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Bezeichnung der Erfindung: Optical fiber connectors
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G02B 7/26

ENTSCHEIDUNG / DECISION

vom / of / du 18 September 1990

Anmelder / Applicant / Demandeur : GTE Laboratories Incorporated

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire

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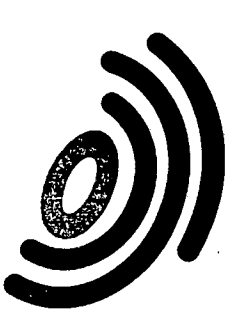

Case Number : T 218/88 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 18 September 1990

Appellant : GTE Laboratories Incorporated
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Representative : Grünecker, Kinkeldey, Stockmair & Partner
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Decision under appeal : Decision of Examining Division 041 of the European Patent Office dated 10 December 1987 refusing European patent application No. 81 100 254.2 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : J. Roscoe
Members : C. Black
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 81 102 254.2 (publication number 0 032 722) was refused by decision of the Examining Division.

II. The reason given for the refusal was that the subject-matter of Claim 1, though novel, lacked an inventive step having regard to the following documents:

FR-A-2 334 969 (D1)
FR-A-2 349 150 (D2)
DE-A-2 722 367 (D3).

III. The Appellant lodged an appeal against the decision.

IV. The Statement of Grounds of Appeal was accompanied by three different sets of claims (main and first and second auxiliary motions) and the Appellant requested that a patent be granted on the basis of one or other of these sets of claims.

V. In a response, filed on 21 July 1989, to a communication of the Board raising objections under Article 123(2) EPC and formal objections to all three sets of claims, the Appellant withdrew his earlier requests and, following a suggestion of the Board, filed a new independent Claim 1, appendant Claims 2 to 11 and new pages of description adapting the description to the revised claim formulation.

The Appellant is now requesting that the appealed decision be set aside and a patent granted on the basis of the following documents:

Claims 1 to 11 filed on 21 July 1989;
description - pages 1 to 5 and 14 filed on 21 July 1989
and
pages 8 to 13 and 15 to 19 as originally filed;
drawings - Figures 1 to 4 as originally filed.

Claim 1 reads as follows, with obvious errors corrected by the Board:

"An optical fiber connector body (17) with a reference surface (26), with a lens having a convex surface (18) molded into said connector body and with a third surface (27), forming a focal plane of said lens and having a point (16) thereon one focal length from the convex lens surface (18), said third surface (27) being parallel to said reference surface (26), characterized in that

(a) said connector body (17) is integrally molded in one piece of optical quality transparent plastics material

(b) that said convex lens surface (18) is recessed inward from said reference surface and that

(c) said reference surface (26) constitutes one end face of the body and is accurately plane and perpendicular to the axis of the lens surface so that, when the reference surface is held against the corresponding surface of a similar body the optical axes of the lens surfaces are automatically aligned with each other."

VI. The Appellant argued that for investigating an inventive step it did not appear right to argue, as the Examining Division had done, what would happen when an integrated moulding of the outer element (housing) of D1 together with the lens body would be carried out.

The connector bodies of D1 and D2 had the disadvantage that because the lens surface formed a projection on the external surface of the moulded body it was liable to get scratched before assembly into the complete connector to the detriment of transmission properties of the latter. The problem to be overcome was to provide an optic fibre connector allowing an easy and quick connection of optic fibres, and providing insensitivity of its optical transmission under such conditions.

Although the lens surface in Figure 1 of D1 was recessed from reference surface 31, this surface was not integral with the lens body. Therefore, this document gave no hint to the claimed structure and the same applied to D2. None of the cited documents relating to connector bodies for optical fibres showed or gave any hint towards the characterising features of Claim 1. The only document disclosing a unitary body incorporating a lens surface and an integral ring surrounding it was US-A-3 649 098, hereafter D5. In this body, intended exclusively for connecting an optic fibre bundle to a panel, there was, however, no third surface forming a focal plane of the lens. Since this document did not deal with fibre connectors and the problems which arose in their design, its teaching was not relevant to the problems underlying the present invention.

Reasons for the Decision

1. The appeal is admissible.

2. The amendments made to the application documents are admissible.

Claim 1 is a combination of the features of the originally filed Claim 1 with information relating to the reference surface derived from page 10, line 30 to page 11, line 2, and page 15, lines 4 to 7 of the original description.

The amendments to the description serve only to eliminate now redundant matter, to indicate the background art in the manner required by Rule 27(1)(c) EPC and to satisfy the requirements of Rule 35(12) EPC relating to units of measures. They do not, therefore, introduce matter which was not originally disclosed (Article 123(2) EPC).

3. Novelty

3.1 Since Claim 1 includes all the features of the Claim 1, the subject-matter of which was found to be novel by the Examining Division (see item of the Statement of Reasons for the Decision), the Board deems it unnecessary to deal with this matter in great depth.

3.2 The following remarks apply to the documents referred to in the decision or in the examination proceedings leading up to it.

Although the connector bodies disclosed in documents D1, D2 and D3 and in FR-A-2 340 558 (hereafter D4) are all formed from one piece of transparent plastics and incorporate a convex lens surface, this surface is not recessed from a surface of the body as Claim 1 requires.

On the other hand, although in the moulded polycarbonate lens structure of the fibre optic assembly disclosed in D5 the convex lens surface is recessed inwardly from an annular surface, there is nothing in this document to suggest that this surface should be accurately plane and normal to the lens axis to enable alignment of the axes of two such structures by abutment of their surfaces.

Furthermore, the focal plane of the lens does not lie on any surface of the body.

The Japanese document JP-A-554 043 referred to in a communication from the Board is still less relevant.

3.3 For the above reasons, the subject-matter of Claim 1 and hence that of the remaining claims, which are all appendant to it, is considered to be novel within the meaning of Article 54 EPC.

4. Inventive step

4.1 Although more than one of the prior art documents discussed under item 3.2 above describes connector bodies having all the features of the preamble of Claim 1, the connector body which comes closest to the subject-matter of the claim is, in the Board's opinion, that described with reference to Figure 2 of document D1 in which the reference surface is identified as 35, the convex lens as 33, and the third surface as the base of the narrowest part of the recess.

4.2 A major advantage of the claimed connector body over this known structure is that the characterising features enable the structure of the connector as a whole and its assembly to be simplified, without any deterioration in the axial alignment of the axes of the lens surfaces which ensures

low loss transmission between the fibres, the ends of which will, as is conventional, lie in planes normal to these axes. This is achieved by forming the end surface of the connector body so that it alone, in association with a corresponding surface of a similar body, assures alignment of the optical axes of the lens elements. Another advantage is that there will be less risk of damage to the lens surface during handling and assembly into the connector as a whole.

4.3 Therefore, the main problem to be solved is to be seen as that of reducing the complexity of the prior art structure without losing its optical advantages.

4.4 The skilled person in every field of technology is constantly striving not only to improve the performance of existing devices but also to reduce their complexity and cost without sacrificing performance, therefore no contribution to inventive step is to be seen in recognition of the above-mentioned problem.

4.5 The question remaining to be answered is thus whether the state of the art represented by the above cited documents would render it obvious for the skilled person, aware of the problem, to modify the connector of document (1), Figure 2 to the claimed form, which differs from it in requiring that

(a) the connector be moulded in one piece of optical quantity transparent plastics material;

(b) the convex lens surface be recessed inwardly from a reference surface;

(c) this reference surface should constitute one end face of the body and be accurately plane and perpendicular to the axis of the lens surface, so that when the

surface is held against the corresponding surface of a similar body the optical axes of the lens surfaces are optically aligned with each other.

4.6 With regard to difference (a) it is to be noted that the document D1 simply states that the connector body is a single block of material and makes no reference to plastics or moulding. However, members performing the same dual role of lens and optical fibre guide in the connectors disclosed in documents D2, D3 and D4 are stated to be of plastics and in document D3 (page 8, line 35 - page 9, line 1) it is stated that the relevant member can very advantageously be a one-piece plastics moulding. Thus, no inventive step can be seen in the selection of optical quality plastics as the material for the connector body in document D1 and moulding as the technique for forming it.

4.7 In document D1 the Board can find nothing which would suggest to the skilled person to redesign the connector body shown in Figure 2 with the reference surface (abutment) 35 brought forward beyond the lens surface for any reason. The fact that this document presents the monobloc structure of Figure 2 as a mere alternative to the two-part structure of Figure 1 does not teach the skilled person to form further functional structures with the monobloc as the Examining Division has assumed. The prior art available to the Board shows no structure equivalent to the ferrule 25 or 29 combined with a lens or fibre guide in a transparent body.

Although the manner in which the termination disclosed in D2 is joined to another termination is not in fact stated, the Board does not accept the view apparently adopted by the Examining Division in its decision that the ferrule 25 in document D1 has the same function as the hollow cylindrical portion of the unitary plastics body 11 in

Figure 2 of D2. In the Board's view, that cylindrical portion is equivalent to the rear-end cylindrical part of the body seen in Figure 2 of D2 and does not and cannot serve the purpose of alignment and connection fulfilled by the forward end of ferrule 25.

Furthermore, the annular conical guide 32 which may be integrated with lens body 11 in D2 has a function quite different from the ferrule and corresponds to the tapered recess in D1.

4.8 It is not, therefore, considered that the skilled person without hindsight would be led by the teaching of D1 alone or when considered in combination with that of D2 to the idea of forming the tube 25 or 29 in Figure 1 of D1 integral with the lens-fibre guide unit. Nor do any of these documents provide him with a reason to restructure the unit itself or the corresponding units in D2 or D3 to provide a reference surface in relation to which the lens surface is recessed while retaining all the other elements of these connectors.

4.9 The contention of the Examining Division that it would be obvious to form the tube 20 surrounding the lens-fibre guide body in Figure 4 of D3 integral with the body in optical quality plastics material also has to be rejected. No statement can be found in this document which might lead the skilled person to do so, and indeed the presence of elastic disc 25 between the tube 20 and the lens-guide body in the preferred arrangement, to allow movement between them, would be a disincentive to combine them. Furthermore, were the skilled person to seek guidance in D1 on possible ways of modifying this connector he would find there no suggestion to combine members having the corresponding functions.

4.10 Even if the skilled person were to have hit upon the idea of combining the aforementioned tubular members in D1 or D3 with the lens-fibre guide unit into a single entity moulded in optical quality transparent plastics, he would still not have arrived at the subject-matter of the present Claim 1 which requires (feature (c)) the reference surface from which the lens surface is recessed to be such that when it is held against the corresponding surface of a similar body the optical axes of the lens surfaces are automatically aligned. None of the above-mentioned documents makes any reference to such a requirement.

Although it is not explicitly stated in D1, the skilled person sees that alignment of the lens axes is assured by cooperation of the annular engaging surfaces of the tubular ferrules 29, 25 and of the inner surfaces of the ferrules with the peripheral surfaces of the associated lens-fibre guides and that the end surface 30 of ferrule 25, contrary to the view expressed by the Examining Division, has no role to play in this.

On the other hand, in D3 alignment is assured by the exact straightness of the tube 10 (see page 13, lines 25-30) and the accurate fitting of the lens-fibre guide body in the tubes 20 and of these tubes in the tube into the ends of which they are inserted.

Thus, there would be no reason if simply combining the lens-fibre guide body and the surrounding ferrule in either D1 or D3 to ensure that the end surfaces fulfilled the requirements of feature (c) of Claim 1, even if these surfaces do come into contact with corresponding surfaces. In D1, the surfaces merely ensure maintenance of the non-critical axial spacing of the lenses whereas in D3 the bayonet connectors 24 assume this role.

4.11 The Board can find nothing in D4 or in any of the other documents to suggest that any useful purpose would be served by combining the spacer ring in Figure 3 with either of the lens-fibre guide bodies. Furthermore, in this arrangement also axial alignment is assured by other means (see page 2, lines 71-75).

4.12 Finally, there appears to be nothing in D5 which would lead the skilled person charged with simplifying any of the connectors disclosed in any of D1 to D4 to effect changes which would result in the claimed structure. This document discloses only a self-retaining fibre optic lens and makes no reference to problems concerned with alignment of a pair of light fibres. Nor does it disclose the combining of one body with another body into which it normally slidably fits into a single moulded unit.

4.13 For the above reasons, the Board finds that the subject-matter of Claim 1 and therefore also that of the appendant Claims 2 to 11 is not only novel but also involves an inventive step within the meaning of Article 56 EPC.

Order

For these reasons, it is decided that:

1. The appealed decision is set aside.

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

Claims 1 to 11 as filed on 21 July 1989, with obvious errors corrected as follows:

line 1: reference numeral 17' amended to 17
line 4: "focus" amended to "focal"
line 6: reference numeral 17 amended to 18
line 10: "plactics" amended to "plastics".

Description - pages 1 to 5 and 14 filed on 21 July 1989; and
pages 8 to 13 and 15 to 19 as originally filed;
Drawings - Figures 1 to 4 as originally filed.

The Registrar: The Chairman:

P. Martorana J. Roscoe