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D E C I S I O N
of 16 September 1997

Case Number: T 0614/96 - 3.4.2

Application Number: 90312528.4

Publication Number: 0434212

IPC: G02B 6/38

Language of the proceedings: EN

Title of invention:
Thermoplastic adhesive mounting for an optical fiber connector

Applicant:
Minnesota Mining and Manufacturing Company

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 113(2), 56

Keyword:
"Main request"
"Text submitted by the appellant (applicant): yes"
"Inventive step: yes"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0614/96 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 16 September 1997

Appellant: Minnesota Mining and Manufacturing Company
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Minnesota 55133-3427 (US)

Representative: Baillie, Iain Cameron
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 23 January 1996 refusing European patent application No. 90 312 528.4 pursuant to Article 97(1) EPC and Rule 51(5) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: M. Chomentowski
B. J. Schachenmann

Summary of Facts and Submissions

I. European patent application No. 90 312 528.4 (publication No. 0 434 212) was refused on the grounds that there was no text approved by the applicant (appellant) to serve as a basis for the grant of a European patent.

Following a communication under Rule 51(4) EPC informing the applicant that the Examining Division intended to grant a European patent with a text and drawings indicated therein, the applicant had expressed its disapproval and proposed no amendment.

The text with said communication corresponded in substance to the second auxiliary request filed by the applicant during foregoing oral proceedings and which, according to the minutes of said oral proceedings, the Examining Division had found allowable; a main request had been found to lack an inventive step as resulting from an obvious combination of **US-A-4 588 256,** which was cited in the original application and in the European Search Report but which had not been cited in the previous communications, with **the general knowledge of the skilled person**; in particular, the preferred ranges for viscosity, adhesion properties and hardness of an adhesive to be used to mount a fibre in the optical connector listed in claim 1 of the submitted main request were those which the skilled person would certainly select.

II. The appellant (applicant) lodged an appeal against this decision.

III. With the statement of grounds of appeal dated 24 May 1996, the appellant filed i.a. a main request with 11 claims, whereby the only independent claim reads as follows:

"1. An optical fibre connector for mechanical connection to effect optical connection wherein the bare end of an optical fibre is mounted in a solid adhesive to position the end of the fibre precisely and reliably,
characterised in that said solid adhesive is a thermoplastic resin which:

a) is softenable on heating to a molten viscosity of between 1 Pas and 10 Pas (1,000 and 10,000 cp) at a working temperature not harmful to the connector;

b) has an Adhesion-to-Glass Value, to restrain the fibre against pistoning, of at least 10 N wherein said Adhesion-to-Glass Value is measured by the following steps:

i) remove from one end of a piece of a 125-µm multimode optical fibre cable (Siecor 1K31-31111-00) 0.6 m in length, 10 cm of the jacket and 5 cm of the buffer to leave 5 cm of the bare fibre and clean said 5 cm of bare fibre with acetone;

ii) fill a cylindrical bore (6.4 mm in depth and 3.2 mm in diameter) of a steel fixture with said thermoplastic adhesive to be tested, wherein said thermoplastic adhesive is molten;

iii) insert said bare fibre into said fixture to its full length while the viscosity of said thermoplastic adhesive is from 1 Pas to 10 Pas (1,000 to 10,000 cp);

iv) let said thermoplastic adhesive cool to room temperature;

v) clamp the fixture into the lower jaw of an Instron Tensile Tester;

vi) wind the jacketed end of the optical fibre around a rod and clamp said jacketed end of said optical fibre on either side of the rod by the upper jaw of said Instron Tensile Tester, thus ensuring against slippage in the upper jaw;

vii) measure the resistance to pullout at a jaw separation rate of 6.4 mm/min; and

c) has a Shore D hardness of at least 60 at 20°C."

IV. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request. Moreover, the appellant mentioned that it did not immediately accept reduction to an auxiliary request and that it further requested oral proceedings if final rejection were threatened. The appellant argued as follows in support of its main request:

US-A-4 588 256, cited in the present application, is the nearest prior art. However, the characteristics of the known connector, in particular of the solid adhesive, and thus values listed in the second part of claim 1 of the present main request, are not mentioned in this document. According to the present application, **a problem** which is solved by the invention is that of **pistoning** of the optical fiber in the bore caused by **stresses arising from temperature changes (temperature cycling).**

The Examining Division has indicated that such a claim lacked an inventive step as resulting from an obvious combination of **US-A-4 588 256** with the general knowledge of the skilled person; in particular, the preferred ranges for viscosity, adhesion properties and hardness of an adhesive to be used to mount a fibre in the optical connector listed in claim 1 of the submitted main request were "ideal" values, i.e. those which the skilled person would certainly select.

However, these findings are not based on any cited document and, especially, the "ideal" specific values of the features listed in the second part of claim 1 of the present main request are not to be found as such in the prior art. Thus, it is not established that the values listed in claim 1 of the present main request would be arrived at only on the basis of the general knowledge of the skilled person. Moreover, the need to solve the specific problem caused by thermal cycling by these specific measures is not identifiable either from the prior art and it cannot be seen which reasons could have prompted the skilled person to make the measurements and select these "ideal" specific values of the listed features; thus, there is an unexpected effect, i.e. avoiding the consequences of thermal cycling; it is also to be noted that, even if the skilled person "could" have used materials with said optimal values of their properties, there is no indication about the reasons, why he "would" have done so. Therefore, the subject-matter of claim 1 of the present main request involves an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Formal requirements

2.1.1 The main request which the Board of Appeal is considering and upon which it is deciding has been submitted by the appellant and applicant for the present patent application (Article 113(2) EPC).

2.1.2 No formal deficiencies of claim 1 of the present main request have been detected. The following is also to be noted in this respect:

As compared to claim 1 submitted as second auxiliary request during the proceedings before the first instance and annexed to the communication under Rule 51(4) EPC, claim 1 of the present main request is distinguished in substance only in that it does not comprise the particular feature that the thermoplastic adhesive is **filled with glass microspheres** that are from 5 to 50 µm diameter. This particular feature was not comprised in an independent claim in the original application, but in a dependent claim, so that its deletion from claim 1 annexed to the above-mentioned communication, which had been found allowable, does not introduce subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC). Moreover, there is no indication that, without said particular additional feature in claim 1 with said communication, the matter for which protection was sought was ambiguously or insufficiently defined, or was defined in contradiction with the description and drawings. Therefore, claim 1 of the present main

request, obtained by deletion of said additional feature from a claim otherwise found allowable, is also clear in the sense of Article 84 EPC.

2.2 *Novelty*

An optical fibre connector comprising all the features of claim 1 of the present main request does not form part of the state of the art and is thus new in the sense of Article 54 EPC.

2.3 Inventive step

2.3.1 US-A-4 588 256 can be chosen as the nearest prior art because, according to the present application (see page 6, lines 29 to 31), an optical fiber connector in which the thermoplastic adhesive of the invention can be used is that of said document.

The optical fibre connector known from **US-A-4 588 256** (see column 2, lines 23 to 32; column 4, lines 18 to 27; column 7, lines 43 to 54; column 8, lines 10 to 22) is for mechanical connection to effect optical connection wherein the bare end of an optical fibre is mounted in a solid adhesive to position the end of the fibre precisely and reliably; in this connector, a hot-melt adhesive is used, which upon heating allows the fibre (84) to be inserted through the tube member (24) and upon cooling, to be anchored therein; alternatively, a cyanoacrylate adhesive can be utilized.

2.3.2 **US-A-4 588 256** does not provide any indication about the values of the features of the adhesive. Thus, it is not derivable that, in the known connector, the solid

adhesive is a thermoplastic resin with any of the features listed in the second part of claim 1 of the main request.

2.3.3 According to the present application (see page 6, lines 4 to 10) and to the statement of grounds of appeal (see page 2, last paragraph), **a problem** which is mentioned as being solved by the present invention is that of **pistoning** of the optical fiber in the bore caused by stresses arising from temperature changes (temperature cycling).

2.3.4 A claim comprising in substance the same features as claim 1 of the present main request has been found by the Examining Division to lack an inventive step as resulting from an obvious combination of **US-A-4 588 256** with the general knowledge of the skilled person; in particular, the preferred ranges for viscosity, adhesion properties and hardness of an adhesive to be used to mount a fibre in the optical connector listed in claim 1 of the submitted main request were "ideal" values, i.e. those which the skilled person would certainly select.

However, as convincingly argued by the appellant, these findings are not based on any cited document and, especially, the "ideal" specific values of the features listed in the second part of claim 1 of the present main request are not to be found as such in the prior art. Thus, it is not established that the values listed in claim 1 of the present main request would be arrived at only on the basis of the general knowledge of the skilled person.

As further convincingly argued by the appellant, the need to solve the specific problem caused by thermal cycling of connectors with thermoplastic adhesives by

these specific measures is not identifiable either from the prior art; thus, the fact that the problem referred to above, i.e. avoiding the consequences of thermal cycling, could be solved amounts to an unexpected effect. It cannot be seen which reasons could have prompted the skilled person to make the measurements and select the "ideal" specific values of the listed features. Indeed, even if the skilled person "could" have used materials with said optimal values of their properties, there is no indication about the reasons why he "would" have done so.

2.3.5 Incidentally, the following is to be noted in this respect:

Example 6 of the present application (see page 9, line 11 to page 10, line 30, more especially page 10, lines 28 to 30) shows that connectors corresponding in substance to those of claim 1 of the present main request exhibit a very low temperature-induced optical transmission loss; 0.12 dB is mentioned to be satisfactorily low for use with multimode fibers. In Example 8 of the present application (see page 11, line 9 to page 12, line 14, particularly page 12, lines 9 to 12; see also page 4, line 16 to page 5, line 3), this loss is particularly low when the thermoplastic adhesive is loaded **with glass microspheres** (which reduce the temperature coefficient of expansion of the adhesive), and a value of 0.6 dB is specified. Thus, since there is no indication that the results **without microspheres** in the solid adhesive are to be considered as less adequate than those with microspheres, i.e. those in accordance with the request which had been **found allowable by the Examining Division**, it cannot be concluded that the problem stated in the present application is not solved by the connector of claim 1 of the present main request.

2.3.6 Therefore, having regard to the state of the art, the subject-matter of claim 1 of the present main request is not obvious to a person skilled in the art and thus involves an inventive step in the sense of Article 56 EPC.

2.4 Consequently, the claim is allowable in the sense of Article 52(1) EPC and a patent can be granted on this basis, with the description to be adapted, so that the auxiliary requests of the appellant and its request for oral proceedings can be left aside.

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 grant a patent on the basis of claims 1 to 11 filed by the appellant with letter dated 24 May 1996 and of the drawings (1 sheet) as originally filed, with the original description to be adapted.

The Registrar:

P. Martorana

The Chairman:

E. Turrini