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Datasheet for the decision of 28 August 2007

Case Number: T 0542/05 - 3.3.09

Application Number: 02718897.8

Publication Number: 1373383

IPC: C08J 9/32

Language of the proceedings: EN

Title of invention:
Two-component (epoxy/amine) structural foam-in-place material

Applicant:
L & L Products, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 84, 123(2)

Keyword:
"Main request: Clarity (no)"
"Auxiliary Request: Novelty, inventive step (yes)"
"Compliance with Article 123(2)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0542/05 - 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 28 August 2007

Appellant: L & L Products, Inc.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 29 November 2004 refusing European application No. 02718897.8 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Kitzmantel
Members: W. Ehrenreich
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. European patent application No. 02 718 897.8 in the name of *L & L Products, Inc.* entitled *"Two-Component (Epoxy/Amine) Structural Foam-in-Place Material"* was filed on 4 February 2002 as International application No. PCT/US02/03133.

The application published on 14 November 2002 as WO 02/090427 was refused by the decision of the Examining Division issued in writing on 29 November 2004.

II. The decision was based on a set of Claims 1 to 19 filed with the letter dated 20 April 2004. Independent Claims 1 and 10 read as follows:

"1. A method for producing a foamed article, comprising the steps of:

providing an epoxy component, said epoxy component comprising an epoxy resin, a blowing agent having a thermoplastic shell filled with a solvent core, and a thixotropic filler; said epoxy component being provided in a liquid form;
providing an amine component, said amine component comprising an amine and a thixotropic filler; and said amine component being provided in a liquid form; and
combining said epoxy component and said amine component to form a reactive mixture and allowing said thermo-plastic shell filled with a solvent core to soften from amine-epoxy exotherm and then expand due to gas pressure from said solvent core without addition of external heat."

"10. A method for producing a foamed article, comprising the steps of:
providing an epoxy resin in a liquid form;
providing a thixotropic filler in the epoxy resin;
providing a blowing agent in the epoxy resin, the blowing agent having a thermoplastic shell filled with a solvent core;
providing an amine component, said amine component comprising an amine and a thixotropic filler, said amine component being provided in liquid form; and
combining said epoxy resin and said amine component to form a reactive mixture and allowing said thermoplastic shell filled with a solvent core to soften from amine-epoxy exotherm and then expand due to gas pressure from said solvent core without addition of external heat."

Claims 2 to 9 were, either directly or indirectly, dependent on Claim 1 and Claims 11 to 19 were dependent on Claim 10.

III. In its decision, the Examining Division acknowledged the novelty of the claimed subject-matter, but denied the presence of an inventive step vis-à-vis document

D1 US-A 4 995 545.

The Examining Division saw the difference between the process according to Claim 1 and that of D1 as being in the use of both the epoxy and the amine component in liquid form and in the presence of a filler which was thixotropic. The Division argued that the objective problem was merely the provision of an alternative method for producing a foamed reinforcing material,

because no evidence was on file that the distinguishing features provided an improvement of the structures obtained according to the claimed invention over those obtained according to D1. In the Division's view it was therefore a matter of routine for a skilled person starting from D1 to adapt the consistency of the components and to use thixotropic fillers like calcium carbonate and clay already disclosed in D1.

IV. On 21 January 2005 the Applicant (hereinafter: the Appellant) filed a notice of appeal against the decision of the Examining Division. The Statement of the Grounds of Appeal was submitted on 29 March 2005. In response to a communication of the Board dated 4 July 2005 the Appellant filed, with a letter dated 27 July 2005, a set of Claims 1 to 19 as a basis for its main request to grant a patent. The claims were identical with the claims on which the appealed decision was based (see point II above).

With a letter dated 15 August 2007 the Appellant filed a test report for the purpose of illustrating the invention. The report compared the sag properties of the epoxy/amine systems according to the invention containing aramid pulp or fumed silica as thixotropic fillers with the sag resistance of a system containing a non-thixotropic calcium carbonate filler. The sag properties were demonstrated by way of three photographs enclosed with the test report.
With the same letter a set of Claims 1 to 19 as the basis for an auxiliary request was also filed.
Independent Claims 1 and 10 correspond to Claims 1 and 10 of the main request, the only exception being that the reactive mixture resulting from *"combining said*

epoxy resin and said amine component" is now characterized as a *flowable reactive mixture*.

V. During the oral proceedings held on 28 August 2007 the Appellant withdrew the existing main request and made the set of claims filed on 15 August 2007 the basis for its new main request.

Furthermore, a set of amended Claims 1 to 10 as the basis for a new auxiliary request was filed. Claim 1 according to this auxiliary request, which is mainly based on Claim 10 according to the new main request, reads as follows:

"1. A method for producing a foam-in-place structural reinforcement of hollow structures comprising the steps of:
providing an epoxy resin in a liquid form,
providing a thixotropic filler in the epoxy resin;
providing a blowing agent in the epoxy resin; the blowing agent having a thermoplastic shell filled with a solvent core;
providing an amine component, said amine component comprising an amine and a thixotropic filler; and
combining said epoxy resin and said amine component to form a flowable reactive mixture;
disposing the mixture on a substrate of the hollow structure and allowing said thermoplastic shell filled with a solvent core to soften from amine-epoxy exotherm and then expand due to gas pressure from said solvent core without addition of external heat to provide the structural reinforcement."

Claims 2 to 10 are dependent on Claim 1.

VI. In the oral proceedings the issues of clarity and consistency of Claim 1 of the main request and of inventive step of the claimed invention were discussed.

Concerning the requirements of Article 84 EPC, the Board pointed to a discrepancy between Claim 1 and the description of the application. According to Claim 1 the epoxy and the amine component, both containing the thixotropic filler, were provided in liquid form. A combination of both components should therefore result in a reactive mixture which was also liquid. This was not in agreement with the intention to provide a reaction mixture which was shear-thinning, ie not "liquid" before the application of shear as also demonstrated by the results of the Appellant's tests, according to which an "inventive" aramid-pulp-filled reactive mixture had indeed a paste-like consistency. Furthermore, the description indicated in the first paragraph of page 4 that the mixture could be of paste or solid consistency.

The Appellant's arguments as to the presence of an inventive step provided in writing and during the oral proceedings may be summarized as follows:

The whole teaching of D1 was directed to the use of dough-like compositions for car repair purposes by introducing these compositions into the cavities of damaged parts of a car, generating thereby reinforced hollow structures. Because of the dough-like consistency the compositions were not flowable and could not be used more generally for the reinforcement

of more complex cavities whatever their shape or accessibility.

In contrast thereto, the compositions used in the process of the invention were much more versatile because they had a thixotropic behaviour and could therefore be liquefied under load allowing the effective filling and consequential reinforcement of any desired cavity of a hollow car part.

It was not rendered obvious by D1 alone or in combination with the other cited documents to employ shear thinning, foamable and curable epoxy/amine compositions for the foam-in-place structural reinforcement of hollow structures.

VII. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims filed with the letter dated 15 August 2007, or alternatively on the basis of the set of Claims 1 to 10 of the first auxiliary request filed during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible

Main Request

2. *Clarity and consistency - Article 84 EPC*

As pointed out in item VI above, the contradiction between Claim 1, which indicates that the epoxy and

amine components filled with the thixotropic filler are provided as liquids, and the intention of the claimed invention to provide shear-thinning reactive compositions, ie compositions which are not liquid before the application of shear, leads to an inconsistency which contravenes the requirements of Article 84 EPC.

This conclusion is reached on the basis of the normal understanding by the skilled practitioner of the word "liquid", which means easily flowable, as distinct from "pasty", and is fully in agreement with Appellant's own understanding as expressed by its test report and also by its interpretation of document D1 (see below).

Therefore, the main request is not allowable.

Auxiliary Request

3. *Amendments - Article 123(2) EPC*

The amended Claim 1 complies with Article 123(2) EPC. Claim 1 is based on original Claim 10 and the introduced amendments are disclosed in the description as filed (basis: WO-publication 02/090427):

- producing foam-in-place structural reinforcement of hollow structures: page 3, lines 8/9;
- epoxy resin in liquid form: page 6, lines 5/6;
- disposing the mixture on a substrate of the hollow structure: page 10, lines 12 to 15 in conjunction with page 3, lines 8/9;
- expansion without addition of external heat: page 3, line 34 to page 4, line 2 in conjunction with page 10, lines 10/11.

Dependent Claims 2 to 10 which correspond to Claims 11 to 19 as filed are merely adapted in wording to Claim 1 and also meet the requirements of Article 123(2) EPC.

4. *Clarity and consistency - Article 84 EPC*

The objection under Article 84 raised against Claim 1 of the main request has been overcome in Claim 1 of the auxiliary request.
While the epoxy resin is provided in liquid form according to Claim 1, it is no longer stated that the epoxy component (resin plus thixotropic filler) has to be liquid. The requirement to be liquid has also been deleted for the amine component.

5. *Novelty*

The claimed process is novel over the prior art. In particular the pertinent document D1 does not disclose a foam-in-place reinforcement process in which the foamable reinforcing reactive epoxy/amine composition is thixotropic due to the presence of a thixotropic filler.

Section 3.2 of the decision under appeal states that the then-claimed subject-matter was different from the composition exemplified in D1 (i) by the mixture of materials being in liquid form, and (ii) by the use of a non-thixotropic filler, ie of hollow glass microspheres. In Section 3.4, however, the decision arrived at the conclusion of obviousness on the basis of the assumption that calcium carbonate and clays,

mentioned in the general part of D1's description, would be thixotropic fillers.

It follows from the above considerations under Article 84 EPC that there is in fact no different consistency of the mixed composition before shear. Notwithstanding this, there is no novelty conflict with D1 because the conclusion drawn by the Examining Division that the mention therein of calcium carbonate and clays was equivalent to the disclosure of a thixotropic filler cannot be accepted. As the skilled person is aware, and as confirmed by the Appellant's test report, not every calcium carbonate can provide thixotropy, and the same is true for clays (cf Appellant's submission dated 15 August 2007).

6. *Inventive step*

6.1 The subject-matter of the application

The application is concerned with foam-in-place structural materials on the basis of foamable two-component epoxy/amine compositions and their application for reinforcing hollow structures, such as cavities in automobile parts (WO publication, page 1, first paragraph and page 3, lines 8 to 11).

According to Claim 1 of the auxiliary request a process for producing foam-in-place structural reinforcement of hollow structures is provided which comprises the following steps:

– provision of a foamable epoxy component filled with a thixotropic filler and containing a blowing

agent composed of a temperature-softenable thermoplastic shell and a solvent core;

– provision of an amine component filled with a thixotropic filler;

– combining both components to form a reactive mixture flowable under shear;

– disposing the mixture on a substrate of the hollow structure; and

– allowing the exothermic reaction to proceed, leading to foaming and curing of the reactive mixture generating thereby a foam-in-place structural reinforcement material.

6.2 The closest prior art

D1 is representative of the closest prior art. It also discloses a method for reinforcing hollow structural members with a resin-based reactive system on the basis of a foamable, filled two-part epoxy/amine composition (column 1, lines 9 to 13; column 3, lines 5 to 19; column 4, lines 3 to 6 and column 8, lines 5 to 9). The system is particularly suitable as repair material for damaged car parts with the aim of restoring the original shape of the damaged part (column 1, lines 15 to 38). It is pointed out several times in D1 (column 2, line 66 to column 3, line 2; column 3, lines 48 to 52) that the reactive system has to have a dough-like consistency. Accordingly, the two (epoxy and amine) parts of the reactive system (designated "part A" and "part B") have a consistency such that no substantial flow of the material takes place (column 5, lines 61 to 65 in context with column 8, lines 18 to 20). This consistency is achieved by adding a

sufficient quantity of filler (column 7, lines 3 to 7 and column 8, lines 20 to 23).
The fillers may be selected from a number of components, including calcium carbonate and clays, listed in column 7, lines 17 to 25. As referred to above (paragraph 5) it is not disclosed in D1 that the properties of any of the fillers are such that they give a thixotropic behaviour to the reactive system.

6.3 Problem and solution

The claimed process differs from that disclosed in D1 in that - owing the use of thixotropic fillers - the reactive system used has "shear thinning" properties.

As stated in the application as filed (page 10, lines 3 to 9) and as convincingly argued by the Appellant in the oral proceedings, the reactive system according to the invention is able to fill hard-to-access cavities due to the flowability induced by the application of shear forces.

Therefore, the problem to be solved when starting from D1 is seen in the provision of a similar but more versatile foam-in-place process for hollow structures which allows the reinforcement of complex and difficult-to-access cavities.

The solution to the problem, namely the use of thixotropic fillers instead of conventional ones is, in the Board's judgment, not rendered obvious by D1.

There is no indication in this document which would motivate a skilled person to provide the reactive

epoxy/amine system disclosed therein in a form that it would be flowable under shear forces.
On the contrary, it is pointed out in column 5, lines 61 to 68 that the consistency of the A side (ie the filled epoxy resin component) of the reactive system is "compared to a kneaded bread dough" and should be sufficiently firm that "no substantial flow of the material takes place". It is furthermore stated that the consistency of the A-side should "be soft enough so that it can be easily kneaded or blended with side B" (which has the same consistency according to column 8, lines 18 to 20) "without undue effort by the repair person". This disclosure teaches away from the claimed invention because a skilled person would conclude therefrom that free flow (sag) under shear forces - which are imposed on the system during the kneading procedure - should be avoided.

This conclusion of the Board is not affected by the known existence according to D3 (US-A 5 783 272) of thermosetting epoxy/amine compositions comprising thixotropic fillers for the preparation of thin, tacky, non-pourable films (D3: columns 11/12, column 18, lines 34/35 and column 20, lines 19 to 22) because according to this document the thixotropic fillers are merely used to increase the resin viscosity in the same way as other fillers (column 9, lines 28 to 30; column 11, line 42 to 45). D3's disclosure does not therefore suggest the use of such compositions for the purpose of exploiting their shear-thinning properties for the filling of complex cavities of hollow structures.

7. *Conclusion*

From points 2 to 6 above the Board concludes that the subject-matter according to Claim 1 of the auxiliary request meets the requirements of the EPC.

Claim 1 and dependent Claims 2 to 10 are allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

- Claims 1 to 10 of the first auxiliary request filed during the oral proceedings;
- the description yet to be adapted.

The Registrar The Chairman

G. Röhn P. Kitzmantel