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D E C I S I O N
of 24 January 1997

Case Number: T 0468/96 - 3.4.2

Application Number: 91200068.4

Publication Number: 0441419

IPC: G02B 6/28, G02B 6/14

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Title of invention:
Fibre optic assembly

Patentee:
General Motors Corporation

Opponent:
-

Headword:
-

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

Keyword:
"Subject-matter extended - no; clarity - yes"
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0468/96 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 24 January 1997

Appellant: GENERAL MOTORS CORPORATION
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Decision under appeal: Decision of the Examining Division of the European Patent Office posted 19 January 1996 refusing European patent application No. 91 200 068.4 pursuant to Article 97(1) EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I. European patent application No. 91 200 068.4 (publication No. 0 441 419) was refused on the grounds that the subject-matter of the submitted claim 1 lacked an inventive step having regard to D1 = US-A-4 213 670 and D3 = Patent Abstracts of Japan, vol. 6, No. 129 (P-128) (1007), 15 July 1982 & JP-A-57-54 913, interpreted by taking into account the corresponding pre-published JP-B2-62-57 966 and the translation thereof provided by the applicant (appellant).

The Examining division took the following view:

The submitted fibre optic assembly for coupling signals between optical fibres comprising first and second sets of optical fibres was distinguished from the assembly known from D3 only in that the optical coupling means of said known assembly was not a ribbon; in particular, the feature of the claimed device that the optical fibres had no jacket enveloping the core of the fibre was also known from D3 wherein parts shown in Figure 2 and mentioned as clads were derivable from the corresponding text as being optical clads forming part of the fibre and confining the light withing the fibre, and not as being further protective plastic jackets of fibres. Since the "ribbon" feature was known from D1, in the same technical field, where it was used for the same purpose, the mere replacement of the rigid coupler of D3 by theequivalent ribbon element of D1 did not involve an inventive step.

II. The appellant lodged an appeal against this decision.

III. In the communication dated 20 September 1996, the Board of appeal expressed the opinion that the main claim filed with the statement of grounds of appeal appeared to lack clarity because in particular one of the features which could be necessary for solving the problem of the invention was missing, and, consequently, appeared to lack also an inventive step because, starting from D3, it was not apparent whether the stated problem could be solved. However, the Board indicated some amendments to the main claim by which these objections could possibly be met.

IV. With letter dated 16 December 1996, the appellant declared that it agreed with the amendments indicated by the Board and requested that the decision be set aside and a patent granted on the basis of this claim and of the other application documents on file consisting of the dependent claims Nos. 2 to 9 filed with applicant's letter of 23 December 1994, pages 1 and 3 to 9 as originally filed with the amendment (deletion of lines 1 to 3) on page 3, as requested in applicant's letter of 23 December 1994, page 2 filed with applicant's letter of 23 December 1994, of the description, and sheets 1/3 to 3/3 of the drawings as originally filed.

The amended new main claim reads as follows:

"1. A fibre optic assembly for coupling signals between optical fibres comprising first and second sets of optical fibres (18, 20), each set having contiguous fibre ends (28) arranged in a first or second linear array (18', 20') respectively; optical means (48) comprising a curved centre portion (54) and first and second end portions (50); and holding means (30, 40) for holding each linear array of fibre ends in substantial alignment with its associated end portion so as to couple signals between the fibres and the

optical means; wherein the first end portion (50) lies substantially in the same plane as the first linear array (18') of fibre ends and the second end portion (50) lies substantially in the same plane as the second linear array (20') of fibre ends, the planes of the first and second end portions (50) lying spaced from and substantially parallel to one another and said end portions (50) being approximately thinner than the diameter of the associated fibre ends (28); characterised in that the optical means is an optical ribbon (48); in that the fibre ends (28) are the bare ends of the optical fibres, with removed jackets (26); in that each linear array has a width substantially equal to the sum of the diameters of the fibre ends of its respective set of fibres; and in that each end portion (50) has a width substantially the same as the width of its associated linear array of fibre ends."

V. The appellant submitted the following arguments in support of its request:

In the fibre optic assembly for coupling signals between optical fibres shown in D3, the optical fibres (19) have a core (19a) which is of the same refractive index as the internal optical wave directing layer (13) of the optical means of the coupler and which is substantially of the same thickness as said layer. Moreover, the optical fibres (19) have enveloping elements mentioned as being "clads", which are actually jackets, which provide gaps between adjacent optical fibres (19) which do not contribute to the transmission of light. Parts enveloping the fibres (18) and which do not contribute to the transmission of light are also shown in D1. One of the aims of the invention is to provide a coupler which minimises insertion losses from/to the optical fibres. As a first step towards achieving this aim, the width W of the optical means of the coupler, i.e. the ribbon, is made substantially

equal to the sum of the diameters of the light transmitting portions of the optical fibres. Since both documents show elements enveloping the fibres, neither D3 nor D1 has the claimed feature concerning the specific width of the optical ribbon and their combination consequently does not lead in an obvious way to the claimed device.

Reasons for the Decision

1. The appeal is admissible.

2. *Allowability of the amendments*

Present claim 1 is based mainly on original claim 1. The indication in present claim 1 about the thickness of the optical means, i.e. the ribbon, as compared to the diameter of the fibre ends, whereby the diameter of the ribbon is approximately smaller than the diameter of the fibre ends (28) of the fibre (24), said fibre ends being with removed jacket (26), is derivable from the original application (see page 4, lines 16 to 21; page 7, line 1 to page 8, line 29; Figures 1 and 3). Therefore, the application satisfies the requirement of Article 123(2) EPC that a European patent application may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed.

3. *Clarity*

Present claim 1 comprises all the features essential to the performance of the invention, in particular those concerning the thickness of the optical means, i.e. the

ribbon, as compared to the diameter of the fibre ends. Since moreover these features correspond to the indications derivable from the description and the drawings, present claim 1 is clear in the sense of Article 84 EPC.

4. *Novelty*

Novelty has not been questioned, and the amendments have not modified in substance this situation (Article 54 EPC).

5. *Inventive step*

5.1 A fibre optic assembly for coupling signals between optical fibres is known from D3, i.e. JP-B2-62-57 966 (see figure 2; page 2, last paragraph to page 3, first paragraph and page 4, last paragraph to page 7, first paragraph of the accompanying English translation); said assembly comprises first and second sets of optical fibres (17, 18; 19), each set having contiguous fibre ends arranged in a first or second linear array respectively; optical means (11), comprising an internal optical wave directing layer (13) lodged between two enveloping dielectric layers (12, 14), said optical means (11) comprising a curved centre portion and first and second end portions (15, 16); the assembly also comprises holding means for holding each linear array of fibre ends in substantial alignment with its associated end portion so as to couple signals between the fibres (17, 18; 19) and the optical means (11); in the known assembly, the first end portion of the optical means (11) lies substantially in the same plane as the first linear array (17, 18) of fibre ends and the second end portion of the optical means (11)

lies substantially in the same plane as the second linear array (19) of fibre ends, the planes of the first and second end portions lying spaced from and substantially parallel to one another; the end portions of the internal optical wave directing layer (13) are derivable as being approximately thinner than the diameter of the associated ends of the fibres (17, 18; 19).

5.1.1 However, contrary to the present fibre optic assembly, the optical means (11) of the known assembly is not an optical ribbon (48).

Moreover, the appellant has convincingly argued that each of the fibres of D3 (see page 5, lines 8 to 10) consists of a central element, mentioned as "core", and of a cylindrical enveloping element mentioned as "clad", designating the portions other than the cores, and that the clads in the known assembly do not contribute to the transmission of the signals. Indeed, taking into account the whole content of D3 (see in particular page 2, third paragraph to page 3, first paragraph; page 5, lines 2 to 12), it is derivable that signals are transmitted only by the cores of the optical fibres, and not by the enveloping cylindrical clads. Therefore, in any case, contrary to the present assembly, the fibre ends of the device known from D3 are not to be interpreted as being, in the sense of the present application, the bare ends (17a, 18a; 19a) of the optical fibres (17, 18; 19), with removed jackets (17b, 18b; 19b), but are the jacketed ends of said optical fibres (17, 18; 19).

Additionally, in the known assembly, each linear array has not a width substantially equal to the sum of the diameters of the fibre ends, with removed jacket, of

its respective set of fibres; and each end portion of the internal optical wave directing layer (13) of the known assembly has not a width substantially the same as the width of its associated linear array of fibre ends, with removed jacket.

5.2 It is derivable from the present description (see page 6, line 9 to page 7, line 27; figure 2 and 3) that the present invention intends to solve the problem encountered in fibre optic assemblies of i.a. the loss of light which arises at the interface between the coupler and the fibres due to the geometrical mismatch between the circular fibres and the elongated shape of the internal optical wave directing layer (58) whereby interstitial spaces (62) between the circular fibres and the walls of the internal optical wave directing layer (58) are created.

5.2.1 As convincingly argued by the appellant, starting from the assembly of figure 2 of D3, whereby the fibre ends are not, in the sense of the present application (see in particular figures 1 and 3), the bare ends of the optical fibres (17, 18; 19), with removed jackets, but are the jacketed ends of said optical fibres (17, 18; 19), each linear array has not a width substantially equal to the sum of the diameters of the fibre ends, with removed jacket, of its respective set of fibres, so that insertion losses due to interstitial spaces (62) between the circular fibres and the walls of the internal optical wave directing layer (58) and, additionally, due to the jackets of said fibres, are created. In this context, the term jacket is understood as meaning any layer of substantial thickness which does not contribute to the transmission of the coupling signals.

5.3 Indeed, D1 (see column 1, lines 31 to 40; column 1, line 54 to column 3, line 45; figures 1 to 4) shows a fibre optic assembly for coupling signals between optical fibres , i.e. the array (11) of fibres with further individual fibres (12, 13), wherein the optical means is an optical ribbon (10) so that advantages related to this structural feature could be taken into account by the person skilled in the art of D3. However, as convincingly argued by the appellant, D1 also shows i.a. the mismatch due to the use of fibres with an internal signal transmitting core (18). Indeed, it is derivable from the whole content of D1 (see in particular column 2, lines 15 to 18, 33 to 35 and 41 to 43) that only the cores (18) of the optical fibres, but not the enveloping cylindrical clads, transmit signals. Therefore, contrary to the present assembly, the fibre ends of the device known from D1 are not to be interpreted as being, in the sense of the present application (see figures 1 and 3), the bare ends of the optical fibres, with removed jackets, but are the jacketed ends of said optical fibres.

5.3.1 Hence, D1 (see in particular column 2, lines 18 to 23) does not provide any indication about the presently claimed features for solving the problem of insertion loss in the device of D3. In this respect, it is to be noted that the argument of the appellant that the fibres in the present application (see page 6, lines 3 to 4) may have a covering (cladding) of different refractive index, whose thickness is negligible, is credible in that sense that it is directly apparent from the whole content of the present application that the elements which contribute to transmission losses in the prior art are removed at the ends of the fibres, whereas negligibly thin coverings, which do not influence the insertion loss, are not mentioned as being removed.

It is also to be noted that it is not derivable from D1 (see figure 2) that each linear array of (unjacketed) fibre ends, i.e. of the cores (18), has a width substantially equal to the sum of the diameters of fibre ends and that each end portion of the ribbon has a width substantially the same as the width of its associated linear array of fibre ends. These features are not derivable either from the other documents of the prior art.

5.4 Therefore, the subject-matter of present claim 1 involves an inventive step in the sense of Article 56 EPC, so that claim 1 is patentable in the sense of Article 52(1) EPC and a patent can be granted on this basis (Article 97(2) EPC).

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 the following application documents:

Description: Pages 1 and 3 to 9 as originally filed with the amendment (deletion of lines 1 to 3) on page 3, as requested in applicant's letter of 23 December 1994;

Page 2 filed with applicant's letter of 23 December 1994;

Claims: No. 1 annexed to the communication of the Board dated 20 September 1996 and agreed by the appellant in its letter of 16 December 1996; Nos. 2 to 9 filed with applicant's letter of 23 December 1994;

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

The Registrar: The Chairman:

P.Martorana E.Turrini