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D E C I S I O N
of 2 August 1999

Case Number: T 0999/97 - 3.5.2

Application Number: 86309309.2

Publication Number: 0225190

IPC: H01R 13/53

Language of the proceedings: EN

Title of invention:
Cable connection

Patentee:
Raychem GmbH

Opponent:
Société Euromold

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes; could-would approach)"

Decisions cited:
-

Catchword:
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Boards of Appeal

Chambres de recours

Case Number: T 0999/97 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 2 August 1999

Appellant: Societé Euromold
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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 22 July 1997
concerning maintenance of European patent
No. 0 225 190 in amended form.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. R. J. Villemin

Summary of Facts and Submissions

I. The appellant filed an opposition against European patent No. 0 225 190 and now contests the interlocutory decision of the opposition division that account being taken of the amendments made during the opposition proceedings, the patent and the invention to which it related met the requirements of the EPC.

II. The opposition was based on the ground that the subject-matter of claims 1 and 4 did not involve an inventive step (Article 100(a) EPC in conjunction with Articles 52(1) and 56 EPC). The following documents, which were cited in the notice of opposition, were referred to by the appellant in the grounds of appeal:

A: EP-A-0 139 483,

B: US-A-3 883 208 and

D: EP-A-0 121 986.

III. The patent has not been amended during the appeal proceedings. Claim 1 reads as follows:

"A method of making a connection between an electric cable (20) and electrical apparatus by means of an electrically insulating electrical connector (2, 46), wherein an outer insulating jacket (22) of the cable is removed to expose an electrical screen (28) of the cable, the screen is removed to expose primary insulation (30) of the cable, and the primary insulation is removed to expose a conductor (32) of the cable;

wherein the cable is terminated by electrical stress control material (34) that extends over the exposed end of the cable screen and along at least part of the exposed primary insulation, and by electrical insulation material (36, 44) that extends in close conformity over the cable screen and over the stress control material (34);

wherein the connector (2, 46) comprises: an insulating body having a first passageway (6; 48) that is arranged to receive the cable; a second passageway (8; 58) for engagement with the electrical apparatus; and electrically conductive means (12, 38; 54, 56, 62) that is disposed in the insulating body so as to form an electrically conductive path between the conductor of the cable and the electrical apparatus when the cable is received in the first passageway (6; 48) and the electrical apparatus is engaged within the second passageway of the insulating body of the connector; and

wherein the terminated cable is inserted as a push-fit into the first passageway (6; 48) of the connector (2; 46) and the cable conductor is electrically connected to the electrically conductive means."

Independent claim 4 reads as follows:

"A cable connection arrangement comprising (a) an electric cable (20; 40), and (b) an electrically insulating connector (2; 46) for connecting the cable to electrical apparatus,

wherein (i) an outer insulating jacket (22) of the cable has been removed to expose an electrical screen (28) of the cable, the screen has been removed to expose primary insulation (30) of the cable, and the

primary insulation has been removed to expose a conductor (32) of the cable, and (ii) the cable is partially terminated by electrical stress control material (34) that extends over the exposed end of the screen and along at least part of the exposed primary insulation; and

wherein the connector (2, 46) comprises: an insulating body having a first passageway (6; 48) that is arranged to receive the cable; a second passageway (8; 58) for engagement with the electrical apparatus; and electrically conductive means (12, 38; 54, 56, 62) that is disposed in the insulating body so as to form an electrically conductive path between the conductor of the cable and the electrical apparatus when, in use, the cable is received in the first passageway (6; 48) and the electrical apparatus is engaged within the second passageway of the insulating body of the connector;

characterised in that

the termination of the cable (20; 40) is completed by electrical insulation material (36; 44) that extends in close conformity over the cable screen and over the stress control material;

and in that the terminated cable (20; 40) and the first passageway (6; 48) of the connector (2; 46) are so arranged that the completely terminated cable is receivable in the first passageway of the connector as a push-fit."

Claims 2 and 3 are dependent on claim 1 and claims 5 to 9 are dependent on claim 4.

IV. The appellant's arguments in the grounds of appeal may be summarised as follows:

According to the contested patent, the invention related to a cable connection arrangement between an electrical cable and an electrical apparatus, which was connectable/disconnectable and which was suitable for voltages in excess of 1 kV, in particular for 12, 17.5 and 24 kV voltage ranges.

Document B disclosed a push-fit cable connection arrangement comprising an electric cable suitable for voltages of 1 kV or more, but generally less than 7 kV, and a connector for connecting this cable to an electrical apparatus. The person skilled in the art would have realized that it was necessary to reduce the electrical stress at the end of the screen of this prior art arrangement for cables submitted to voltages higher than 10 kV. Seeking a way of achieving this, the skilled person would have consulted document D which disclosed a method of limiting electrical stress at a cable connection by means of at least one layer of electrical stress control material extending over the exposed end of the screen of the cable and over at least part of the exposed end of the electrical insulating layer of the cable, and a layer or tube of electrically insulating material extending in close conformity over the cable screen and over the stress control material. The presence and the shape of the contact element and the shape of the connecting member for the cable in the arrangement disclosed in document B had nothing to do with the push-fit aspect of the connector disclosed in document B. The person skilled in the art would have disregarded document A because it did not disclose a mountable-dismountable arrangement able to form a push-fit connection between a connector and a cable. The method defined in claim 1 and the

cable connection arrangement defined in claim 4 of the contested patent were obvious in view of a combination of documents B and D.

- V. The respondent argued essentially that before the priority date of the patent in suit there were three main methods of connecting an electrical cable to electrical equipment by means of an electrically insulating connector, as exemplified by documents A, B and D. The method disclosed in B was not suitable for voltages above 7 kV and the connector could not accept a wide range of cable diameters. Nor could it be used with paper insulated cables, because the paper would tear and unravel during insertion of the cable. The method disclosed in document A could be used with a wide range of cable diameters and it could be used with paper insulated cables. But it was not suitable for very high voltages and had the disadvantage that the moulding of a heat-shrinkable passage into the main body of the connector involved a complex manufacturing process and the cable could not be removed from the connector without destroying the connector. The method according to document D had the disadvantage that two heat-shrinkable sleeves were needed and the cable could be disconnected only by destroying the outer heat-shrink sleeve. The invention combined the use of a fully terminated cable with a push-on type of connector. The non-inventive skilled person would not have considered fully terminating a cable by applying stress control material and electrical insulation material to it before inserting it into a push-on connector, because there would be no need to do so and it would detract from the advantage of push-on connectors, namely quick and simple installation.

- VI. Following a communication of the board accompanying a summons to oral proceedings, the appellant informed the board that it would not attend. The oral proceedings were cancelled.
- VII. The appellant requested that the decision under appeal be set aside and that European patent No. 0 225 190 be revoked.
- VIII. The Respondent requested that the appeal be dismissed.

Reasons for the Decision

- 1. The appeal is admissible.
- 2. The novelty of the subject-matter of claims 1 and 4 was not challenged by the appellant. Therefore, the main issue to be considered in the present appeal is whether the subject-matter of claims 1 and 4 involves an inventive step within the meaning of Article 56 EPC over the prior art cited by the appellant.
- 3. There is agreement between the parties and the Board that document B discloses the prior art closest to the method of making a connection according to claim 1 and to the cable connection arrangement according to claim 4.
 - 3.1 According to document B (see Figure 2 and column 2, line 42, to column 3, line 7), a cable 12 is prepared for termination by stripping an outer semiconductive layer 38 from the end of the cable to expose the insulation 42 and removing a portion of the insulation

42 to expose the end of the conductor 40. Cable termination is achieved by means of a cable connecting element 18 which includes a blind bore 44, into which the exposed end of the conductor 40 is inserted and secured in place by crimping the connecting element. Then the cable end with the connecting element is inserted into a passage 36 in a resilient insulating housing 30. An electrically conductive elastomeric lining is provided on the surface of the passage to equalize the voltage gradient around the electrical connection between the connecting element 18 and a connecting member 20 located in a passage running at right angles to the passage 36.

3.2 The cable connection arrangement according to claim 4 of the patent in suit differs from the one known from document B *inter alia* in that the cable itself is fully terminated by electrical stress control material that extends over the exposed end of the cable screen and along at least part of the exposed primary insulation, and by electrical insulation material that extends in close conformity over the cable screen and over the stress control material, so that the terminated cable is receivable in the first passageway as a push-fit, whereas according to document B the stress control material is provided as a lining in the passage and, as shown in Figure 2, is of larger diameter than the hole through which the cable is introduced. In this arrangement a push-fit insertion of the cable and the stress control material into the passage would be impossible.

3.3 The method according to claim 1 of the amended patent in suit differs from that disclosed in document B *inter*

alia in that, in the former, the cable is fully terminated (in the sense of providing all the necessary stress control and insulation at its end) before it is inserted as a push-fit into the first passageway, whereas, in the latter, the connecting element 18 and cable end are inserted into the passage 36 which is lined with stress control material.

- 3.4 As is acknowledged in the description of the patent in suit, the arrangement disclosed in document B is suitable only for voltages up to about 7 kV and only for cable having plastic (as opposed to paper-lead) insulation. It is also explained there that it is not generally feasible to form a push-fit connection on to paper-lead cable since the wrappings of the paper tend to unravel. The appellant has not challenged this assessment of the disadvantages of the prior art known from document B.
4. Starting from the closest prior art according to document B, the problem underlying the patent in suit may be seen as that of modifying the push-on type connector known from document B for use with a greater variety of cables capable of operating at voltages of 7 kV or more.
5. The question to be addressed is whether the disclosure in documents A and D renders it obvious to the person skilled in the art to modify the prior art known from document B in such a manner as to arrive at a method of making a connection according to claim 1 or a cable connection arrangement according to claim 4.
6. As pointed out by the respondent, the method disclosed

in document A can be used with a wide range of cable diameters and it can be used with paper insulated cables. However it has the disadvantage that the moulding of one end of a heat-shrinkable tube 16 into the electrically insulating body of the connector around the opening of the passage for receiving the cable involves a complex manufacturing process and the cable cannot be disconnected from the connector without destroying the connector. Furthermore, document A does not disclose or suggest a completely terminated cable that is a push-fit into the connector, so the subject-matter of claim 1 or claim 4 of the amended patent cannot be regarded as the result of an obvious modification of the arrangement known from document B to incorporate features of the arrangement known from document A.

7. In the electrical stress control arrangement disclosed in document D, an outer insulating jacket 2 of the cable has been cut back to expose an electrical screen 4, 6, 8 of the cable, the screen has been cut back to expose primary insulation 10 of the cable, and the primary insulation has been cut back to expose the end of the conductor 12, on to which a connecting element 14 has been crimped. A first layer of electrical stress controlling material in the form of a heat-shrinkable tube 16 surrounds the exposed portions 6, 8 of the screen and part of the exposed length of the primary insulation. A second layer of electrical stress controlling material in the form of a coating 18 applied to part of the inner surface of a heat-shrinkable insulation tube 20 covers most of the first layer of electrical stress controlling material. The tube 20 extends from the cable jacket 2 to cover all

the exposed parts of the cable and part of the crimped connector 14. This arrangement can operate at 20 kV and can be used with cables containing paper layers.

8. The appellant particularly stressed that the claimed method was obvious in view of the combination of documents B and D. However, document D does not indicate anywhere that the cable termination arrangement described there is suitable for push-fit insertion into a passageway in an electrically insulating connector body. Rather, it is complete in itself and does not require any further insulation.
- 8.1 If the terminated cable described in document D were inserted as a push-fit into an appropriately constructed modification of the passageway 36 of the connector shown in Figure 2 of document B, and the connecting element 14 described in document D were adapted to cooperate with the connecting member 20 described in document B, the resulting arrangement would fall within the terms of claim 4 of the amended patent. However, this can only be seen with the benefit of hindsight once the subject-matter of claim 4 has been made known, and only shows that it **could** be done.
- 8.2 In the judgement of the Board, the notional knowledgeable but relatively unimaginative person skilled in the art **would not** have thought of making such a combination, since it would greatly increase the complexity of connecting a cable to the connector known from document B to the detriment of one of its known advantages, simplicity. Unless further steps were undertaken to simplify it, such an arrangement would have three layers of stress controlling material

(namely two layers on the cable, known from document D, and a layer lining the passageway, known from document B). The idea only becomes worthwhile when the useful features (as specified in claim 4 of the amended patent) are selected and the redundant ones eliminated. The notional skilled person cannot be expected to envisage all this by himself without at least some hint to point him in that direction.

9. In conclusion, it has not been shown that the subject-matter of claim 1, or that of claim 4 of the patent in suit is obvious having regard to the prior art documents A, B and D. The claimed invention must therefore be considered as involving an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Fabiani

W. J. L. Wheeler