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D E C I S I O N
of 1 March 1994

Case Number: T 0264/93 - 3.2.1

Application Number: 88309993.9

Publication Number: 0313416

IPC: F16C 1/26

Language of the proceedings: EN

Title of invention:
Poly(amid-imide) conduit

Applicant:
Teleflex Incorporated

Opponent:
-

Headword:
-

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (after amendment: yes)

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0264/93 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 1 March 1994

Appellant: Teleflex Incorporated
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Representative: Geldard, David Guthrie
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 27 October 1992 refusing European patent application No. 88 309 993.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: F.A. Gumbel
Members: P. Alting van Geusau
B.J. Schachenmann

Summary of Facts and Submissions

I. The Appellant's European patent application No. 88 309 993.9 (publication No. 0 313 416) was refused by a decision of the Examining Division dated 27 October 1992.

The Examining Division expressed the view that the subject-matter defined in Claim 1, filed with letter dated 8 June 1992, lacked an inventive step, having regard in particular to the prior art disclosed in the documents:

D2: Elias, H.-G.: "Neue polymere Werkstoffe 1969-1974", München/Wien 1975, pp. 137 to 153,
D3: US-A-4 362 069 and
D5: Elias, H.-G, "Macromolecules: synthesis, materials and technology", New York, 1984, p. 1214, table 36-9, second last and last column.

The Examining Division considered that, taking into account the disclosures of this prior art, it would be obvious for the skilled person to replace the additive polyphenylenesulphide (PPS) responsible for the strength of the liner known from D3, by the additive poly(amide-imide) (PAI) known from D2 and D5 showing better and/or additional properties, which replacement would therefore lead to the subject-matter of Claim 1 without involving an inventive step.

II. An appeal was lodged against this decision on 1 December 1992 and payment of the appeal fee was received on 7 December 1992.

In the Statement of Grounds of Appeal, filed on 1 March 1993, the Appellant referred to the following additional

documents for substantiation of the non-obviousness of the claimed subject-matter:

D6: Concise Encyclopaedia of Polymer Science and Engineering, 1990, pp. 758-760, 768-770, 826-828,
D7: The Penguin Dictionary of Chemistry, second edition, pp. 320 and 321,
D8: "Organic Chemistry" by John McMurry, 1984, pp. 1154-1156,
D9: "Polymers; Chemistry and Physics of Modern Materials" by J.M.G. Cowie, 1973, pp. 15-17,
D10: US-A-4 112 708
D11: US-A-5 045 600
D12: US-A-5 161 427.

Further were submitted:

1. a declaration of Dr Charles P. Marino and

2. an affidavit of Mrs Diane P. Fukuda.

III. In preparation for the oral proceedings, auxiliarily requested by the Appellant, the Board informed the Appellant of its provisional opinion in a communication dated 2 July 1993.

Since novelty of the claimed subject-matter was not in dispute the main issue to be discussed at the oral proceedings did, in the Board's opinion, amount to the question whether the skilled person was led by the available prior art in an obvious manner to substitute the known filler material polyphenylene sulphide (PPS) in the liner material of the remote control assembly disclosed in D3 by a filler of poly(amide-imide) (PAI) and whether he had used the same quantities of ingredients for preparing the compound of PTFE and PAI as claimed in the present application.

In this respect the Elias publication (D2), paragraph 10.3 on page 143, was considered to be relevant.

IV. With letter of 23 February 1994 the Appellant filed a report of comparative test results relating to the liners AR-500 (10% polyphenylene sulphide filled liner), ESM-0111 (glass filled liner) and ESM-0112 (liner comprising 3% PAI).

V. At the oral proceedings the Appellant filed new Claims 1 to 6 and an adapted description, pages 1 to 8.

He requested that the decision under appeal be set aside and a patent be granted on the basis of these documents together with the original drawings.

The independent Claims 1 and 6 in accordance with this request read as follows (after correction of a clerical error in line 6 of Claim 6):

"1. A remote control assembly (10) of the type for transmitting motion in a curved path, said assembly (10) comprising: a conduit (11); a liner (12) made of a fluorocarbon polymer disposed in said conduit (11); and a core element (14) adapted for movement within said liner (12), said assembly (10) characterised by said liner (12) including poly(amide-imide) dispersed substantially uniformly throughout the fluorocarbon polymer for increasing the strength and lubricity of the liner (12), said liner (12) comprising 97 weight percent fluorocarbon polymer and 3 weight percent poly(amide-imide).

6. A remote control assembly liner (10), the assembly being of the type for transmitting motion in a curved path, said liner made from a fluorocarbon polymer and

characterised by including poly(amide-imide) dispersed substantially uniformly throughout the liner (12) for increasing the strength and the lubricity thereof, said liner (12) comprising 97 weight percent fluorocarbon polymer and 3 weight percent poly(amide-imide)."

VI. In support of his request the Appellant relied essentially on the following arguments:

D3 discloses a remote control assembly of the general type claimed in the present application. The liner within which the moveable core is disposed, is made of a composite material comprising 80 to 98.04% of polytetrafluoroethylene (PTFE) and 20 to 1.96% polyphenylenesulphide (PPS).

The present invention differs from D3 in that a liner material comprising 97% PTFE and 3% of poly(amide-imide) (PAI) is used which leads to considerable improvement of the motion transmission efficiency and exhibits less wear, which is apparent from the comparative test results.

When compared with the preferred quantity of 10% PPS used in the prior art liner, the liner comprising 3% PAI in accordance with the invention not only gives better performance but leads also to considerable manufacturing cost savings.

Neither a hint to the use of PAI in a remote control liner nor the particular amount to be used can be derived from any of the cited prior art documents.

The Elias publications D2 and D5, relied upon by the Examining Division to show equivalence of PPS and PAI do not afford a clear and unmistakable instruction to replace PPS by PAI. As can be derived from the further

cited prior art documents D6 to D9, polyimides are considered to be speciality plastics. As such, they are priced well above commodity polymers. Furthermore, their mechanical and electrical properties are stated to vary widely. General statements of the kind contained in Elias are thus of little value to a skilled addressee who is attempting to develop a material with specific essential properties which are an improvement over existing high performance materials (e.g. PPS), in particular since known attempts to improve the assembly under consideration have led to different technical solutions, thus indicating the non-obviousness of the present invention. In this respect D10 discloses the use of a liner composed of plastic material selected from a number of different materials adapted for conventional moulding or extruding techniques. Especially excellent results were obtained with a liner made of graphite-containing plastic materials which are rather of less friction resistance.

Although D4 discloses the use of PAI as a filler material in fluorocarbon articles, detailed study of this specification provides a teaching that the weight proportion of the fluorocarbon polymer and filler can be 100:5 to 80. This extremely wide range includes very high levels of PAI which are ineffective and unusable and thus a person skilled in the art would conclude that combinations of PAI and fluorocarbons disclosed in D4 are not useful in manufacture of motion transmitting control assemblies. The inventor of the present application unexpectedly found that utilising the claimed amount of PAI afford a flexible and usable push-pull assembly which can fully utilise the benefits of use of a PAI additive.

Sales of products incorporating the liner of the present invention which has superseded the Appellant's

previously used glass filled liner obtained an immediate significant share of the market as a direct result of the claimed invention thus proving a significant nexus between the claimed invention and the success of the product. Also this aspect supports the conclusion that the assembly in accordance with the present patent application involves an inventive step.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rules 1(1) and 64 EPC. It is admissible.

2. *Amendments*

Claim 1 substantially comprises the features of the originally filed Claims 1 and 4. The further independent Claim 6 is based on the originally filed Claim 9 and now comprises the limitation of the original Claim 4 that the liner comprises 97 weight per cent fluorocarbon polymer and 3 weight per cent poly(amide-imide). The additional feature in both independent claims according to which the poly(amide-imide) is dispersed substantially uniformly throughout the liner, respectively the fluorcarbon, follows from the original description, in particular page 4, last paragraph.

The dependent Claims 2 to 5 are essentially repetitions of the original Claims 5 to 8.

The amendments to the description concern the correction of obvious errors, the inclusion of a reference to the closest prior art (D1) and the addition of supplementary metric system units in accordance with Rule 35(12) EPC

as well as the necessary adaptations of the description to the subject-matter now claimed.

None of these amendments contravenes the requirements of the EPC. In particular they comply with the provisions of Article 123(2) EPC.

4. *Novelty*

Novelty of the subject-matter of the independent Claims 1 and 6 can be concluded for the reason that none of the cited prior art documents discloses a liner for a remote control assembly comprising 97 weight per cent fluorocarbon polymer and 3 weight per cent poly(amide-imide).

5. *Inventive step*

5.1 The Board agrees with the Examining Division that among the cited prior art documents it is D3 which comes closest to the claimed subject-matter and should therefore be used as starting point for assessing inventive step. This prior art document relates to a liner for remote control assemblies of the type for transmitting motion in a curved path for rotary motion or linear unidirectional motion (see column 1, lines 20 to 27).

The known liner is composed of a tubularly extruded polymer composite consisting essentially of a mixture of a resin of fluorocarbon polymers and a polymer of arylene sulphide (PPS) in the range of from about 2 to 25 weight parts per hundred resin (thus from 1.96 to 20 weight per cent).

Such a known remote control assembly corresponds to the precharacterising features of Claims 1 and 6, respectively.

5.2 The problem to be solved by the subject-matter of the independent Claims 1 and 6 starting from the liner of D3 can be seen in the provision of a liner in a remote control assembly with improved wear and friction characteristics which allows low cost manufacturing.

5.3 Considerations as to the improvement of the known remote control assembly both in respect of its technical properties and manufacturing costs belong, in the Board's opinion, to the normal professional duties of the develop engineer.

In D3 the properties of the known liner are improved by mixing fluorocarbon polymer with a filler (polyphenylene sulphide (PPS)) and it would therefore, in the Board's opinion, be obvious that the skilled person confronted with the problem referred to above would carry out tests with other fillers that are suitable for mixing with fluorocarbon polymer and are likely to give improvement of the wanted properties.

5.4 In this respect the Appellant argued that, in addition to the filler materials disclosed in the documents cited in the European search report, the available prior art discloses a great number of other materials that would be likely to provide high efficiency and abrasion resistance of the liner and that, when judging inventive step in respect of the selection of poly(amide-imide), the prior art as a whole should be taken into account. Since no lead to a selection of poly(amide-imide) or to the specific amount as claimed is derivable from the prior art the subject-matter of the independent Claims 1 and 6 must be considered inventive.

The Board agrees that the skilled person would consider the prior art in its entirety and indeed many plastic materials and fillers such as different polymers, glass and graphite are mentioned as possible candidates for liner members or inner layers of the liners (see for example D10, column 3, lines 55 to 64).

5.5 The Examining Division considered the selection of a compound of a fluorocarbon and poly(amide-imide) obvious to the skilled person in view of D2 disclosing that all polyimides show an exceptionally good wear resistance and lubricity with a high short-time strength and heat resistance and in view of the fact that compounds of poly(amide-imide) and poly(tetrafluoroethylene) have been available before 1975 (cf. D2, page 138, last chapter), whereas D5 discloses that PPS, the filler material used in D3, and poly(amide-imide) have similar physical properties. For this reason the mere substitution of the one by the other within the same broad range of the amount of the filler material was considered obvious.

However the skilled person is aware of the fact that the properties of a compound are not necessarily directly linked to the properties of its constituents, in particular in case of the use of relatively small amounts of the additive now claimed. Therefore, although the disclosures of D2 and D5 might be considered to give the skilled person a hint to incorporate poly(amide-imide) in a comparative test scheme with other filler candidates known from the prior art in order to find a solution to the problem posed, no direct lead to the replacement of PPS by poly(amide-imide) in any particular amount is derivable from either D2 or D5.

D4, which is the only further cited document that mentions poly(amide-imide) as a filler for fluorocarbon polymer, relates to a process for preparation of filler-containing polytetrafluoroethylene in which the filler may be poly(amide-imide). However, this document does not contain any information as to the physical properties of the compound other than its heat resistance (see column 2, lines 46 to 49) or as to its specific use and therefore can also not be considered pertinent as regards a specific amount of poly(amide-imide) in the compound and its use for a liner of a remote control assembly.

5.6 Moreover, in the present case the Appellant documented with the report of comparative test results filed with letter dated 23 February 1994, which substantially correspond with Figures 4 and 5 of the present application, that the now claimed small amount of 3% poly(amide-imide) in the fluorocarbon polymer leads to an non-proportional rise of efficiency and lifespan (see the "severe load efficiency test summary" on the last two pages of the report) of the liner according to Claims 1 and 6 now on file. This unexpected effect is not foreshadowed by any of the cited documents including D3 and D4.

Indeed in D3 the amount of PPS can vary between 2 to 25 parts per hundred resin (phr) (see column 5, line 26) and in D4 within a even wider range starting from about 5 weight per cent poly(amide-imide) (see column 3, lines 14, 15), but no indication of any discontinuity in the properties of these known compounds or any indication of an unexpected effect in case of a substitution of PPS by poly(amide-imide) is derivable from these documents.

5.7 Summarising, in the Board's judgment, the proposed solution to the technical problem underlying the patent in suit defined in the independent Claims 1 and 6 involves an inventive step and therefore these claims as well as the dependent Claims 2 to 5 relating to particular embodiments of the invention in accordance with Rule 29(3) EPC, can form the basis for grant of a patent (Article 52(1) EPC).

Under these circumstances it is not necessary to consider the Appellant's arguments in respect of an alleged significant nexus between the claimed invention and the sales success of the product.

6. The description and drawings are in agreement with the actual wording and scope of the current claims. Hence these documents are also suitable for grant of a patent.

Order

For these reasons, it is decided that:

1. The contested decision is set aside.

2. The case is remitted to the first instance with the order to grant a patent with the Claims 1 to 6 and the description pages 1 to 8 as presented during the oral proceedings, and the original drawings, Figures 1 to 5.

The Registrar: The Chairman:

N. Maslin F. Gumbel