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File No.: T 1082/92 - 3.5.2  
Application No.: 86 308 542.9  
Publication No.: 0 227 268  
Classification: H01B 7/02  
Title of invention: Transmission line

**D E C I S I O N**  
of 26 October 1993

Applicant: Junkosha Co. Ltd.  
Proprietor of the patent: -  
Opponent: -

Headword:

EPC: Art. 56

Keyword: "Inventive step (yes, after amendment)"

**Headnote**  
**Catchwords**



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Boards of Appeal

Chambres de recours

Case Number: T 1082/92 - 3.5.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.2  
of 26 October 1993

**Appellant:**

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**Representative:**

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**Decision under appeal:**

Decision of the Examining Division of the European  
Patent Office dated 5 August 1992 refusing  
European patent application No. 86 308 542.9  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** W.J.L. Wheeler  
**Members:** A.G. Hagenbucher  
M.V.E. Lewenton

## Summary of Facts and Submissions

I. The present appeal contests the decision of the Examining Division refusing the Appellant's European patent application No. 86 308 542.9. The reason given for the refusal was that the subject-matter of Claim 1 then on file did not involve an inventive step having regard to the following prior art document

D1: US-A-3 688 016

and general knowledge.

It was also stated that the subject-matter of the dependent claims then on file was obvious, taking into account

D2: DE-C-863 378.

II. During the appeal proceedings the Rapporteur referred in a communication accompanying summons to oral proceedings to the following further documents:

D3: JP-A-57 176 132 and the English translation thereof, D3', and

D4: GB-A-584 183.

III. In the course of oral proceedings held before the Board on 26 October 1993 the Appellant filed amended Claims 1 to 6 and an adapted description page 2. He requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Claims 1 to 6 and page 2 as filed during the oral proceedings on 26 October 1993,

Claims 7 to 9 and description pages 1, 1(a) filed on 7 June 1991,

description pages 3 to 13 and one sheet of drawings as originally filed.

IV. Claim 1 is now worded as follows:

"An electrical transmission line (1,5,10,17) comprising a signal conductor (2,6,11,18), a porous expanded polytetrafluoroethylene insulating material (3,7,12,21) surrounding said conductor (2,6,11,18), said insulating material (3,7,12,21) having at least one opening (4,9,13,22) therein having a wall, the insulating material at and near the wall being solid, fused material, whereby the wall of the opening (4,9,13,22) provides compressive strength for the otherwise highly compressible, porous material (3,7,12,21)."

Claims 2 to 9 are dependent on Claim 1.

V. The Appellant argued in effect that in the transmission lines known from D1, D2, and D4 relatively inflexible and hard materials were used for insulation. D1 disclosed a coaxial cable in which a groove in the outer surface of the rigid insulating material enabled the insulator to flex along with the inner and outer conductors of the cable. Since the groove may be formed by a hot wire so that the plastic melted and fused there was a certain similarity with the opening and its wall of the transmission line as claimed. However, looking at the transmission line as a whole there were clear differences. Due to the deep groove in the outer surface of the insulating material according to D1, the tensile

forces as well as the pressure forces were reduced when the transmission line was bent. If the transmission line was bent such that the material assumed a concave configuration, the groove was narrowed or closed thereby avoiding great pressure within the insulating material. If the line were bent such that the material assumed a convex shape, the width of the groove was widened thereby avoiding extensive tensile stresses within the insulating material. There was nothing in D1 which might suggest an opening having a rigid wall material in order to obtain a certain degree of compressive strength. According to D1 the groove served to make the transmission line with relatively rigid material flexible. If for the cable in D1 a highly compressible material was used, the groove would obviously not be necessary. D2 and D4 showed the use of recesses and spacers, D4 in connection with gas pressure. D3 dealt only with insulation material with holes which could be made in various ways. The present invention followed a different way by starting with a relatively soft material - porous expanded polytetrafluoroethylene - and used the wall of at least one opening in this insulating material for providing compressive strength for the otherwise highly compressible, porous material.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Claim 1 and the corresponding statement of invention on page 2 have been restricted in that the insulating material is porous expanded polytetrafluoroethylene. It is clear therefrom that more general terms for the insulating material appearing later in the description have to be interpreted as being restricted thereto.

Moreover, it has been clarified that it is the wall of the opening which provides compressive strength.

Since the description as filed presents expanded porous polytetrafluoroethylene as the preferred polymer (cf. page 4, penultimate paragraph) and the function of the wall of the opening is clear from the description, the amendments made to Claim 1 do not infringe Article 123(2) EPC. This applies also to the amendments of the description and dependent claims.

3. After examination of the cited documents, the Board finds that none of them shows all the features of the subject-matter defined in present Claim 1. Since novelty is not in dispute, the issue to be decided in the present case is whether the subject-matter of present Claim 1 is still objectionable for lack of an inventive step in the sense of Article 56 EPC.

4.1 It is explained in the introduction of D1 (cf. column 1, lines 28 to 36) and in the present application that transmission lines with a signal conductor require a certain flexibility and that porous substances should be used as dielectric materials because of their low permittivity. Although it is known that porous expanded polytetrafluoroethylene has good electrical characteristics it collapses easily because of its high compressibility. Moreover, it can be expanded by only a limited amount which results in a lower limit to the effective dielectric constant obtainable.

Hence, starting from this prior art and general knowledge, the objective problem underlying the present application is to provide an electrical transmission line in which porous expanded polytetrafluoroethylene is used as insulating material in such a way that it does not easily collapse and has low permittivity.

This problem is solved according to Claim 1 in that the insulating material has at least one opening therein having a wall, the insulating material at and near the wall being solid, fused material whereby the wall of the opening provides compressive strength for the otherwise highly compressible, porous material.

4.2 As explained in the introduction of the present application (cf. page 1a), it is known from D3 to lower the permittivity of porous expanded polytetrafluoroethylene by providing it with a multiplicity of through holes in order to further increase the porosity. According to D3 these through-holes may be manufactured either by press/laser, a needle punch or other high-tech processing means. D3 suggests increasing the shape-retention by heat setting or heat setting and drawing after providing the through-holes. This underlines the fact that any influence of the mentioned use of the laser beam for making the through-holes on the rigidity of the material has not been recognised there. Moreover, according to D3 this material is not mentioned in connection with transmission lines but just as a material for electrical insulation.

4.3 In view of the problems with flexible expanded plastic foam insulators mentioned above, documents D1, D2 and D4 favour the use of more inflexible materials such as polystyrene as insulating materials for transmission lines because they are considered to allow larger air spaces therein for the desired low dielectric constant.

Although D1 (cf. column 1, lines 28 to 36) mentions expanded polyethylene, it points away from using it and suggests instead the use of inflexible materials such as expanded polystyrene. In order to make a cable flexible in spite of the use of inflexible insulating material, according to D1 a groove is provided within the outer

surface of the rigid material. Due to the groove the tensile forces as well as the pressure forces are reduced when the transmission line is bent. The fact that the groove may be formed by a hot wire so that the plastic melts and fuses shows a certain similarity with the opening and wall of the claimed subject-matter but D1 does not teach the provision of an opening having a rigid wall material in order to obtain a certain degree of compressive strength of an otherwise highly compressible material.

- 4.4 Also, according to D2, inflexible insulating material is used which is made flexible by recesses.

D4 shows transmission lines with spaced apart insulator disks in combination with spaces filled with gases under high pressure in order to provide sufficient stability even if more compressible insulating materials are used.

These documents do not hint at using the walls of fused openings in otherwise highly compressible porous materials for increasing the compressive strength in electrical transmission lines, either.

- 4.5 The Board, therefore, comes to the conclusion that the subject-matter of Claim 1 cannot be derived in an obvious manner from the cited prior art and must accordingly be seen as involving an inventive step within the meaning of Article 56 EPC.

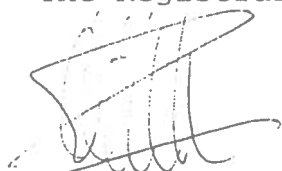
5. The same applies to Claims 2 to 9 which are dependent on Claim 1.

Order

For these reasons, it is decided that:


1. The decision of the Examining Division is set aside.
2. The case is remitted to the first instance with the order to grant a patent in accordance with the Appellant's request.

The Registrar:



M. Kiehl

The Chairman:



W.J.L. Wheeler

