**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) [X] To Chairmen

# D E C I S I O N
## of 29 January 1998

**Case Number:** T 0220/95 - 3.3.3

**Application Number:** 86303290.0

**Publication Number:** 0200547

**IPC:** D01F 6/04

**Language of the proceedings:** EN

**Title of invention:**
Highly oriented molded article of ultrahigh-molecular-weight polyethylene and process for production thereof

**Patentee:**
Mitsui Petrochemical Industries, Ltd.

**Opponent:**
DSM N.V.

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 114, 56

**Keyword:**
"Inventive step (no) - obvious combination of known features"

**Decisions cited:**
-

**Catchword:**
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

**Case Number:** T 0220/95 - 3.3.3

**D E C I S I O N**
**of the Technical Board of Appeal 3.3.3**
**of 29 January 1998**

**Appellant:** (Proprietor of the patent)
Mitsui Petrochemical Industries, Ltd.
2-5, Kasumigaseki 3-chome
Chiyoda-ku
Tokyo 100 (JP)

**Representative:**
Cresswell, Thomas Anthony
J.A. Kemp & Co.
14 South Square
Gray's Inn
London WC1R 5LX (GB)

**Respondent:** (Opponent)
DSM N.V.
Postbox 605
6160 AP Geleen (NL)

**Representative:**
-

**Decision under appeal:**
**Decision of the Opposition Division of the European Patent Office posted 18 January 1995 revoking European patent No. 0 200 547 pursuant to Article 102(1) EPC.**

**Composition of the Board:**

**Chairman:** C. Gérardin
**Members:** P. Kitzmantel
J. A. Stephens-Ofner

## Summary of Facts and Submissions

I. European patent application No. 86 303 290.0 in the name of Mitsui Petrochemical Industries, Ltd., which had been filed on 30 April 1986, claiming priority from a JP application filed on 1 May 1985, resulted in the grant of European patent No. 200 547 on 3 July 1991 on the basis of 11 claims.

Its independent Claims 1, 7 and 9 read as follows:

"1. A process for producing a pre-oriented molded article of ultrahigh-molecular-weight polyethylene, which comprises
(1) extruding a high-concentration molding solution composed of 15 to 80 parts by weight of ultrahigh-molecular-weight polyethylene having an intrinsic viscosity, measured in decalin at 135°C, of at least 5 dl/g and 85 to 20 parts by weight of a solvent capable of dissolving said polyethylene from a molding die at a temperature at which the molding solution remains a solution, and
(2) taking up the extrudate at a draft ratio of at least 6, and cooling the extrudate during or after take-up to crystallize the polyethylene in the extrudate and to form a pre-oriented article."

"7. A process for preparing a stretched molded article which comprises the process of any one of the preceding claims and the additional step of stretching the pre-oriented molded article at a stretch ratio of at least 3."

"9. A pre-oriented molded article of ultrahigh-molecular-weight polyethylene, characterized by
(A) being composed of ultrahigh-molecular-weight polyethylene having an intrinsic viscosity, determined in decalin at 135°C, of at least 5 dl/g
(B) having a degree of orientation, determined by X-ray diffractometry, of at least 0.8, and
(C) having such a creep property that a stretched product of the molded article having a degree of orientation of about 0.97 shows an elongation of not more than 2% in an atmosphere at 80°C at 1000 seconds after the application of a high load which corresponds to 20% of a break load at a strain speed of 100%/min. at 23°C."

Claims 2 to 6 were dependent on Claim 1, Claim 8 was dependent on Claim 7, and Claims 10, 11 were dependent on Claim 9.

II. Notice of Opposition was filed by DSM N.V. on 31 March 1992 requesting revocation of the patent in its entirety, on the ground that the claimed subject-matter lacked novelty and/or inventive step.

III. By its decision announced orally on 2 December 1994 and issued in writing on 18 January 1995 the Opposition Division revoked the patent in suit.

The decision held that the process according to Claim 1 of the then main request, i.e. of the version as granted, was not novel over document

D1: EP-A-115 192,

especially because, in the light of the evidence adduced by the Opponent, namely

D5: Declaration of Prof. Keller, dated 1 March 1991,

D6: Declaration of Prof. Berghmans, dated 13 March 1991, and

D7: Exhibit A, a report of Dr Gerrits entitled "Dissolution and gelation behaviour of UHMWPE in paraffin wax", dated 1 March 1991,

the spinning dope used according to D1 was a solution that met all the requirements of said Claim 1.

Nor, in the Opposition Division's opinion, was the subject-matter of Claim 9 of the main request novel, as was established by the results of the Opponent's reworking of Example 5 of document

D2: EP-A-135 253.

While, owing to their narrower definitions, the subject-matter of the independent Claims 1 and 8 of the auxiliary request (process Claim 1 comprising the features of granted Claims 1 and 4; product Claim 8 comprising the features of granted Claims 9, 10 and 11) was considered novel over D1 and D2, both these claims were still held to be lacking in inventive step over document D1, because the replacement of the

solvent "paraffin wax" by the solvent "decalin", the latter being used according to D2, was held by the Opposition Division to be an obvious alternative.

IV. Notice of Appeal against the above decision was filed by the Patentee (Appellant) on 10 March 1995. The fee for the appeal was paid on the same day and the Statement of Grounds of Appeal, comprising as his sole request a new set of eight claims, was submitted on 26 May 1995.

The independent claims of this request read as follows:

"1. A process for producing pre-oriented molded article of ultrahigh-molecular-weight polyethylene, which comprises
(1) extruding a high-concentration molding solution composed of 15 to 80 parts by weight of ultrahigh-molecular-weight polyethylene having an intrinsic viscosity, measured in decalin at 135°C, of at least 5 dl/g and 85 to 20 parts by weight of a solvent having a boiling point higher then the melting point of the polyethylene, and a melting point lower than 40°C and being capable of dissolving said polyethylene from a molding die at a temperature at which the molding solution remains a solution, and
(2) taking up the extrudate at a draft ratio of at least 6, and cooling the extrudate during or after take-up to crystallize the polyethylene in the extrudate and to form a pre-oriented article having a degree of orientation, determined by X-ray

diffractometry, of at least 0.8, and having a creep property such that a stretched product of the molded article having a degree of orientation of about 0.97 shows an elongation of not more than 2% in an atmosphere at 80°C at 1000 seconds after the application of a high load which corresponds to 20% of a break load at a strain speed of 100%/min. at 23°C."

"8. A pre-oriented molded article of ultrahigh-molecular-weight polyethylene, characterized in that (A) the article is composed of ultrahigh-molecular-weight polyethylene having an intrinsic viscosity, determined in decalin at 135°C, of at least 5 dl/g, (B) the article has a degree of orientation, determined by X-ray diffractometry, of at least 0.8, (C) the article has a creep property such that a stretched product of the molded article having a degree of orientation of about 0.97 shows an elongation of not more than 2% in an atmosphere at 80°C at 1000 seconds after the application of a high load which corresponds to 20% of a break load at a strain speed of 100%/min. at 23°C, (D) the article contains substantially no paraffinic wax having a melting point, determined by the DSC method, of 40 to 120°C and (E) the article substantially does not permit observation of a lamellar porous structure in its electron micrograph."

Independent Claim 6 is identical to Claim 7 in the granted version (see point I supra), Claims 2 to 5 are dependent on Claim 1 and Claim 7 is dependent on

Claim 6.

V. Oral proceedings, auxiliarily requested by both parties, were held on 29 January 1998.

VI. The arguments of the Appellant may be summarized as follows:

(i) The subject-matter of the claims of the main request was novel over documents D1 and D2, because its Claim 1 was even more restricted than that of the auxiliary request before the first instance opposition proceedings, which request was held to be novel by the appealed decision.

(ii) The subject-matter of the main request also involved an inventive step, because it provided in a surprising manner a solution to the problem of producing molded articles from ultrahigh-molecular-weight polyethylene (hereinafter UHMWPE) having improved creep properties and being devoid of undesired porosity.

In order to demonstrate the unexpected creep reduction, the Appellant submitted a **Declaration of Mr K. Yagi** (one of the inventors of the patent in suit) dated 13 July 1995 comprising the result of his reworking of Example 8 of document D8. According to this repeat experiment the creep, as defined in Claim 1 of the patent in suit, was 3.16%, a

value which contrasted with those of 1.78% and 1.56% according to Runs 37 and 38 of Example 2 of the patent in suit, which - apart from the use as solvent for the UHMWPE of decalin instead of the paraffin wax of D1 - used very similar methods of preparation.

Concerning the porosity issue, the Appellant pointed to Table 1 of the patent in suit which showed that, according to the claimed invention, by the application of a draft ratio of above 5.0, the formation of a porous lamellar structure could be prevented. This was contrary to the teaching of document D1, according to which the presence of micropores in the final stretched articles was imperative for the desired applications for selective membranes or electrets.

(iii) With respect to the evidence contained in documents D5, D6 and D7 the Appellant repeated criticism he made before the Opposition Division, alleging that not only was this evidence unreliable and obscure, but that, in addition, the DSC and PICS measurements performed could not establish the physical nature of the material undergoing the detected phase changes.

(iv) Moreover, document D1 was concerned with the replacement as solvent for UHMWPE of decalin by paraffin wax. It would not, therefore be obvious to do exactly the reverse, as suggested

by the patent in suit.

VII. The arguments of the Respondent may be summarized as follows:

(i) He did not contest the novelty of the subject-matter of the main request.

(ii) As to inventive step, the Respondent relied on the following documents:

D8: "Fibres", P. Chapman, 1974, pages 42-47,

D9: JP-B-9765/1962 Nisshin (English translation),

D10: "Mechanical behaviour of high Polymers" Alfrey, (1949) Chapter E: "Systems containing high polymers and materials of low molecular weight", pages 431-453,

D11: EP-A-64 167,

D12: Smook, Flinterman and Pennings, Polymer Bulletin 2, 775-783 (1980),

D13: CRC Handbook of Chemistry and Physics, ed. 58, page C-511 and C793,

D14: Hiltz, SPE Transactions, January, 1963, page 72-77,

D15: Hercules 1900 engineering information

bulletin.

(iii) The Respondent did not deny the existence of the creep improvement as evidenced by the Declaration of Mr Yagi, he did, however, deny its surprising character. In his opinion, the person skilled in the art would have known that the replacement as solvent of paraffin wax by decalin, in the circumstances, must cause this effect. This followed from two well-known facts, confirmed in D8, D9 and D10; firstly, that solvent residues in the final articles acted as plasticizer enhancing the mobility of the polymer molecules and hence lowered the resistance of said articles against cold flow, and secondly, that the lower boiling temperature of decalin as compared with paraffin wax necessarily caused its more effective removal from the extruded UHMWPE article.

(iv) As to the alleged unexpected character of the absence of a lamellar porous structure in the final molded articles manufactured according to the patent in suit, the Respondent contended that there was no evidence either for a dependence of this property on the solvent, paraffin wax or decalin, or for a difference with respect to this property between the filaments drafted to a draw ratio of 50 according to Example 8 of document D1 and those prepared in accordance with the patent in suit.

In his opinion, irrespective of the solvent used, any porosity of the final article resulted from the impossibility of eliminating the voids remaining after removal (extraction/evaporation) of the solvent from the (solvent containing) rigid crystallized article, when the stretching process is carried out below the softening temperature.

VIII. The Appellant requested that the decision under appeal be set aside and the European patent No. 200 547 be maintained on the basis of the claims submitted on 26 May 1995.

The Respondent requested dismissal of the appeal.

## Reasons for the Decision

1. The appeal is admissible.

2. *Article 114 EPC*

From the documents D4 and D8 to D15, newly submitted by the Respondent with his submission dated 6 December 1995, documents D8 and D10 as well as D12 to D15 are admitted into the proceedings, because they were filed in response to pending issues; documents D4 (which was referred to in the opposition proceedings but was not relied upon by the Appellant in his appeal), D9 and D11 are not admitted, because they do not contain any information which is relevant to the case or more

relevant than that contained in other documents which are in the proceedings.

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

All claims are fairly based on the original disclosure and the amendments introduced into the independent Claims 1 and 8 do not extend the protection beyond that of the patent as granted.

The basis of the claims in the original claim version (hereinafter in brackets) is as follows:

Claim 1 (Claims 1, 4, 6, 9, 10); Claim 2 (Claim 2); Claim 3 (Claim 3); Claim 4 (Claim 5); Claim 5 (Claim 7); Claim 6 (Claim 1); Claim 7 (Claim 8); Claim 8 (Claims 10, 11, 12).

The requirements of Art. 123 (2) and (3) EPC are therefore met.

4. *Novelty (Article 54 EPC)*

Novelty was not at issue in this appeal and also the Board is satisfied that, having regard to the available prior art, the subject-matter as defined in the two independent claims is not open to any objection in this respect.

5. *Inventive step (Article 56 EPC)*

5.1 Technical field of the invention

The patent in suit is concerned with the manufacture of stretched molded articles by extrusion of UHMWPE from highly concentrated dopes.

5.2 Prior art

5.2.1 Document D1

This citation relates to a process for producing a stretched article of UHMWPE by melt kneading a mixture comprising 15 to 80 parts by weight of UHMWPE having an intrinsic viscosity [η] of at least 5 dl/g and 85 to 20 parts by weight of a paraffin wax having a melting point of 40 to 120°C in a screw extruder, melt-extruding the molten mixture, cooling the extrudate to solidify it and subjecting it to a stretching treatment at a temperature of 60 to 140°C at a stretch ratio of at least about 3:1 when the melt-extrusion is carried out while a draft is applied to the unstretched extrudate or at stretch ratio of at least about 10:1 when no such draft is applied (Claim 1).

While drafting of the spun fibers is optional in D1, it is stated on page 13, lines 17 to 19: "... the as-formed unstretched extrudate before cooling can be melt-extruded as described above under a draft, and this gives better results." (emphasis by the Board).

Excess of paraffin wax is removed from the extrudate by extraction or leaching, preferably by using during the stretching process a solvent, e.g. n-decane, as

heat medium (page 16, lines 16 to 35; Example 1).

Examples 6, 7 and 8 ( pages 27 to 31) describe the preparation of filaments by melt extrusion of 25:75 blends of UHMWPE ([η] = 8.20 dl/g) and paraffin wax (melting point 69°C) at different draft ratios of, respectively, 2, 5 and 50. The modulus of elasticity and tensile strength values of filaments stretched to the same ratios increase with increasing draft ratio:

| | Table 7, Run 31: draft ratio: 2 stretch ratio: 10.0 | Table 8, Run 38: draft ratio: 5 stretch ratio: 10.0 | Table 9, Run 44: draft ratio: 50 stretch ratio: 9.2 |
|---|---|---|---|
| Modulus of elasticity (Gpa) | 9.84 | 19.4 | 50.6 |
| Tensile strength (GPa) | 0.98 | 1.51 | 2.43 |

The compatibility of the UHMWPE and the paraffin wax "is excellent and they form a very homogeneous mixture" as observed on the unstretched filament/film with a high magnification scanning electron microscope at a magnification of at least 3000 (page 18, lines 8 to 31).

The stretched articles can find use as fibers having high tensile strength and modulus of elasticity as well as in conventional applications of stretched

articles such as monofilaments and tapes. They can also be used as light weight reinforcing materials and, when stretched at very high ratios and after formation of micropores formed secondarily by the extraction of the excess of the paraffin wax, the articles can be used for selective membranes and electrets (page 20, first paragraph).

5.2.2 Document D2

This document is concerned with the preparation of concentrated homogeneous solutions of UHMWPE having an intrinsic viscosity [η] of at least 5 dl/g in a suitable solvent, e.g. decalin, which solutions are characterized by a particular melt flow rate, a single DSC endothermic peak, and a DSC melting point, Tm (°C), determined by ASTM D3418, within the range specified by the following formulae (1) and (2)

(1) $Tm = Tmo - a(1-x)$

(2) $25<a<45$

wherein Tmo is the DSC melting point (°C) of the UHMWPE and x is the weight fraction of the UHMWPE based on the total weight of UHMWPE plus solvent (page 1, line 14 to page 2, line 9; page 11, lines 3 to 27; page 13, lines 11 to 28; Examples 1 to 10 and 12).

According to Claim 7 a mixture of more 10% by weight to 75% by weight of the UHMWPE and less than 90% by

weight to 25% by weight of the solvent is first subjected to a swelling treatment at a certain elevated temperature below the DSC melting point, followed by heat-treating of the swollen mixture at a temperature equal to, or higher than, the DSC melting point of the UHMWPE. Alternatively, according to Claim 8, the mixture is first subjected to a wetting treatment resulting in a slurry of the UHMWPE in the solvent, which slurry is thereafter hot-mixed with further solvent at a temperature of at least 130°C.

According to Example 5 (in combination with Example 1) a 10% by weight solution of an UHMWPE ([η = 17 dl/g]) in decalin was spun at 130°C, passed through acetone kept at 20°C, cooled and solidified. The resulting gel-like wet filament was passed through a tubular oven heated at 120°C and stretched at the ratios of 1:1, 10:1 and 15:1. The filaments obtained at the stretch ratio of 15:1 exhibit a modulus of elasticity (measured at 2% strain) of 24.3 GPa and a tenacity of 2.65 Gpa.

As opposed to the method according to D1 (and also according to the patent in suit) document D2 does not disclose a drawing step of the extruded material before or during take-up and cooling.

5.2.3 Document D3

This citation discloses a process for the preparation of filaments of high modulus and high tensile strength by spinning a solution of a polyethylene having a

molecular weight $M_w \geq 4x10^5$ and subsequent drawing at a ratio sufficient to achieve a modulus of at least 20 GPa (Claim 1). Although there is a general statement that the solutions may contain at least 1 and at most 50 wt.% polyethylene (page 2, lines 39 to 41), the highest concentration of a polyethylene solution exemplified in D3 is that according to Example VIII (page 4, lines 78 to 83), where a polyethylene of a molecular weight $M_w$ _ 600,000 is dissolved in decalin to an 8% by weight solution.

According to Example I (page 3, line 91 to 114) a polyethylene of $M_w = 1.5x10^6$ was dissolved in decalin to a 2% by weight solution. The spun filaments, gel-like after air cooling and still containing 90% solvent, were drawn at 120°C to ratios between 2 and more than 30. Examples II and III (page 3, lines 115 to 129) differ from Example I in that before drawing the solvent content is either reduced at 60°C to 6% by weight or even further by additional extraction with methanol. It is stated on page 4, first paragraph that in the case of Example I higher draw ratios and higher values of modulus and tensile strength could be achieved than in the case of Examples II and III.

5.3 Closest prior art, problem to be solved and its solution

5.3.1 The process disclosed in document D1 essentially differs from that according to Claim 1 of the patent in suit only by the use as "dilution medium" for the UHMWPE of a paraffin wax having a melting point above

40°C instead of a solvent, like decalin, having a melting point below 40°C.

There was much discussion between the parties, whether or not the paraffin wax dope used according to D1 was a homogeneous solution in the same sense as the decalin dopes used according to the patent in suit. However, this question need not be decided here, because, first, following the amendments in the independent claims it is no longer decisive for the issue of novelty, as it was in the first instance opposition proceedings, and secondly, because it is also of no concern for the issue of obviousness. For the latter issue it is the **practical** suitability of the UHMWPE dopes for the melt-extrusion process which is of importance, not the theoretical question of the physical structure of the respective dopes; it is, however, clear from documents D1, D2 and D3 that UHMWPE dopes on the basis of both, paraffin wax and decalin, are suitable for the production of stretched articles, e.g. filaments, by extrusion, which may or may not be drafted before or during take-up and cooling.

It can therefore be decided that document D1 is the closest starting point for the assessment of the obviousness of the subject-matter of Claim 1 of the patent in suit.

5.3.2 The problem underlying the subject-matter of the patent in suit with respect to D1 can, thus, only be defined as the development of a **further** process for

the preparation of UHMWPE articles by the extrusion of dopes comprising the polymer in admixture with an appropriate "dilution agent" which is able to overcome the insufficient melt flowability of the pure polymer.

5.3.3 According to Claim 1 of the patent in suit the above problem is to be solved by the use as "dilution agent" - instead of the paraffin wax used according to D1 - of a solvent having a boiling point higher then the melting point of the polyethylene and a melting point lower than 40°C and being capable of dissolving said polyethylene.

5.3.4 Examples 1 to 4 of the patent in suit demonstrate that the above problem has effectively been solved by the measures of Claim 1, and in particular by the use of decalin as the solvent.

5.4 Obviousness

5.4.1 For the following reasons, it would have been obvious to one skilled in the art starting from document D1, to arrive at the claimed solution of the existing technical problem (cf. point 5.3.2 supra).

5.4.2 Document D2 (cf. point 5.2.2 supra) discloses on page 20, lines 10 to 18 that the UHMWPE/solvent (decalin) compositions prepared by the swelling treatment according to this document can be used for the manufacture of filaments, tapes and films having high elasticity and tenacity by extrusion and subsequent stretching. This fact is exemplified in

Example 5 of D2 on UHMWPE/decalin dopes comprising 10% by weight of the polymer. Thus, one skilled in the art was aware from D2 that highly concentrated solutions of UHMWPE (according to Claim 1 of D2: "more than 10% by weight to 75% by weight) in a solvent, like e.g. decalin, can be prepared and can be fabricated by extrusion.

As a consequence, the person skilled in the art could reasonably have expected that the UHMWPE solutions according to D2 would be suitable alternatives to the UHMWPE/paraffin wax compositions used according to D1, thus offering an obvious solution of the relevant technical problem.

5.4.3 For the reasons to follow, the above conclusion is not invalidated by:

- the missing drawing step after extrusion in Example 5 of document D2,

- the improved creep properties of the filaments obtained according to the patent in suit, or

- the low porosity of the filaments obtained according to the patent in suit.

5.4.3.1 Missing drawing step after extrusion in Example 5 of document D2:

The absence of this feature would not deter the person skilled in the art to substitute the solvent (decalin) dopes of D2 for the paraffin wax dopes of D1, for the

following reasons:

Firstly, it was known from document D3 (cf. point 5.2.3 supra) that filaments extruded from solutions of high molecular weight polyethylene in decalin of up to 8% by weight can be drawn, achieving thereby considerable improvements of modulus and tensile strength (cf. D3: Figures 1 and 2) and there is no reason to assume that the more concentrated dopes used according to patent in suit (Claim 1: 15 to 80 parts by weight) would be less amenable to drawing than the less concentrated dopes according to D3.

Secondly, D2 deals mainly with the **preparation** of concentrated UHMWPE solutions, and the production of extruded articles from these solutions, referred to on page 20, line 10 to page 22, line 1 and in Example 5, is an issue of secondary importance only. It is therefore hardly possible to attach any particular importance, let alone that of a "technical prejudice", to a "missing" technical feature, here the drawing step.

5.4.3.2 Improved creep properties of the filaments obtained according to the patent in suit:

Mr Yagi in his Declaration dated 13 July 1995 submitted the results of his reworking of Example 8, Run 44 (Table 9) of document D1. A comparison of the creep properties of the UHMWPE filaments prepared by Mr Yagi and those according to Runs 37 and 38 of Example 2 of the patent in suit, prepared in a very similar way to those of Example 8 of D1, reveals that

the present invention (cf. Example 2, Table 3 and Example 4, Tables 7 and 8 of the patent in suit) provides for a reduced creep elongation:

| | D1, Example 8 Run 44, Table 9 (Yagi) | patent in suit, Example 2, Run 37 | patent in suit, Example 2, Run 38 |
|---|---|---|---|
| stretch ratio | 9.2 | 7.4 | 9.7 |
| creep [s] | [600 s]: 2.74 | [660 s]: 1.76 | [480 s]: 1.24 |
| creep [s] | [1000 s]: 3.16 | [1200 s]: 1.78 | [1020 s]: 1.56 |

While the advantage of a reduced creep elongation of the filaments prepared according to the process of Claim 1 of the patent in suit is recognized by the Board, nor was it denied by the Respondent, it does not qualify for the following reasons as an unexpected effect capable of supporting the existence of an inventive step.

(i) It was known to one skilled in the art that the presence of solvent in a polymer causes swelling and plastification thereby increasing the mobility and facilitating orientation of the polymer molecules (cf. document D8, page 47, lines 9 to 11).

(ii) It was furthermore known that the presence of plasticizer in a polymer shifts the creep curve to shorter times (faster response) (cf. document D10, bridging sentence page 438/439; page 440, Figure 188).

(iii) According to document D1 there remain considerable amounts of paraffin wax in the final article. It is, for example, stated in the sentence bridging pages 16/17 that the amount of wax in the stretched porous fibers "is not more than 10% by weight". The amount of residual paraffin according to Table 1 (page 22) ranges from 5.8% to 10.7%, according to Table 3 (page 24) from 25.3% to 35.9%, and according to Table 4 (page 25) from 10.7% to 16.3%.

By comparison, according to Examples 1 and 2 of the patent in suit, the decalin solvent was first stripped from the drawn filaments by extraction with hexane and the filaments were then dried overnight at room temperature under reduced pressure. In the Board's opinion, after this treatment the filaments must essentially be free from decalin.

(iv) The filaments prepared according to Example 8 of D1, thus, contain much more residual solvent (= paraffin wax) than those prepared according to Runs 37 and 38 of Example 2 of the patent in suit, the decalin content of which is very probably marginal.

(v) Since the creep elongation is enhanced by the presence of solvent and vice versa (cf. points (i) and (ii) supra), it was to be expected that the filaments prepared according to Runs 37 and 38 of Example 2 of the patent in suit exhibit a lower creep elongation than those prepared according to Example 8 of D1.

5.4.3.3 Low porosity of the filaments obtained according to the patent in suit:

It was stated by the Appellant that document D1 was concerned with the production of **porous** stretched articles (cf. sentence bridging pages 16/17; page 20, lines 6 to 12), while the articles prepared according to the patent in suit (cf. Claim 8) did not substantially permit observation of a lamellar porous structure in its electron micrograph. The subject-matter of the present invention was non-obvious, the Appellant contended, since neither D1 nor D2 would suggest that by the change from paraffin wax to decalin this effect could be obtained.

Irrespective of the correctness of the Appellant's interpretation of D1 in this respect, this argument fails, because the contention that the substitution of a solvent having a melting point lower than 40°C, like decalin, for the paraffin wax used according to D1, will affect the porosity of the final article is not supported by the available evidence or general common knowledge. Nor are the results in Table 1 of the

patent in suit, which demonstrate that UHMWPE articles, which were extruded from decalin solutions, are porous when drawn at low draft ratios and non-porous when drawn at higher draft ratio, of any help to the Appellant as they only confirm what was known from document D12 (cf. page 780, Figure 2 and page 782, last paragraph before "Conclusions"), namely that the degree of porosity is governed by the extent of drawing, not by the nature of the solvent.

5.4.4 The conclusion of obviousness drawn above for the subject-matter of Claim 1 is equally valid for the subject-matter of the further independent Claims 6 and 8. The stretching step specified in Claim 6 was known from D1 and D2 and cannot contribute, therefore, to an inventive step. The product characterized in Claim 8 is the direct result of the process of Claim 1; since the latter was held obvious the same conclusion must apply to the products according to Claim 8.

5.4.5 Owing to their dependency on the independent Claims 1 and 6, respectively, Claims 2 to 5 and 7 stand in the same position, i.e. relate to obvious subject-matter.

## Order

## For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin