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D E C I S I O N
of 16 March 2000

Case Number: T 0664/97 - 3.3.3

Application Number: 90202506.3

Publication Number: 0420331

IPC: C08G 67/02

Language of the proceedings: EN

Title of invention:
Mono- or biaxially drawn films

Applicant:
SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes) - combination lying outside prior art disclosure - selection rules do not apply"
"Inventive step (yes) - unexpected discontinuity in effect"

Decisions cited:
-

Catchword:
-

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Case Number: T 0664/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 16 March 2000

Appellant: SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.
Carel van Bylandtlaan 30
NL-3596 HR Den Haag (NL)

Representative: -

Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 18 September 1996, issued in writing on 16 October 1996 refusing European patent application No. 90 202 506.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
A. C. G. Lindqvist

Summary of Facts and Submissions

I. European patent application No. 90 202 506.3, relating to "Mono- or biaxially drawn films", filed on 21 September 1990, claiming US priorities of 25 September 1989 (US 411771 and US 411772) and published under No. 0 420 331, was refused by a decision of the Examining Division, taken at an oral proceedings held on 18 September 1996 and issued in writing on 16 October 1996. The decision was based on a set of Claims 1 to 9, filed at the oral proceedings. Claim 1 reads as follows:

"Process for producing a mono- or biaxially drawn film by drawing a non- or less-stretched polymer sheet along one or two axes, respectively, characterized by drawing a linear alternating terpolymer of carbon monoxide, ethylene and a second ethylenically unsaturated hydrocarbon of at least 3 carbon atoms, the terpolymer having a melting point of at least 214°C, at a draw temperature of between 175°C and 205°C, to a draw ratio of at least 4 in at least one direction."

Claims 2 to 6 are dependent claims directed to elaborations of the process according to Claim 1.

Claim 7, and independent claim, is worded as follows:

"Mono- or biaxially drawn film obtainable by drawing a non- or less-stretched polymer sheet along one or two axes, respectively, characterized by comprising a linear alternating terpolymer of carbon monoxide, ethylene and a second ethylenically unsaturated hydrocarbon of at least 3 carbon atoms, the melting

point of the terpolymer being at least 214°C and the draw ratio of the drawn film to the non-stretched sheet from which it was produced being at least 4."

Claims 8 and 9 are dependent claims directed to elaborations of the film according to Claim 7. In particular, Claim 9 is directed to such a film, characterized in that it was produced at a draw temperature of between 175°C and 205°C.

II. According to the decision, drawing the films under certain conditions was a feature distinguishing the subject-matter of Claim 1 over the closest state of the art:

D2: EP-A-213 671,

which described polyketones of high strength and stiffness, with a melting point in the range 150°C to 245°C, and in particular of at least 214°C, which could be processed into films and sheets suitable for use in food and drink packaging. The specified minimum melting point of at least 214°C was not, however, a further distinction, because polymers having a melting point in this range were disclosed in D2. Even if it were regarded as a selection from the ranges disclosed in D2, it did not fulfil the requirements of being (i) narrow, (ii) far removed from the examples of D2, and (iii) purposive in character. In the latter connection, the skilled person would expect an increased melting point, reflecting a higher degree of crystallinity, to result in improved mechanical properties, in the light of general knowledge derived from:

D3: Kunststoff-Kompendium, third edition, 1990, pages 282 to 284 (post-published), corresponding to pages 260 to 262 of the second edition, 1988 (pre-published).

Whilst the objective technical problem solved by drawing the known polymers was to improve tangent modulus and tensile strength, it was a well-known procedure to improve mechanical properties by drawing, as evidenced by the document:

D6: Encyclopedia of Polymer Science and Engineering, vol. 7, 1987, pages 699 to 705; 708 to 711 and 721).

Furthermore, it was known from the document:

D1: EP-A-0 306 115,

that polyketones could be drawn.

The particular minimum draw ratio had not, however, been shown to be associated with a technical effect that was not predictable from the prior art.

Neither the results shown in the document:

D7: Kunststoff-Kompendium, 2nd Edition, 1988, page 305),

according to which, for polyamides, an 80 degree rise in melting point led to less than a twofold increase in E modulus,

nor those in calculations derived from the disclosure of

D5: D.W. Krevelen, "Properties of Polymers", 1976, pages 311 and 320 to 324,

filed at the oral proceedings as D8, showing a different drawing behaviour for polyketones having a melting point above 214°C compared with those with a lower melting point, were relevant to the assessment of inventive step, since the melting point was not a distinguishing feature. Consequently, they could not be taken into account in the assessment of inventive step.

Thus, the determination of the minimum value thereof to give the desired property improvement was a matter of routine experimentation and the claimed process was therefore not inventive. The same assessment applied to the products of the process.

III. On 12 December 1996, a Notice of Appeal against the above decision was filed, together with payment of the prescribed fee.

In the Statement of Grounds of Appeal, which was filed on 10 February 1997, the Appellant submitted in essence the following arguments:

(a) The range of polymers disclosed in D2 was considerably broader than that claimed in the application in suit, so that a selection had in fact been made. In any case the failure, in the decision under appeal, to take into account the feature of selecting the polymers having a melting

point of at least 214°C was not correct, because the relevant effect was obtained by the **combination** of drawing to a specified draw ratio **and** selecting a polymer having a melting point of at least 214°C.

(b) The disclosure of D2 was silent about drawing processes in general, and in particular about differences in the drawing behaviour of polymers having a high melting point expressly for film drawing. Thus, on the basis of D2 the skilled person would not draw a film of the polymers having a melting point of at least 214°C in the expectation of achieving an improved strength and rigidity.

(c) Contrary to the finding of the decision under appeal, the skilled person would not favour a higher melting point polymer, but, to avoid gel formation leading to structural heterogeneities or flaws, would choose a low melting point polymer for drawing.

The Statement of Grounds of Appeal was accompanied by a further set of Claims 1 to 9 forming an auxiliary request, and a number of extracts from standard texts in support of the arguments submitted.

IV. The Appellant requested that the decision under appeal be set aside and a patent granted on the basis of the set of Claims 1 to 9 filed on 18 September 1996 as main request, or, failing this, on the basis of the set of Claims 1 to 9 filed with the Statement of Grounds of Appeal as auxiliary request.

Reasons for the Decision

1. The appeal is admissible.

2. *The patent in suit; main request*

2.1 Amendments

Claims 1 to 9 differ from the corresponding claims as originally filed only in that certain minor amendments have been effected in Claims 1 and 7, respectively, to meet an objection of the Examining Division under Article 84 EPC. No objection to these amendments under Article 123(2) EPC was raised against these claims in the decision under appeal, and the Board sees no reason to take a different view. Consequently, the claims of the main request are held to meet the requirements of Article 123(2) and 84 EPC.

2.2 *Novelty*

Although the decision under appeal held that the subject-matter of Claim 1 was novel over D2, which was the closest state of the art, it did so specifically on the basis of one only of the relevant characterising features, namely the drawing of films under specified conditions. It did not recognise a distinction in the feature that the polyketone had to have a melting point of at least 214°C.

Whilst D2 undoubtedly discloses in a specific example a relevant polyketone having a melting point of 214°C (Example 6), and even such polymers having a melting

point above 214°C (Example 8: 244°C; and Example 9: 225°C), there is no indication that any of these polymers have been drawn. Nor is there any reference to drawing the polymer in D2, let alone to drawing a sheet to a draw ratio of at least 4 in at least one direction as required by the application in suit. On the contrary, whilst the applications referred to in D2 include processing the polymers into films, sheets, plates, fibres and moulded objects, the problem of strengthening them is suggested to be solved not by drawing, but by employing them in combination with other sorts of materials (column 6, lines 50 to 52; column 7, lines 2 to 5). It follows from the above, that D2 does not make available, in the sense of Article 54(2) EPC, a drawn polymer.

As regards the polyketones specifically exemplified as having a melting point of at least 214°C, it is evident that none of these has been processed to a point at which drawing takes place. Consequently, the polymers exemplified in D2 are undrawn polymers.

An undrawn polymer having a particular melting point cannot, however, be regarded as identical with such a polymer after having been drawn. On the contrary, the two species are quite distinct. Thus, the act of drawing, to a specific draw ratio, a terpolymer produced according to the teaching D2 (Example 4) generates a new polymer distinct from the original undrawn species. The question of whether the melting point of the polymer meets the criteria for selection from the disclosure of D2 thus becomes irrelevant, since the result of combining the features of melting point and draw ratio is something falling outside this

disclosure of D2.

In other words, neither the process according to Claim 1 nor the product according to Claim 7 can be regarded as arising by selection from within the disclosure of D2.

Consequently, the Board is unable to concur with the consequences of the finding, according to the decision under appeal, that the relationship of the melting point according to Claim 1 to those of the polymers according to D2 did not fulfil the relevant criteria of a selection.

In summary, whilst the Board concurs with the general finding of the decision under appeal that the subject-matter of Claim 1 of the application in suit is novel, it does so on the different basis that the combination of features of drawing polymers of a specific melting point to a specified minimum draw ratio is neither disclosed in D2 nor derivable by simple selection from any generality it makes available.

2.3 The technical problem and its solution

The Board sees no reason to differ from the finding of the decision under appeal, that the objective technical problem, arising from D2, of improving the tangent modulus and tensile strength of the known polymer had been credibly solved (cf. section II, above). Indeed, it is evident from Example 1 of the application in suit, that an extruded polyketone terpolymer (polymer A) having a molecular weight of 70 000, a limiting viscosity number (LVN), measured in m-cresol

at 100°C, of 1.5 dl/g and a melting point of **212°C**, had, when uniaxially drawn to a draw ratio of 6.5, a 1% Tangent modulus of 2620 MPa, whereas a comparable polyketone terpolymer (polymer B), having a molecular weight of 70 000, a LVN of 1.6 dl/g and a melting point of **220°C**, had a 1% Tangent modulus, when drawn to the same draw ratio, of 8 270 MPa; and when drawn to a draw ratio of 7.5, of 10 340 MPa (Table I). This corresponds to a threefold increase in modulus for an 8°C increase in melting point at the same draw ratio.

2.4 *Inventive step*

The question to be answered in the assessment of inventive step, in view of the above, is whether the skilled person would have expected an increase of this order on drawing a polyketone according to D2 having a melting point of at least 214°C, to a draw ratio of at least 4.

2.4.1 There is no disclosure or suggestion of such an improvement in D2. This is not surprising, since it is not concerned with drawing polymer sheets, and its only suggestion for providing an increase in strength is that of combining with other materials (section 2.2, second paragraph, above).

2.4.2 Nor would the disclosure of D3, relied upon in the decision under appeal, lead the skilled person to expect such an increase, since it neither concerns polyketones nor the behaviour of polymers on drawing, but merely the relationship between crystallinity and properties of polymers in general.

2.4.3 D6 states that, "For a given structure, the tensile modulus increases as the straightness or rodlike character of the molecular chain increases; the orientation of the molecular chain approaches perfection (in the direction of measurement); and the packing density of the chains, i.e., the number of chains per cross-sectional area, is maximized. The modulus is a strong function of the solid-state structure which, in turn, is determined by the total process history of the specimen..... In the case of conventional polymers, high modulus properties can only be produced by careful processing to highly perfected structures" (page 701). This is, however, a very general text which does not mention polyketones. On the contrary, it refers primarily to polyethylene (page 705, last full paragraph), specifically high density polyethylene (HDPE; paragraph bridging pages 708 and 709). In relation to the latter, it states, "As shown in Figure 7, the mechanical properties of HDPE change monotonically as a function of draw ratio; the modulus increases in an essentially linear fashion." (page 709). Hence, even if the content of the text were taken to be directly applicable to the drawing behaviour of polyketones, there is nothing to suggest that a higher initial crystallinity or initial melting point prior to drawing would lead to a higher modulus. Consequently, the skilled person would have no incentive to apply the drawing technique to polyketones of higher, rather than lower melting point.

2.4.4 Although D1 refers to deep-drawing polyketone containers (Claim 1), specifically to a ratio of at least about 2:1 and preferably at most 3:1 (page 4, lines 46 to 47), it concerns a technique different from

that of axially drawing a film to a draw ratio of at least 4. Consequently, its disclosure is not relevant to whether the skilled person would expect the observed increase in modulus in the drawn polyketones according to the application in suit.

2.4.5 Even if one were to follow the line taken in the decision under appeal, that the skilled person would expect a polyketone having a higher melting point and therefore a higher crystallinity, to exhibit a higher modulus on drawing according to the application in suit, there is nothing on file to suggest that such a large increase of modulus with such a relatively small difference in melting point of the polymer drawn would be expected, as is in fact observed (section 2.3, above).

2.4.6 In this connection, the disclosure of D7 suggests, in relation to polyamides, a far smaller increase (less than two-fold) in modulus for a much (ten-fold) greater increase in melting point. In contrast, the calculations presented as D8 on the basis of the equation relating modulus of elasticity of semicrystalline polymer to orientation by drawing, when applied to the polyketones according to Example 1 of the application in suit, show a different drawing behaviour depending on whether the melting point is above or below the relevant limit of 214°C. This implies the supervention of some unexplained further effect at the relevant threshold temperature.

2.4.7 The finding of the decision under appeal, that these data, the accuracy of which was not challenged, were not relevant to the assessment of inventive step, was

based on the previous finding concerning the question of whether the melting point was a distinguishing feature. Since, however, the Board has found differently from the decision under appeal in this respect (section 2.2, above), this reason for excluding the data no longer applies.

2.4.8 In summary, the very substantial increase in Tangent modulus characterising the drawn polyketones having a melting point of at least 214°C according to the application in suit, compared with those of lower melting point, is indicative of a different kind of drawing behaviour, which could not have been predicted by the skilled person from the state of the art. Consequently, the solution of the stated problem does not arise in an obvious way from such art.

2.4.9 On the contrary, the very closeness of the melting temperatures above and below which the discontinuity in modulus in the drawn polyketones according to the application in suit is observed, is a factor which makes the effect more, rather than less surprising, taking into account that the claimed subject-matter is not a selection on the closest state of the art, but lies outside it (section 2.2, above). In other words, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.

2.4.10 It follows that the subject-matter of dependent Claims 2 to 6 also involves an inventive step. Similar considerations apply to the subject-matter of independent Claim 7, since it is characterised by the relevant combination of melting point and draw ratio, and of Claim 8, since the latter is dependent on

Claim 7.

2.5 Hence, the main request must be allowed.

3. *Auxiliary request*

In view of the above, there is no need for the Board further to consider the set of claims forming the auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the basis of Claims 1 to 9 forming the main request, after any consequential amendment of the description.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin