BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

D E C I S I O N
of 2 June 2004

Case Number: T 0074/02 - 3.5.2

Application Number: 95933408.7

Publication Number: 0731994

IPC: H01R 13/53

Language of the proceedings: EN

Title of invention:
Cable Termination

Patentee:
NEXANS France

Opponent:
NKT Cables Group GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
T 0204/83

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0074/02 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 2 June 2004

Appellant: (Proprietor of the patent)
NEXANS France
16, rue de Monceau
F-75008 Paris (FR)

Representative:
Feray, Valérie
Feray Lenne Conseil
44/52, Rue de la Justice
F-75020 Paris (FR)

Respondent: (Opponent)
NKT Cables Group GmbH
Schanzenstrasse 24
D-51063 Köln (DE)

Representative:
Schaumburg, Thoenes, Thurn, Landskron
Patentanwälte
Postfach 86 07 48
D-81634 München (DE)

Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 9 November 2001 revoking European patent No. 0731994 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. Ruggiu
E. Lachacinski

Summary of Facts and Submissions

I. The proprietor of the patent filed an appeal against the decision of the opposition division revoking European patent No. 0 731 994.

II. The following documents of the state of the art have played a role in the appeal:

E3: DE-A-3 211 119;

E5: DE-U1-8 502 491;

F2: Prospectus from the firm Euromold, carrying a date of March 1990, part 7.2 "Zubehör der Serie 600 für 800A"; and

F3: DIN standard 47636, parts 1, 2 and 3 carrying a date of January 1986 and part 5 carrying a date of October 1989.

III. Oral proceedings before the board took place on 2 June 2004.

During the oral proceedings, the appellant (patentee) filed new claims 1 to 11 and new columns 1 and 2 of the description. He requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of claims 1 to 11 filed during the oral proceedings.

The respondent (opponent) requested that the appeal be dismissed.

IV. Claims 1 and 2 of the patent in suit as amended read as follows:

"1. Device for interconnecting a high voltage cable with an apparatus or with a second high voltage cable, comprising
- a cable termination (30) which consists of an elastomeric body (36) with a stress relief device (34) and a connector shield (35) integrated therein, the body (36) having a conical interface surface (37) and an outer conductive screen (39); and
- a rigid insulator (41) having a conical interface surface (42) complementary to the interface surface (37) of the cable termination (30);
wherein the angle alpha defining the conical surface (42) of the rigid insulator (41) is between 15° and 45°."

"2. Device for interconnecting high voltage apparatus, comprising
- two rigid insulators (81, 82) each having a conical interface surface (83, 84) and being fastened to respective apparatus (79, 80) to be interconnected; and
- an elastomeric body (90) with a connector shield integrated therein and with an outer conductive screen (91);
wherein the body (90) has two conical interface surfaces (85, 86) complementary to the conical interface surfaces (83, 84) of the rigid insulators (81, 82) with the angle alpha defining the conical surfaces of the rigid insulators (41, 81, 82, 93) being between 15° and 45°."

Claims 3 to 11 are dependent on claim 1 or 2.

V. The arguments of the appellant can be summarised as follows:

Document F3 was a standard concerning apparatus connection parts with external cones, for voltages of 24 kV and 36 kV. In particular, the Figures 1 of parts 1, 2, 3 and 5 of document F3 each showed an apparatus wall, a cable connection part outside of the apparatus in the upper portion of the figure, and an insulating cone in the lower portion of the figure. This lower insulating cone was internal to the apparatus and thus was not intended to cooperate with a cable termination. This was confirmed in particular by the fact that the standard F3 only specified the maximum dimensions h6, d7 of an envelope of the lower insulating cone. The cable connection parts shown in the upper portion of said figures of F3 each comprised a conical interface surface that was intended to be complementary to the interface surface of a cable termination. The dimensions d1, d2, h2 given in document F3 for the different apparatus connection parts specified therein resulted in angles α defining these conical interface surfaces having values between 0.895° and 5.95°. These values were well outside the range defined in claims 1 and 2 of the patent in suit. Thus, document D3 was not relevant against claim 1 or 2. In particular, it did not destroy the novelty or inventiveness of the claimed range between 15° and 45°.

Document E5 disclosed the closest prior art. E5 described a device for interconnecting a high voltage cable with an apparatus, comprising a cable termination, which consisted of an elastomeric body having a conical

interface surface, and a rigid insulator having a conical interface surface complementary to the interface surface of the cable termination. It could be seen from Figure 1 of E5 that the angle defining the conical surface of the rigid insulator was approximately 10°. Thus, E5 did not suggest a range between 15° and 45°. The object of the invention of the patent in suit was to provide a simplified connection system for cables having ratings up to 400 kV and more. More precisely, the object of the invention was to standardize and optimise the connection, in particular provide a single simplified connection for high voltage cables, especially above 36 kV, with a conical insulator having the same angle α for every voltage. With an increase in voltage, the interface had to be made longer to increase the leakage creeping path. However, the angle α was chosen based on other considerations. An angle α between 15° and 45° provided the best possible compromise between the dimensional, electrical and mechanical properties of the device. In particular, because the resistance at the elastomer-epoxy interface was lower than inside these two materials, it was advantageous to reduce the tangential component of the electrical field at the interface. For a simple configuration, this tangential component was given by sin (α) and was substantially reduced for values of α lower than 45°. For small values of α, lower than 15°, the height of the device increased very rapidly, which made the device too bulky. Furthermore, due to the high friction coefficient of the elastomer, lubricant had to be used abundantly during assembly. The lubricant tended to be absorbed, so that, due to the increased friction, disassembly required a large force to separate the parts. By increasing α, it was

possible to reduce the required force and diminish the quantity of lubricant, while keeping a relatively small height. Thus, the choice to have an angle α between 15° and 45° as specified in claims 1 and 2 of the patent in suit was not arbitrary, but had a technical significance. Furthermore, none of the cited prior art documents suggested having an angle α between 15° and 45°. Indeed, at very high voltages, other manufacturers used an angle α = 0° or a hollow insulator filled with a dielectric fluid, in general oil. The subject-matter of claims 1 and 2 of the patent in suit thus involved an inventive step.

VI. The respondent essentially argued as follows:

Figure 1 of document E5, which disclosed the closest prior art, showed a device interconnecting a high voltage cable with an apparatus. The cable termination consisted of an elastomeric body, which had a conical interface surface, and a metallic cover. A rigid insulator having a conical surface complementary to the interface surface of the cable termination was provided on the side of the apparatus. The subject-matter of claim 1 of the patent in suit differed from this prior art device in particular in that a stress relief device and a connector shield were integrated in the elastomeric body of the cable termination. As appeared from column 2, lines 29 to 36, of the patent in suit, this stress relief device was in fact a stress relief cone comprising a voltage deflector. A similar conical voltage deflector 5 was already included in the rigid insulator 3 shown in Figure 1 of E5. Furthermore, a similar element 105 was included in an elastomeric body 103 shown in Figure 2 of E5. Document E3 also showed

such a voltage deflector 18 integrated in a body made of silicone rubber. It was therefore obvious to the skilled person to include such an element in the elastomeric body of the cable termination. Figure 1 of E5 also showed a metal lattice 9 integrated in the rigid insulator 3 and it was obvious to the skilled person to provide such a lattice also in the cable termination as a connector shield. Thus, all the components mentioned in claim 1 of the patent in suit were obvious. The object of the invention described in E5 was to reduce the length of the connection and the particular device shown in Figure 1 of E5 was intended for operation at a voltage of 20 kV. It was obvious to reduce the length of the connection at higher voltages by increasing the angle defining the conical interface surface, thereby flattening the conical interface. Furthermore, document F3 showed a trend to increase the angle defining the conical interface as well as the height of the device with increasing voltage. Thus, at higher voltages, the skilled person would not only increase the height of the device but also the angle α. In particular at a voltage of 400 kV as envisaged in the patent in suit, α would necessarily be greater than 15°. Therefore, the subject-matter of claim 1 of the patent in suit was obvious in view of either E5 alone or a combination of E5 and E3. The components specified in claim 2 of the patent in suit were obvious in view of document E3, which disclosed a device with two plugs 21, each having a conical interface surface, and an elastomeric body 8 with a connector shield integrated therein and an outer conductive screen 19, wherein the body had two conical interface surfaces complementary to conical interface surfaces of the plugs. The figure in the upper part of page 2 of document F2 also showed

an elastomeric body 2 with a connector shield 5 integrated therein and an outer conductive screen 1, which body had two conical interface surfaces for receiving rigid insulators having complementary interface surfaces. Due to the trend to higher voltages and the desire to keep the connection short, it was obvious to have an angle for the conical interface surfaces in the range between 15° and 45°. Furthermore, the angle would necessarily have to be made larger if the length of the device was to be reduced. It was correct that the invention of the patent in suit aimed at standardising and optimising. However, this did not mean that the invention involved an inventive step. The skilled person would increase the angles resulting from the DIN standard (document F3) when standardising the connection at higher voltages.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

With respect to claim 1 of the patent in suit as granted, the present claim 1 no longer mentions a device for interconnecting a high voltage cable with an apparatus and a second high voltage cable (emphasis added). A corresponding amendment has been made in the first sentence of the description for consistency with the subject-matter of claim 1. Claims 2 to 4 have not been amended. Claims 5 to 11 have only been amended to clarify the dependencies specified therein. Thus, the amendments to the patent do not contravene

Articles 123(2) and 123(3) EPC.

3. *Novelty*

3.1 Document F3 shows different rigid insulators for voltages *U*m up to 36 kV, which are parts of devices for interconnecting cables with apparatuses. The rigid insulators have conical interface surfaces intended to cooperate with respective cable terminations of complementary shape. The angles α defining the conical surfaces of the rigid insulators can be determined from the dimensions d1, d2 and h2 specified in F3 and vary between 0.895° and 5.95°. The rigid insulators illustrated in the figures of F3 have further conical surfaces (shown in the lower parts of the Figures 1 of F3) that are internal to the apparatuses and thus, contrary to what was assumed by the opposition division, are not intended to cooperate with cable terminations of complementary shape.

3.2 Document E5 discloses a device for interconnecting a medium or high voltage cable with an apparatus. In particular, the cable termination 7 comprises an elastomeric body having a conical interface surface. The device of E5 further comprises a rigid insulator 3 having a conical interface surface 6 complementary to the interface surface of the cable termination. E5 does not explicitly indicate the value of the angle of the conical interface surface of the rigid insulator or other dimensions that would allow that angle to be calculated. In the view of the board, Figures 1 and 2 show diagrammatic representations of the devices described in E5 and dimensions that would be obtained merely by measuring said diagrammatic representations

do not form part of the disclosure of E5 (see decision T 0204/83, OJ 1985, 310). Thus, E5 does not disclose the value of the angle defining the conical interface surface of the rigid insulator.

3.3 Document E3 discloses a device for interconnecting an apparatus and medium or high voltage cables, wherein the cable terminations 21 and an insulator body 8 have complementary conical interface surfaces. However, E3 does not explicitly indicate the value of the angle defining the conical interface surfaces, or other dimensions that would allow that angle to be calculated.

3.4 Document F2 discloses a device comprising an elastomeric body that has two conical interface surfaces that are complementary to the conical interface surface of rigid insulators intended to cooperate therewith. The value of the angle defining the conical interface surfaces, or dimensions that would allow it to be calculated, are not mentioned in F2.

3.5 Thus, none of the cited documents of the prior art discloses a conical interface surface with an angle in the range between 15° and 45°. The subject-matter of claims 1 and 2 is therefore considered to be new in the sense of Article 54 EPC.

4. *Inventive step*

4.1 The board agrees with the parties in taking document E5 as the closest prior art from which to start the assessment of inventive step of the subject-matter of claim 1. As explained above, E5 does not disclose a

value for the angle of the conical interface surface. According to the patent in suit (see column 1, lines 15 to 19 of the printed specification EP-B1-0 731 994), the object of the invention is to provide a simplified connection system for cables having ratings up to 400 kV and above. In particular, having an angle α in the range specified in claim 1 allows a reduction in the height of the device while keeping the tangential component of the electric field at the conical interface surfaces within acceptable limits, and simultaneously reduces the mechanical effort necessary for separating the rigid insulator and the cable termination when they have to be disassembled.

4.2 In the view of the board, a skilled person aiming at providing a device for interconnecting a high voltage cable with an apparatus or a second high voltage cable would first base his design on existing standards, in particular on document F3. This standard discloses angles of 0.895° or 4.31° for devices operating at 24 kV and 3.18° or 5.95° for devices operating at 36 kV. Thus, F3 suggests angles that are well outside the range specified in the claims of the patent in suit. Furthermore, F3 gives specifications for only two voltages and one of the angles (4.31°) for the lower voltage (24 kV) is larger than one of the angles (3.18°) for the higher voltage (36 kV). Thus, in the view of board, F3 does not show a trend to systematically increase the angle with the voltage. It is true that document E5 is concerned with the length of the device. According to E5 (see in particular page 4, penultimate paragraph), the axial length of the device can be reduced by having the rigid insulator tightly gripping both an exposed portion and an insulated portion of the

conductor on the apparatus side. E5 does not discuss the influence of the angle defining the conical interface surface on the length of the device and does not suggest increasing the angle to a value between 15° and 45°. Documents E3 and F2 also do not disclose an interface angle in the range specified in claim 1 of the patent in suit and, in respect of the value of the angle, do not add anything to the disclosure of document E5. The board comes therefore to the conclusion that, having regard to the state of the art, the subject-matter of claim 1 of the patent in suit is not obvious to a person skilled in the art and thus has to be considered as involving an inventive step in the sense of Article 56 EPC.

4.3 The subject-matter of claim 2 of the patent in suit, which specifies an angle defining the conical surfaces of the rigid insulators between 15° and 45°, has to be considered as involving an inventive for the reasons indicated above in connection with claim 1.

5. The subject-matter of claims 3 to 11, which are dependent on claim 1 or 2, is thereby also to be considered as being new and involving an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent as amended in the following version:

   Description: columns 1 and 2 received during the oral proceedings, columns 3 and 4 of the patent specification.

   Claims: 1 to 11 received during the oral proceedings.

   Drawings: figures of the patent specification.

The Registrar: The Chairman:

D. Sauter W. J. L. Wheeler