the fibrous material, against the percent of total solids in the relevant test wetted fibre composition. From this curve, a percent of total solids corresponding to the required homogeneity is selected (Claim 1).

The polymer latex is first combined with any optional ingredients and any required water of dilution, the mixture blended with the fibrous filler material, and the resulting wetted fibre mixture coagulated by mixing it with a solution of a coagulant. The serum is then decanted off. Wash water is added and then also decanted off. Finally, the predispersed fibre composition is dried by suitable means, such as a forced air oven or partial vacuum evaporation (column 4, lines 44 to 59).

According to a typical example (Example 20), such a predispersed fibre composition comprises 79.21 wt% chopped 1/4-inch polyester fibre and 19.80 wt% rubber (column 9, 10, Table III).

Furthermore, according to an example of application (Example XXXIII), such a predispersed fibre composition is mixed into uncured rubber compound stock, in a two-roll laboratory mill, and found to be rapidly, uniformly and thoroughly dispersed into the rubber compound stock (column 11, line 54 to column 12, line 17).

4.2 As is evident from the number of sequential steps required, this method is not only cumbersome, but also both energy intensive and expensive, due to the long times required by the fabricator to incorporate fibre into the rubber (application in suit, page 1, line 34 to page 2, line 10). Compared with this state of the art, therefore, and in line with the approach taken in the application in suit, the technical problem may be seen in the search for a simpler, cheaper and more efficient process of incorporating fibrous filler uniformly into a styrene-butadiene rubber.

4.3 The solution proposed according to Claim 1 of the application in suit is to mix the styrene-butadiene rubber latex with 1 to 30 pbw synthetic fibrous filler per 100 parts styrene-butadiene rubber, to contact the mixture with a coagulant for the styrene-butadiene rubber latex to form a coagulated fibre-filled rubber, and to feed the coagulated fibre-filled styrene-butadiene rubber to a dewatering extruder and through a flow restriction in the extruder that applies back pressure so that water present in the coagulated fibre-filled styrene-butadiene rubber is forced out of a vent provided upstream of the flow restriction, and discharging and recovering the fibre-filled styrene-butadiene rubber from the extruder.

4.4 It is evident from the description of the application in suit, and in particular from Example 2, that the process successfully enables an acceptably uniform dispersion of synthetic fibres for use, for instance, in making tyres or power transmission belts, to be obtained at relatively low power input (0.4 kW average drive power), in a single processing step.

4.5 The finding in the decision under appeal, that the problem to be solved was simply to provide a further process for incorporating synthetic fibrous filler into an elastomer cannot be supported by the Board, not only since it diverges from the approach advocated in the case law of the Boards of Appeal, of normally starting from the problem actually described by the Applicant (T 246/91 of 14 September 1993, referring to T 495/91 of 20 July 1993, neither published in OJ EPO), but also because it ignores the facts (i) that the claimed procedure avoids the necessity of establishing a particular solids content for each set of ingredients, from a standard deviation curve, which itself requires the results of a series of iterative experiments, and (ii) that it enables an acceptable fibre distribution to be obtained without intermediate drying of the coagulated styrene-butadiene rubber. Thus, the multiple steps according to D3 are combined in a single, quasi-continuous operation, and the process is simpler, more efficient and consequently cheaper than that of D3.

4.6 In summary, it is credible that the claimed measures provide an effective solution of the problem as stated by the Board.

5. *Novelty*

Lack of novelty was not a ground of refusal of the application. Nor does the Board take the view that such an objection arises. Consequently, the claimed subject-matter is held to be novel.

6. *Inventive step*

To assess whether the claimed subject-matter involves an inventive step, it is necessary to consider whether the skilled person, starting from D3 and wishing to simplify and improve the efficiency of the process, would realise, in the ordinary course of his work, that the steps involved in the preparation of the "predispersed fibre composition" could be omitted, and an intermediate drying step avoided, by simply feeding the crude, still wet coagulated fibre-filled styrene-butadiene rubber composition into a dewatering extruder.

6.1 There is no suggestion, in D3, that the step of preparing the "predispersed fibre composition" could be omitted. On the contrary, such an intermediate product is essential, to provide a source of prepared fibres which will uniformly and rapidly disperse when directly compounded with rubber stock using a conventional device.

6.1.1 The finding in the decision under appeal, that there was no restriction in D3 regarding the means suitable for drying the fibre-filled material (Reasons for the decision, point 4, page 5, second paragraph) ignores the fact that D3 only teaches one procedure for the mixing step, and this involves decanting off the serum (column 4, lines 44 to 59). Thus, whatever kind of apparatus was envisaged according to D3, it could not have been a dewatering extruder.

6.1.2 The further finding of the decision under appeal, that it would have been obvious for the skilled person to use a dewatering extruder for this purpose, fails to recognise the nature of the mixing step in D3, which,

as pointed out above, is merely a pretreatment to deposit polymer on the individual fibres preparatory to compounding them in a conventional device. It therefore need involve only relatively small amounts of water.

6.1.2.1 In the latter connection, the argument in the decision under appeal, that there is no restriction on the concentration of the components of the "predispersed fibre composition" is not convincing, because the passage relied upon refers only to the starting ingredients, not to the resulting "predispersed fibre composition" (column 4, lines 4 to 6).

6.1.2.2 On the contrary, it is evident from the relevant disclosure in D3 that the aim is that of maximising the concentration of fibrous material, none of the exemplified compositions having a fibre content less than 50 wt%, and around 80 wt% being typical (column 4, lines 12 to 18; examples).

6.1.2.3 Thus, it is evident that, in practice, the "predispersed fibre composition" consists essentially of fibrous material wetted with a small amount of coagulated elastomer latex, from which the water can therefore easily be removed.

6.1.2.4 Hence, there is no need to use an expensive and elaborate apparatus such as a dewatering extruder to dry the wet "predispersed fibre composition".

6.1.3 On the contrary, the further compounding involved in such use would tend to destroy the prepared condition of the "predispersed fibre composition", required for the subsequent conventional compounding step, and thus conflict with the purpose of preparing such an intermediate product in the first place.

6.1.4 In summary, the use of a dewatering extruder at this stage of the process according to D3 would be, at best, a completely redundant exercise in the use of expensive apparatus, and at worst, counterproductive to the point of vitiating the entire process.

6.1.5 Thus, there is no hint to the solution of the stated problem in D3.

6.2 According to D2, which was published in January 1979, it was known to isolate a polymer, such as a chloroprene polymer, from its latex by introducing the latex and separately a latex coagulating agent, into a twin screw extruder (Claims 1 and 4). The latex may comprise a water-dispersible thickener, preferably hydroxyethylcellulose (column 4, lines 29 to 34).

6.2.1 There is no reference to the presence of fibres, nor any indication that the extruder is suitable for processing a fibre containing mixture. Consequently, there is no support for the assertion in the decision under appeal that such processing was well known.

6.2.2 The argument in the decision under appeal, that the Applicant failed to demonstrate why the extruder according to D2 should be considered by the skilled person as unsuitable for recovering a mixture of polymer and fibrous filler (Reasons for the decision, page 5, second paragraph) is not convincing to the Board, since the onus of proving this assertion, which has been challenged by the Appellant, lay with the Examining Division.

6.2.3 Even if the assertion were accepted at face value by the Board, however, the use of such an extruder as a drying means in the process according to D3 is practically excluded by the constellation of the latter process, since a mechanical compounding step is already envisaged in the latter, after drying has taken place (section 6.1.3, above).

6.2.4 Finally, D2 was published over ten years before the earliest priority date of the application in suit. The fact that such use did not suggest itself to any operator, in a closely worked art such as that of reinforced polymers, for a full decade after the extruder became public knowledge, is an indication to the Board that general knowledge would not have sufficed to make available the solution of the technical problem to the skilled person.

6.2.5 If, in spite of the above considerations, use were nevertheless made of a dewatering extruder on the model of D2, such use would in any case involve coagulation of the latex within the extruder, which is contrary to the requirement of the solution of the technical problem, that such coagulation occurs before the extruder. Consequently, the result of using such an extruder according to the teaching of D2 would not be something corresponding to the solution of the technical problem.

6.2.6 Under these circumstances, the disclosure of D2 does not assist the skilled person to the solution of the technical problem, even in the light of his general technical knowledge.

6.3 Thus, the solution of the stated problem does not arise in an obvious way from the state of the art.

6.4 Hence, the subject-matter of Claim 1, and, by the same token, of dependent Claims 2 and 3 involves an inventive step in the sense of Article 56 EPC.

7. Although the Board would be prepared to grant a patent on the basis of Claims 1 to 3, it is aware that certain passages of description are inconsistent with, and to this extent fall outside the scope of, Claim 1. In particular, the reference to "natural", as opposed to synthetic fibre and the specific mention in this context of cotton, as well as Example 3, which discloses the incorporation of cotton fibres (page 3, last line to page 4, line 4; page 12, lines 1 to 11) require amendment in this respect, in the Board's view, before grant can take place.

In the light of the circumstances, the Board has decided to make use of its powers under Article 111(1) EPC to remit the case to the Examining Division for the necessary consequential amendments to be made.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the basis of Claims 1 to 3 filed on 30 May 1995, after consequential amendment of the description.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin