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Bezeichnung der Erfindung: Insulating multiple conductor cables

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : H02G 15/10

ENTSCHEIDUNG / DECISION

vom / of / du 9 November 1989

Anmelder / Applicant / Demandeur : Raychem Corporation

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 (no)"

Leitsatz / Headnote / Sommaire

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European Patent
Office

Boards of Appeal

Office européen
des brevets

Chambres de recours



Case Number : T 546/88 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal
of 9 November 1989

Appellant : Raychem Corporation (a Delaware Corporation)
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Decision under appeal : Decision of Examining Division 052
of the European Patent Office
dated 15.06.1988 refusing European
patent application No. 85 301 038.7
pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : P.K.J. van den Berg
Members : W.B. Oettinger
M. Lewenton

Summary of Facts and Submissions

- I. European patent application No. 85 301 038.7, filed on 15 February 1985 claiming a priority of 17 February 1984, and published under No. 153 174, was refused by a decision of the Examining Division 2.2.07.052 dated 15 June 1988.

The reason given for the refusal was that the subject-matter of claims 1 to 10 filed on 16 November 1987 lacked an inventive step, having regard to prior art document I: EP-A-57 742.

- II. On 9 August 1988, the applicant lodged an appeal against that decision requesting its cancellation in entirety, and paid the appeal fee.

On 19 October 1988, the Appellant filed a Statement of Grounds contesting the Examining Division's view and accompanied by amended claims 1 to 10 in two versions, submission 1 and submission 2.

Claim 1 submission 1 reads as follows:

"A method of electrically insulating a joint between two multiple conductor, medium voltage power cables, in which the outer insulation of each cable has been removed and respective exposed individual conductors have been connected together, the method comprising

- (a) positioning an insert (1) between each of the conductors (2,3,4) of the cable (5,6), the insert being non-meltable and either comprising a void-filling material or having a coating of void-filling material thereon;

- (b) positioning a dimensionally heat-recoverable polymeric sleeve (11) so as completely to enclose the insert (1) and to extend longitudinally over the conductors (2,3,4) and over the insulation of the cables (5,6); and
- (c) applying heat to the sleeve (11) to effect recovery of the sleeve (11) around the cables (5,6) so as to seal on to the insulation of the cables (5,6) on each side of the joint and to soften the void-filling material so as to provide a void-free volume within the sleeve (11)"

(with feature labels (a), (b), (c) added by the Board).

Submission 2 differs from submission 1 by the insertion of the following phrase at the end of feature (a):

"wherein the insert is formed of a polymeric insulating material having a dielectric constant in the range of between 2 to 6 and the void-filling material is a thermoplastic material having a viscosity at 70°C of between 1×10^3 poise and 1×10^5 poise"

(with a clerical error corrected by the Board).

III. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board considered that a method as defined in the introductory part of claim 1 and comprising steps (b) and (c), except where they refer to feature (a), was known from any one of the following documents:

- II: US-A-4 383 131 (mentioned in the description)
- III: FR-A-2 132 338 (mentioned in the Search Report).

It further considered that other pieces of prior art as mentioned in the description on page 2 (and confirmed by III) and on page 1, and general knowledge (documented by II), would render the addition of feature (a) obvious, and that this view appeared confirmed by I.

- IV. In oral proceedings, held on 9 November 1989 on the Appellant's request, the Appellant upheld his request that the decision under appeal be set aside and a patent granted on the basis of claims 1 to 10, submission 1, filed on 19 October 1988 (main request), or on the basis of claims 1 to 10, submission 2, amended however by the deletion of "either comprising a void-filling material or" in feature (a) (auxiliary request).

- V. In support of these requests, he argued essentially as follows:

A joint between cables for use with relatively high voltages has hitherto been insulated either by the method using a box as described on page 1 of the description or by the method using a heat-shrinkable enclosure as mentioned on page 2 and described in document II. According to II, after the individual cores of the two cables have been connected together, they are shielded by a conducting screen so that there is no substantive potential difference between different cores of the cable.

Alternatively, as is known from document III, they may only be individually insulated. In such a case, the use with higher voltages, typically 15 kV, would require that no voids are allowed anywhere between the individual cores.

Another problem to be solved is to get enough heat into the interior of the cable joint to ensure that all voids

are filled, without however overheating the outer heat-recoverable sleeve.

The insert used in the claimed method serves two functions:

insulate the cores from each other, without melting during the shrinking process, on the one hand, and deliver the necessary void-filling material, on the other.

As the insert takes most of the space between the cores, a comparatively small amount of void-filling material is required.

Document I does not render this obvious because its insert, which may be hollow, and its sealing material serve a totally different problem, viz. block the entrance to the joint against gas and water.

DE-A-2 821 797 (mentioned in the Search Report) is the only prior art document addressing the problem of getting enough heat into the interior of a cable joint for the purpose of melting a sealing tape, but solves this problem only by an electrical heating device incorporated in the tape.

Claim 1 of submission 2, which is restricted to the second alternative embodiment of claim 1 of submission 1, specifies the important properties of the insert and of its coating of void-filling material. More particularly, it specifies that the temperature at which melting occurs is relatively low.

Reasons for the Decision

1. The appeal is admissible.
2. Claim 1, submission 1, is based on the original claim 4 and the dependent claims are based on the original claims 2, 3 and 5 to 11.

The features added to claim 1 by submission 2, are based on the description page 11, lines 13 to 15 and page 12, lines 11 to 13. The amendment made during the oral proceedings, amounts to the deletion of one of two embodiments disclosed.

~~The amendments comply, therefore, with Article 123(2) EPC.~~

3. The subject-matter of claim 1 in either version is, without any doubt, new but does not, in the opinion of the Board, involve an inventive step, having regard to the prior art.

Regarding claim 1 of submission 1, this conclusion is essentially based on the following considerations:

- 3.1 It is agreed that the art of insulating multiple conductor cable joints developed from the box method, mentioned on page 1 of the description, to the heat-shrinkable sleeve method mentioned on page 2.

Although no prior art document for the box method was cited during the examination or the appeal procedure it is clear (and could be confirmed by documents mentioned in the Search Report) that the statement on page 1 that conventionally, in order to prevent the conductors from contacting each other, a solid separator can be placed between them, is correct.

- 3.2 In the opinion of the Board, it is clearly obvious to maintain, for the same purpose of preventing the conductors from contacting each other, the solid separator when using a heat-shrinkable sleeve, known from document II, in particular column 7, lines 37 to 47, or from document III, in particular page 14, lines 18 to 30, instead of a solid box. This the more so as it is very clear to the skilled person that the heat shrinking process would apply a radial force to the conductors tending to push them together.
- 3.3 It is true that III does not propose this use of an insert because it uses, instead, individual heat shrinkable sleeves on each conductor but their possible replacement by a solid separator as formerly used (page 1 of the description) must be regarded as obvious.
- 3.4 Document I would only seem to confirm this by the fact that it proposes to use a separator or insert for the same purpose of preventing the conductors from contacting each other even if in a heat-shrinking process a radial force is applied.

It is less relevant for this purpose that I is concerned with sealing a cable end against entering gas or water while the claimed invention is concerned with avoiding any adverse effects of voids in the presence of high electrical field strength.

In passing, it is noted that the description as filed also mentions a possible use of the claimed method, for example, in preparing terminations or the like. Although this statement is inconsistent with claim 1 restricted to a joint, it may be taken as an indication for the fact that the person concerned with joining cables would take

into account also any prior art, such as I, concerned with terminations.

- 3.5 The claimed void-filling coating of the insert corresponds to the void-filling materials in the prior art.

According to II, any space which is not filled by solid materials (cf. Figures 2 to 6, in particular the materials referenced 25, 34 and 45), is made void-free for the purpose of avoiding any electrical discharge phenomena (column 4, line 62 to column 5, line 11), by applying, for instance, a film of silicon grease (cf. examples on column 7 ff.).

~~According to III, the same effect is achieved by coating the interior of the heat-shrinkable sleeve (1) with a melting adhesive.~~

It is only an obvious modification to coat, instead, the insert between the conductors if one is used.

According to I, a melting adhesive or other sealing material is applied, by any suitable method not further specified, in any space between the insert, the conductors and the heat-shrinkable sleeve.

It appears obvious to do this, as far as the space between the insert and the conductors is concerned, for instance by a coating on the former (and/or on the latter).

In this context it is noted that the claimed method is not restricted to particularly high voltages but specifies "medium voltage" as starting with about 1 kV. Independent of this fact, however, it is clear that higher voltage values such as, for instance, 15 kV, require more care as regards the filling of any voids.

- 3.6 The Appellant submits that the claimed invention solves, in particular, the problem of sufficient heat transfer into the interior of the joint without there being the danger of burning the outer sleeve.

To the Board it appears, that this problem solution, which is not mentioned in the application documents, is the obvious effect of the prior art solid separator (page 1 of the description) which is maintained when the box is replaced by a heat-shrinkable sleeve (page 2 and document II or III).

- 3.7 The Appellant submits that a hollow insert as known from I would not solve this problem and heat transfer is accomplished in a different way.

This is true but not a convincing counterargument.

Since I is only concerned with a cable end, heat can be introduced from the open end (cf. page 6). It goes without saying that in the case of a joint, heat must be introduced from the sides (unless it is generated in the interior such as according to the DE document) and the separator must therefore be suitable to conduct heat.

It is noted in this context that claim 1 does not even prescribe that the insert is solid and no express statement to this effect appears in the description. Nevertheless, the Board accepts that a solid insert would be preferred as seems to be derivable from Figure 2; but its advantages are only obvious: it may be a better thermal conductor than a hollow insert and no discharge effects are caused by any void.

- 3.8 It may be added that claim 1 covers an alternative which uses an insert which is not coated by, but comprises itself a void-filling material.

Given that this alternative is an obvious equivalent to the case considered above (at paragraph 3.5), and the same considerations as above apply (paragraphs 3.6 and 3.7), this alternative can also not be regarded as unobvious.

- 3.9 For these reasons, the Board is unable to find an unobvious feature in any of the method steps in claim 1 of submission 1.

4. Claim 1 of submission 2 does not add any unobvious feature to the method of claim 1 of submission 1. Its subject-matter does not therefore involve an inventive step either.

This conclusion is based on the following considerations:

- 4.1 The embodiment of the claimed method using a non-melting insert as an insulating separator for the conductors and a coating thereon as a void-filler, is specified in the claim by properties of these materials which are independent of each other.

- 4.2 The insert is specified by a particular range for the dielectric constant.

The claimed range, namely between 2 and 6, is generally a very usual range for insulators and moreover the same as proposed for an insulating layer in document II (column 3, lines 1 to 2).

- 4.3 The void-filling material is specified by a particular range for its viscosity at 70°C.

The claimed viscosity range reflects only the general requirement for materials to flow into voids as described on page 12, lines 14 to 16. Although it is not expressly mentioned in any of documents II, III, or I, it cannot differ substantially from that of the void-filling materials proposed there, and the Appellant has not alleged it does.

This view would seem to be confirmed by the Appellant's citation DE-A-2 821 797 (paragraph bridging pages 15 and 16).

The claimed temperature at which melting occurs is also not suggested in II, III or I but it does not appear to be a particularly unusual melting temperature for a thermo-plastic void-filler and the Appellant has not established that it is. This opinion would also appear confirmed by DE-A-2 821 797 (page 16).

- 4.4 Claim 1 of submission 2 does not therefore contribute an unobvious feature.

The method claimed in this claim must therefore be regarded as obvious.

5. The Board does not deny that the claimed method may well be a very practicable method of insulating higher voltage multiple conductor cable joints even in the field.

In the circumstances dealt with above (paragraphs 3 and 4), however, this advantage alone is not a sufficient reason for recognising an inventive step.

6. Claim 1 being, for these reasons, unallowable in both versions, and the dependent claims sharing their fate, the appeal must fail.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Fabiani

P.K.J. van den Berg

S. Fabiani

P.K.J. van den Berg

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