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**Datasheet for the decision
of 8 April 2021**

Case Number: T 2601/18 - 3.4.02

Application Number: 13859456.9

Publication Number: 2926184

IPC: G02B6/44, G01B11/16, G01L1/24,
G02B6/12

Language of the proceedings: EN

Title of invention:

FIBER OPTIC STRAIN LOCKING ARRANGEMENT AND METHOD OF STRAIN
LOCKING A CABLE ASSEMBLY TO TUBING

Applicant:

Baker Hughes, a GE company, LLC

Relevant legal provisions:

EPC Art. 54(1), 56, 84, 123(2)

Keyword:

Added subject-matter (no)
Clarity (yes)
Novelty and inventive step (yes)



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Case Number: T 2601/18 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 8 April 2021

Appellant:
(Applicant)

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Representative:

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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted on 25 May 2018
refusing European patent application No.
13859456.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: F. J. Narganes-Quijano
B. Müller

Summary of Facts and Submissions

I. The appellant lodged an appeal against the decision of the examining division refusing European patent application No. 13859456.9.

II. During the first-instance proceedings reference was made to the following documents:

D1: WO 2007/089791 A2
D2: US 2009/0003780 A1
D3: WO 99/19653 A1
D4: EP 1 443 351 A2
D5: EP 0 299 123 A2
D6: WO 02/099491 A1.

In its decision the examining division held in respect of the requests then on file that

- the subject-matter of claim 1 of the main request and the first auxiliary request was not new in view of document D3 (Article 54(1) EPC),

- claim 1 of the second auxiliary request was not clear (Article 84 EPC) and its subject-matter was not new in view of document D3 (Article 54(1) EPC), and

- claim 1 of the third auxiliary request contravened the requirements of Article 123(2) EPC.

III. With the statement setting out the grounds of appeal the appellant submitted claims according to a main and first to third auxiliary requests and requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main or one of the first to third auxiliary requests.

IV. In reply to a communication of the board annexed to the summons to oral proceedings, with the letter dated 12 March 2021, the appellant filed claims according to a main and first to third auxiliary requests replacing the claims of the respective requests submitted with the statement of grounds of appeal, and pages 1 to 4 of the description.

The present main request is thus based on the following documents:

- claims: Nos. 1 to 8 of the main request filed with the letter dated 12 March 2021,
- description: pages 1 to 4 filed with the letter dated 12 March 2021, and
- drawings: sheets 1/3 to 3/3 of the application as published.

V. Subsequently, the oral proceedings were cancelled.

VI. Claim 1 of the present main request reads as follows:

"A fiber optic strain locking arrangement (10; 110; 210) comprising:

a cable assembly (14; 114; 214) having an outer radial surface (18; 118; 218);

an optical fiber (20) strain transmissively coupled to the outer radial surface (18; 118; 218); and

tubing (22) disposed at the outer radial surface (18; 118; 218) being strain locked to the outer radial surface (18; 118; 218),

characterised in that:

the tubing (22) is strain locked to the outer radial surface (18; 118; 218) through interference fit with granules (26), wherein:

the granules (26) are partially embedded into an inner radial surface of the tubing (22) and the

granules (26) are a harder material than the tubing (22); and/or

the granules (26) are partially embedded into the outer radial surface (18; 118; 218) and the granules (26) are a harder material than that of the outer radial surface (18; 118; 218)."

The claims of the main request also include dependent claims 2 to 8 referring back to claim 1.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments - Articles 84 and 123 (2) EPC*
 - 2.1 Claim 1 is based on claim 1 as originally filed after omission of the variant (see "strain locked [...] through at least one of interference fit [...] and adhesive bonding [...]") relating to the strain locked arrangement involving adhesive bonding, in combination with the features of dependent claim 7, and the passage on page 3, lines 13 to 15, of the description of the application as filed.

In addition, the expression "at least" in the feature of claim 1 as originally filed relating to the "granules [being] at least partially embedded [...]" has been omitted in present claim 1. In its decision the examining decision held in respect of claim 1 of the third auxiliary request then on file that there was no basis in the application as filed for the deletion of the corresponding expression "at least" (Article

123(2) EPC). However, as submitted by the appellant, the passage on page 3, lines 13 to 15, of the description of the application as filed discloses that "[b]y making the granules 26 of a material that is harder than the outer radial surface 18 [of the cable assembly] and the face 34 [i.e. the inner radial surface of the tubing] they can become partially embedded in one or both of the outer radial surface 18 and the face 34". The skilled person would understand that, while the expression "at least partially embedded" of claim 1 as originally filed would encompass the possibility that all the granules are completely embedded in the material, according to the mentioned passage of the description the interference fit which strain-locks the tubing to the outer radial surface of the cable assembly comprises granules that are partially (and only partially) embedded into the inner radial surface of the tubing and/or into the outer radial surface of the cable assembly as required by present claim 1. Therefore, the board is of the view that the omission of the mentioned expression "at least" in present claim 1 does not go beyond the content of the application as filed (Article 123(2) EPC) and, in addition, clarifies claim 1 and brings the claimed subject-matter into line with the invention as disclosed in the description (Article 84 EPC).

2.2 Dependent claims 2 to 7 of the main request correspond to dependent claims 2 to 5, 8 and 9 as originally filed, respectively, and dependent claim 8 is based on the variant defined in claim 1 as originally filed relating to the strain locked arrangement involving adhesive bonding and omitted in present claim 1.

2.3 The objection of lack of clarity (Article 84 EPC) raised by the examining division in its decision in

respect of claim 1 of the then second auxiliary request related to a feature that is not present in the claims of the present main request.

- 2.4 The amendments made to the description relate to the adaptation of its content to the invention as defined in the present claims (Rule 42(1)(c) EPC), and to the acknowledgement of the pertinent state of the art (document D1) in the introductory part of the description (Rule 42(1)(b) EPC).
- 2.5 The board is therefore satisfied that the application documents amended according to the present main request meet the requirements of Articles 84 and 123(2) EPC.

3. *Novelty*

- 3.1 Document D3 discloses a fiber optic strain locking arrangement (see abstract and Fig. 8, together with page 24, line 35, to page 25, line 27) comprising a cable assembly (inner pressure barrier layer 12 and tubular composite layer 14) having an outer radial surface, an optical fiber (energy conductor 70 constituted by an optical fiber, see page 25, lines 1 and 2, together with page 12, lines 22 to 27; see also Fig. 22, together with page 30, lines 17 to 20) strain transmissively coupled to the outer radial surface of the cable assembly (page 26, lines 24 to 30), and a tubing (outer protection layer 60) disposed around the outer radial surface of the cable assembly (Fig. 8) and, at least to a predetermined extent, strain-locked to it (page 25, lines 10 to 14).

In addition, document D3 discloses adding particles made of ceramics, metallics etc. to the tubing, and in particular Teflon particles and aramid powder to the

matrix of the tubing, in order to increase the wear resistance and reduce friction of the tubing (page 25, lines 15 to 21). The mentioned particles are, however, completely embedded in the material of the tubing, and document D3 is silent as to the provision of the particles, or at least some of them, as being only partially embedded into the inner radial surface of the tubing. In addition, only some variants resulting from the combination of the list of materials of the tubing (page 25, lines 7 to 14) and the list of materials of the particles (page 25, lines 15 to 21) disclosed in document D3 would satisfy the claimed condition relating to the material of the granules being harder than the material into which they are partially embedded, so that - contrary to the view of the examining division expressed in its decision - document D3 does not disclose in a direct and unambiguous way the corresponding claimed feature.

It follows that the fiber optic strain locking arrangement defined in claim 1 is new over that disclosed in document D3 in that the tubing is strain locked to the outer radial surface of the cable assembly through an interference fit with granules partially embedded into the inner radial surface of the tubing and/or partially embedded into the outer radial surface of the cable assembly, the material of the granules being harder than the material into which they are partially embedded.

Therefore, the subject-matter of claim 1 is new over the disclosure of document D3.

3.2 The remaining documents on file are less pertinent for the issue of novelty. In particular:

- document D1 discloses a strain sensing device (Fig. 1 and the abstract) constituted by a sub-assembly (120) including an optical fibre (160), and a metallic coating (110) strain-coupled by friction to the jacket (130) of the sub-assembly using different techniques, and in particular by encasing (paragraphs [26], [27], and [32] to [36]);

- document D2 (Fig. 3 and 6 to 8, together with the abstract) discloses the use of water-swellaable powder (104) within a tube (106) and/or a cavity of an optical fibre cable (paragraphs [0033], and [0043] to [0046]), and also the use of a surface roughness on the inner surface of the tube or cavity for creating coupling (page 6, right column, lines 11 to 14);

- document D4 discloses a fiber optical cable (Fig. 1 and the abstract) with a composite polymeric/metallic armour (20 and 22) fixed to the cable by means of adhesive and/or by swaging (Fig. 1, and paragraphs [0018] and [0020]);

- document D5 discloses the manufacture of an optical fiber cable comprising an armour (abstract);

- document D6 discloses an optical fibre cable (Fig. 1 and the abstract, together with page 14, lines 1 to 9) having a protective layer (32) of a foamed polymeric material (page 15, lines 25 to 35), the protective layer being manufactured from a thermoplastic elastomer matrix containing particles of a vulcanized elastomeric polymer (page 17, line 34, to page 18, line 12).

It follows, in particular, that none of these documents discloses an interference fit of granules between the contact surfaces of two materials, the granules being partially embedded into the surface of at least one of the two materials and formed of a material harder than the material of the surface into which they are partially embedded.

3.3 The board concludes that the subject-matter of claim 1, and therefore also that of dependent claims 2 to 8, is new over the documents of the prior art on file (Article 54(1) EPC).

4. *Inventive step*

4.1 The provision of an interference fit between the adjacent opposite surfaces of the cable assembly and the tubing constituted by granules partially embedded into at least one of the two surfaces and being of a material harder than the material of the surface into which they are partially embedded improves the mechanical strain-locking characteristics between the cable assembly and the tubing (description of the application, page 3, lines 9 to 19). In addition, none of the documents on file - in particular, none of documents D1, D2 and D4 to D6 referred to in Nr. 3.2 above - discloses or suggests an interference fit of partially embedded granules as claimed, let alone the technical effect thereby achieved, i.e. the improvement of the strain-locking characteristics between the contact surfaces of a cable assembly and a tubing surrounding the cable assembly.

For these reasons, the subject-matter of claim 1, and consequently also that of dependent claims 2 to 8, involves an inventive step over the documents of the prior art on file (Article 56 EPC).

5. In view of the above considerations, the board concludes that the application documents amended according to the present main request meet the requirements of the EPC.

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 in the following version:
 - claims: Nos. 1 to 8 of the main request filed with the letter dated 12 March 2021;
 - description: pages 1 to 4 filed with the letter dated 12 March 2021; and
 - drawings: sheets 1/3 to 3/3 of the application as published.

The Registrar:

The Chairman:



L. Gabor

R. Bekkering

Decision electronically authenticated