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D E C I S I O N
of 23 May 2001

Case Number: T 0861/99 - 3.4.2

Application Number: 94120014.9

Publication Number: 0664466

IPC: G02B 6/38

Language of the proceedings: EN

Title of invention:

Ferrule

Applicant:

SUMITOMO WIRING SYSTEMS, Ltd.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 123, 54, 56

Keyword:

"Amendment - admissible (yes)"
"Novelty - yes (after amendment)"
"Inventive step - yes"

Decisions cited:

-

Catchword:

-



Case Number: T 0861/99 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 23 May 2001

Appellant: SUMITOMO WIRING SYSTEMS, Ltd
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Representative: Kuhnen & Wacker
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 20 April 1999
refusing European patent application
No. 94 120 014.9 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: M. A. Rayner
V. Di Cerbo

Summary of Facts and Submissions

I. The applicant has appealed against the decision of the examining division refusing European patent application 94 120 014.9. The invention concerned a ferrule fitted to an optical fibre.

Included in the documents mentioned in the examination procedure before the first instance are the following:

D1: US-A-4 510 005

D2: US-A-4 695 124

During the proceedings before the examining division, the appellant referred to omission of adhesive as a feature of the invention. His submissions culminated in the presentation of a claim including the feature "without intervention of any adhesive". In the minutes of the oral proceedings, the opinion is however expressed by the examining division that the application documents as filed do not provide an unambiguous disclosure of the feature. The fact that an adhesive is not mentioned in any of the embodiments cannot be interpreted as meaning that it excludes under all circumstances a fibre end being held by an adhesive. The division also observed that the sheath holding the ferrule according to the application (see page 3, lines 18 and 19) has an outer diameter slightly greater than the outer diameter of the sheath so that the sheath will not be held by friction, which is interpreted as a hint towards the presence of adhesive rather than the absence thereof. However, in a communication preceding the oral proceedings, also with reference to the diameters, the division had indicated

that the description does not make clear exactly how the sheath is held in the ferrule but since no adhesive is to be used, it was imagined that a mechanical fixation like that of document D2 is to be used. The upshot of the discussion during the oral proceedings about the "without intervention of any adhesive" feature was that the applicant presented claims in which this feature was omitted.

In the decision under appeal itself, the division referred to a flare angle of about 20° derivable from Figure 4 of document D1 and reached the conclusion that the subject matter of claim 1 of the then main request was not novel and that that of the amended auxiliary requests were not admissible under Article 123(2) EPC.

On the question of the feature relating to "without intervention of any adhesive" which was not present in any of the various claims 1 up for decision by the division, it was incidentally mentioned in connection with a dependent claim that the ferrule according to document D2 did not use adhesive and is capable of surviving a heating cycle test. Moreover, it was obvious that this teaching could be applied to that of document D1 for the stripped plastic end portion.

- II. In the statement setting out the grounds for appeal, the appellant submitted that absence of adhesive is disclosed in the application papers as originally filed. In particular, the application discloses the prior art as using adhesive to solve sinking and crack generation. The specific description of the application itself concentrates on the front end of the fibre and the result of tests of varying flaring angles are shown in Table I. The description does not mention adhesive

and nor is it shown in the drawings. Thus its absence is directly and unambiguously disclosed. Document D1 does not show a flaring angle systematically not more than 30°, nor does it teach the concept of the present application to use a specific geometry of the fibre end to avoid cracks and sinking in. A surprising effect of flaring the tapered inner surface of the ferrule at a specific angle of not more than 30° is being able to avoid use of adhesive without sinking and cracks and without the disadvantage of a plastic cylinder of the same thermal coefficient as the optical fibre as taught by document D2.

III. The board issued a preliminary opinion and in reply thereto, the appellant requested that the decision under appeal be set aside and a patent granted on the basis of the documents identified in the reply as well as on an auxiliary basis oral proceedings.

IV. Claim 1 according to the request of the appellant is worded as follows:

A ferrule fitted on an end of a plastic fiber comprising:

a tubular core wire holding portion (12) receiving and holding adhesive-free a core wire portion (b) of the plastic fiber (A); and

a tubular sheath holding portion (11) receiving and holding a sheath portion (a) of said plastic fiber (A), the plastic fiber (A), when not held, undergoing shrinkage relative to the ferrule during thermal shocks caused by different thermal expansion coefficients of the ferrule, sheath and core wire, and

said core wire holding portion (12) including a large-diameter portion (13) at a front end thereof having a

tapered inner surface such that an inner diameter thereof increases towards the front end, the angle at which said tapered inner surface is flared being not more than 30 degrees.

Reasons for the Decision

1. The appeal complies with the provisions mentioned in Rule 65(1) EPC and is therefore admissible.

2. *Admissibility of amendments (Article 123(2) EPC)*

2.1 Compared with the documents as filed, present claim 1 has had introduced thereto the following wording, now referenced (a), (b) and (c) by the board for convenience:

(a) fitted on an end of a plastic fiber

(b) adhesive-free, and

(c) the plastic fiber (A), when not held, undergoing shrinkage relative to the ferrule during thermal shocks caused by different thermal expansion coefficients of the ferrule, sheath and core wire.

Consequential grammatical changes were made to the claim, which also had reference numerals introduced thereto in accordance with Rule 29(7) EPC. The introductory part of the specification has been adapted to the independent claim and to discuss the prior art {Rules 27(1)(b) and (c)}.

2.2 Figure 1 of the documents as filed shows a ferrule

fitted on the end of a plastic fibre, so that feature (a) was present in the documents as filed. The original disclosure of feature (c) can be found in lines 10 to 15 on page 2, which set out the starting point for the invention.

Conflicting signals about admissibility in the sense of Article 123(2) EPC of an amendment pertaining to a feature like feature (b) are present in the proceedings before the first instance. On the one hand "no use of adhesive" seems to have been accepted in the communication before the oral proceedings and moreover the feature "without intervention of any adhesive" present in claim 5 was incidentally mentioned in the decision under appeal solely with reference to Article 56, implying admissibility under Article 123(2) EPC was not challenged. On the other hand, during the oral proceedings, no decision was necessary on the feature because the negative "opinion" on admissibility advanced at that time occasioned cancellation thereof.

The board observes that no reference is made to adhesive in the specific description or drawings. During the examination proceedings, the first instance was however concerned that no explicit exclusion of adhesive "under all circumstances" is present. Consideration of the application as a whole and especially the introduction thereof nevertheless reveals that this feature is indeed directly and unambiguously derivable from the application documents as originally filed. The reason for this is that having explained the problem of sinking in and cracking (lines 10 to 20 on page 2), lines 16 and 30 on page 2 then teach that the plastic fibre *has been* fixed by adhesive. In line 30, it is explained that use of

adhesive avoids sinking in and cracking. However, the disadvantage of this approach is then given, namely that it is necessary to wait for the adhesive to dry, leading to poor productivity. The board notes, in particular, the use of the perfect tense in "has been fixed", which means that from the viewpoint of the patent application, use of adhesive is in the past, i.e. something already tried and other than the patent application. Thus, from the same starting point the stated object of the invention remains that of avoiding sinking in and cracking, which necessarily means that a fresh approach to that already dealt with in relation to adhesive is used as is confirmed by adhesive not being shown in the specific description. The board agrees with the view expressed in the communication of the examining division that the description does not make clear exactly how the sheath is held in the ferrule but sees no reason in the light of page 3, lines 18 and 19 of the specification to speculate about hints to adhesive in relation to the amended claim, i.e. to feature "a tubular core wire holding portion (12) receiving and holding adhesive-free a core wire portion (b) of the plastic fiber (A)" in claim 1. Likewise open ended speculation about absence of adhesive "under all circumstances" is not related to the disclosure of the patent application, but to undefined "circumstances".

2.4 Therefore, the board is satisfied that documents according to the request of the appellant satisfy the requirements of Article 123(2) EPC.

3. *Novelty (Article 54 EPC)*

3.1 Document D1 discloses with reference to Figure 1, one

end of a fiber optic cable 10, including an outer jacket 12 with a central optical fiber 14 to be terminated by a ferrule 16. Initially, the optical fiber includes an unpolished end face 18, which must be highly polished in order to permit efficient transmission of light. The ferrule is formed with a hollow, cylindrical bore 20 and a smaller diameter hollow, cylindrical bore 22, suitably sized so as to permit the ferrule to be fitted onto the cable as shown in Figure 2. Either or both of the hollow portions 20 and 22 may be tapered to facilitate holding the cable and fiber. A heat bonding agent 24 is placed between the ferrule and the fiber optic cable so that the ferrule can be heat bonded to the cable. The ferrule is flared at the end of its narrow bore to provide a cavity 26 into which the fiber, when softened, can flow as it is urged against mold 28 during polishing and forming of the end face. A flared end portion is shown in Figure 4 with a flare angle by inspection of approximately 20 degrees, although no specific angle or any significance thereof is mentioned in the document. Document D1 discloses the optical fibre being made of glass, plastic or quartz and materials suitable for the ferrule as metals, ceramics and glasses.

3.2 Accordingly, the subject matter of claim 1 differs from the disclosure of document D1 by virtue of the "adhesive-free" feature. In addition, taking the possibilities contained in the disclosure of document D1 as a whole, an explicit choice of material (plastic fibre) and range of flare angle is made.

3.3 Document D2 discloses in Figures 1 and 2, a plastic optical fiber cable 1, which is formed of a plastic optical fiber 2 and a plastic sheath 3 for covering the

outer periphery of the core 2. The core is formed, for example, of alkyl methacrylate resin, or polystyrene resin, the cladding is formed, for example, of fluorine-containing polymer, or alkyl methacrylate resin, and the plastic sheath is formed of thermoplastic resin. The plastic sheath 3 is removed for a suitable length from the end of the plastic optical fiber cable 1, thereby exposing the end of the plastic optical fiber 2. The end of the core 2 is enlarged in a flared shape and the end of the core 2 is formed into an enlarged part 2a. In Figures 1 and 2, reference numeral 4 designates a ferrule, which is axially formed as a combination of a plastic cylindrical member 5 which forms the terminal end of the ferrule 4 and a metal cylindrical member 6 which forms the base end of the ferrule 4. The plastic cylindrical member 5 is made of thermoplastic resin such as polyesters, and the metal cylindrical member 6 is made of metal such as aluminum or brass. The plastic cylindrical member 5 has a bore capable of containing the end of the plastic optical fiber 2 therein, and the inner peripheral surface 5a of the end of the cylindrical member 5 is enlarged in a flared shape. Moreover, according to line 65 et seq. of column 2, part of the ferrule is formed of plastic, and corresponds to the plastic optical fiber of the plastic cylindrical member. Consequently, the optical fiber core is not affected by the influence of the heating cycle which occurs when the materials of both are different, and damage to the core when treated by a heating cycle can be accordingly avoided.

3.4 Accordingly, the subject matter of claim 1 differs from the disclosure of document D2 by virtue of the flare angle of not more than 30 degrees and the functional

feature relating to the plastic fibre (A), which when not held, undergoes shrinkage relative to the ferrule during thermal shocks caused by different thermal expansion coefficients of the ferrule, sheath and core wire.

3.5 No other available document comes closer than document D1 or D2 to the subject matter of claim 1 so that the requirements of Article 54 EPC are satisfied.

4. *Inventive Step (Article 56 EPC)*

4.1 In the opinion of the board, the closest prior art is to be found in document D2, because it also starts from an adhesive based configuration, shows a flare angle and addresses the problem of adhesive drying time (see column 1, lines 60 to 63) by dispensing with adhesive. However, the way this is achieved necessarily involves use of plastics in the ferrule corresponding to the plastic of the wire portion. The problem solved by the novel features of the claim is to find an alternative adhesive free configuration. The importance of the flare angle in this context is not recognised at all in the teaching of document D2 and thus the subject matter of present claim 1 including the flare angle specified cannot be reached in an obvious way therefrom. No help in this respect is provided by document D1 because an arrangement employing adhesive is disclosed, in other words a step backwards is taken from document D2, which is a course running counter to the teaching of document D2 and which the skilled man accordingly would not have followed. Therefore, the subject matter of claim 1 cannot be reached in an obvious way by starting from the teaching of document D2 in a combination with that of document D1.

4.2 If, on the other hand, document D1 is taken as starting point, the problem solved by the novel features of the invention is to provide a ferrule fitted on an end of a plastic fiber which can be produced more quickly because it does not involve waiting for adhesive to dry. While adhesive is not used according to the teaching of document D2, the board considers that the skilled person would not have applied this teaching to that of document D1 without also applying the "corresponding plastic" feature as explained in line 65 et seq. of column 2 which is contrary to the claimed "thermal expansion coefficients" feature. This is because the use of a "corresponding plastic" for ferrule and fiber is the thrust of document D2 in relation to avoidance of adhesive, the teaching of which accordingly would have been directly followed. Moreover, in view of the differing flare angle magnitudes in document D1 and the flare angle shown in document D2, even in a combination of the documents, whether the flare angle produced would have satisfied claim 1 is at best indeterminate. Therefore, the subject matter of claim 1 also cannot be reached in an obvious way by starting from the teaching of document D1 in a combination with that of document D2.

4.3 Accordingly the subject matter of claim 1 is considered as involving an inventive step and therefore to satisfy Article 56 EPC. The same conclusion applies to claim 2 in view of its dependence from claim 1.

4.4 No other available document comes closer to the invention than document D1 or D2 so that the inventive step of the subject matter of claim 1 is not called into question thereby.

5. Having convinced itself that the patent application satisfies the requirements of the Convention, the board, in accordance with Article 111(1) EPC, considers it appropriate to exercise the power within the competence of the examining division to order grant of a patent. Since the board is not deciding against the request of the appellant, the oral proceedings requested on an auxiliary basis by the appellant are not necessary.

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 with the following description, claims and drawings:

description:

pages 1, 2, 2a (text to be inserted on page 2) and 3
filed with the letter of 19 June 2000
pages 4 to 6 of the description as originally filed

claims:

claims 1 to 2 filed with the letter of 19 June 2000

drawings:

sheets 1/4 to 4/4 as originally filed,

The Registrar:

The Chairman:

P. Martorana

E. Turrini