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D E C I S I O N
of 12 June 2002

Case Number: T 0034/00 - 3.3.3

Application Number: 85303077.3

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Language of the proceedings: EN

Title of invention:
Gas fluidised bed terpolymerisation of olefins

Patentee:
BP Chemicals Limited

Opponent:
Union Carbide Chemicals and Plastics Company Inc.

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 114(2)

Keyword:
"Novelty - implicit disclosure (no)"
"Inventive step - non-obvious combination (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0034/00 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 12 June 2002

Appellant:
(Opponent)

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Decision under appeal:

Interlocutory decision of the Opposition Division
of the European Patent Office posted 5 November
1999 concerning maintenance of European patent
No. 0 164 215 in amended form.

Composition of the Board:

Chairman: P. Kitzmantel
Members: C. Idez
J. De Preter

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 0 164 215 in respect of European patent application No. 85 303 077.3 in the name of BP Chemicals Limited, which had been filed on 30 April 1985 claiming a FR priority of 2 May 1984, was announced on 23 August 1989 on the basis of 10 claims, independent Claims 1, 8, and 10 reading as follows:

"1. A gas fluidised bed process for the production of copolymers having a density comprised between 0.900 and 0.935, the process being characterised in that it comprises a copolymerisation of (a) ethylene, (b) propylene and/or 1-butene, and (c) alpha olefins comprising comprising [sic] 5 to 8 carbon atoms in the gaseous state in admixture with an inert gas and optionally hydrogen, the gas mixture circulating from bottom to top through the fluidised bed of the copolymer in course of formation, the copolymerisation being effected at a temperature comprised between 50°C and 100°C in the presence of a catalyst system comprising:

- a cocatalyst consisting of at least one organometallic compound of a metal of Groups II and III of the Periodic Table of Elements, and
- a solid catalyst of the general formula



in such proportions that the atomic ratio of the quantity of the said metal of groups II and III in the cocatalyst to the quantity of titanium in the catalyst is between 0.5 and 100 and in which solid catalyst Me is an aluminium and/or zinc atom, R_1 is an alkyl group comprising 2 to 8 carbon atoms, R_2 is an alkyl group comprising 2 to 12 carbon atoms, X is a chlorine or

bromine atom, D is an electron donor compound, the titanium being in a valency state less than the maximum, where

m is comprised between 1 and 8,
n is comprised between 0 and 1,
p is comprised between 0 and 2,
q is comprised between 0.01 and 1,
r is comprised between 2 and 22 and
s is less than 0.2,

the partial pressures (pp) of the various ingredients of the gas mixture being such that:

$0.05 \leq \text{pp comonomer (b)} : \text{pp ethylene} \leq 0.4$

$0.05 \leq \text{pp comonomer (c)} : \text{pp ethylene} < 0.177$

$0 \leq \text{pp hydrogen} : \text{pp ethylene} \leq 0.5$

$0.2 \leq \text{pp inert gas} : \text{total pressure} \leq 0.8$, and

$0.01 \text{ MPa} \leq \text{pp comonomer (c)} \leq 0.1 \text{ MPa}$

comonomer (b) being propylene or 1-butene or a mixture of these two olefins, comonomer (c) being an alpha-olefin comprising 5 to 8 carbon atoms or a mixture of these alpha olefins."

"8. A copolymer of ethylene and comonomers (b) and (c) which can be obtained by the process according to claim 1, comonomer (b) being propylene or 1-butene or a mixture of these two olefins, comonomer (c) being an alpha olefin comprising 5 to 8 carbon atoms or a mixture of these alpha olefins, characterized in that it has:

(a) a density comprised between 0.900 and 0.935,

(b) a total content of units derived from comonomers (b) and (c) comprised between 4 and 15 % by weight,

(c) contents of units derived from comonomers (b) and (c) such that the ratio by weight of the quantity of comonomer (c) to the quantity of comonomer (b) is comprised between 0.1 and 1.5,

(d) a melt index ($MI_{2.16}$) measured under 2.16 kg comprised between 0.1 and 30 g/10 minutes,

- (e) a flow parameter comprised between 20 and 40, calculated by the ratio of the melt index ($MI_{21.6}$) measured under 21.6 kg to the melt index ($MI_{2.16}$) measured under 2.16 kg,
- (f) a content of copolymers soluble in n-hexane at 50°C less than or equal to 2.0 % by weight, when the copolymer has a density equal to or greater than 0.918,
- (g) a total content in comonomers (b) and (c) present in the fraction of the copolymers which is soluble in boiling n-hexane which does not exceed by more than 15% the total content in comonomers (b) and (c) present in the fraction of the copolymer which is insoluble in boiling n-heptane,
- (h) an ethylenic unsaturation level of the vinyl, vinylene and vinylidene type of less than 0.2 ethylenic double bond per 1000 carbon atoms,
- (i) a single melting point comprised between 116° and 128°C, determined by scanning differential calorimetric analysis after stoving at 200°C, cooling at a speed of 16°C per minute and heating at a speed of 16°C per minute,
- (j) a structure with a low level of long branchings, such that $g^* \geq 0.90$, $g^* = (\eta) : (\eta_1)$, (η) being the intrinsic viscosity of the copolymer and (η_1) being the intrinsic viscosity of a linear polyethylene having the same weight average molecular weight as that of the said copolymer,
- (k) a titanium content less than 5×10^{-4} milligram atom of titanium per gram of the copolymer,
- (l) a bulk density comprised between 0.30 and 0.45 g/cm³ and
- (m) an inorganic residue content less than 350 ppm."

"10. Application of the copolymer according to claim 8 to the production of finished objects by injection moulding or rotational moulding techniques, or extrusion forming or blowing extrusion techniques, especially for films of high mechanical strength."

Claims 2 to 7 were dependent on Claim 1 and Claim 9 was dependent on Claim 8.

II. Notice of Opposition requesting revocation of the patent in its entirety on the grounds of Article 100(a) and (b) EPC was filed by Union Carbide Chemicals and Plastics Company Inc. on 22 May 1990.

The opposition was *inter alia* based on documents

D1: US-A-4 363 904,

D4: US-A-4 205 021,

D6: US-A-3 645 992,

D7: US-A-4 021 599, and

D9: GB-A-2 036 764.

III. By its decision dated 15 May 1995 (announced orally on 9 May 1995) the Opposition Division revoked the patent on the ground of Article 100(b) EPC because in its finding Claim 8, particularly feature (g) thereof, failed to meet the requirements of Article 83 EPC.

IV. On 10 July 1995 the Patentee lodged an appeal against this decision (appeal case T 573/95).

V. As a consequence, the previous decision of the Opposition Division was set aside by the decision of the Board of Appeal dated 22 July 1998 and the case was remitted to the Opposition Division in order to decide the remaining issues of novelty and inventive step on the basis of the claims as granted.

In that decision the Board held that the requirements of Article 83 EPC were fulfilled because the skilled person had been provided with ample information as to how to obtain the copolymers according to Claim 8 of the opposed patent (cf. Section 3.3).

VI. With its interlocutory decision dated 5 November 1999 the Opposition Division held that the patent met the requirements of the EPC in the amended version of the claims and the description submitted at the (second) oral proceedings held on 27 October 1999. This version of the claims differs from the granted version only with respect to following amendments (hereinafter in bold characters) in the introductory statements of Claims 1 and 8:

"1. A gas fluidised bed process for the production of copolymers having a density comprised between 0.900 and 0.935, the process **comprising** [granted version: being characterised in that it comprises] a copolymerisation of (a) ethylene, (b) propylene and/or 1-butene, and (c) alpha olefins comprising 5 to 8 carbon atoms in the gaseous state in admixture with an inert gas and optionally hydrogen, the gas mixture circulating from bottom to top through the fluidised bed of the copolymer in course of formation, the copolymerisation being effected at a temperature comprised between 50°C

and 100°C in the presence of a catalyst system used in the form of a prepolymer, said catalyst system comprising:

....."

"8. A Ti-containing copolymer of ethylene and comonomers (b) and (c) in the form of a powder which can be obtained by the process according to claim 1, comonomer (b) being propylene or 1-butene or a mixture of these two olefins, comonomer (c) being an alpha olefin comprising 5 to 8 carbon atoms or a mixture of these alpha olefins, the copolymer having [granted version: characterized in that it has]:

....."

VII. This second decision of the Opposition Division held that the claims as amended met the requirements of Article 123(2) and (3) EPC and that their subject-matter was novel and inventive over the prior art, especially over document D1. According to that decision D1 failed to disclose in combination all features of Claim 8 and did not suggest that the objective of the patent in suit, i.e. the provision of a gas fluidised process for the production of homogeneous, powdery ethylene copolymers having high bulk density, a low content of inorganic residues as well as excellent mechanical and optical properties, could be attained by the process of Claim 1 and the product of Claim 8.

VIII. On 5 January 2000 the Opponent (Appellant) lodged an appeal against the interlocutory decision of the Opposition Division and paid the appeal fee on the same day. The Statement of Grounds of Appeal was submitted on 29 February 2000.

The following new documents were cited by the Appellant:

D11: B.C. Childress, Properties of Homogeneous and Heterogeneous Polyolefins: Metallocene Catalyzed versus Ziegler-Natta Catalyzed Resins, W.R. Grace & Co., Cryovac Division, May 1994, and

D12: undated BP data sheet for Innovex LL 7409 KJ (supplemented by allegedly corresponding experimental evidence).

IX. According to the Statement of Grounds of Appeal the appeal was directed against the subject-matter of Claims 8 to 10 of the patent as amended only (cf. page 1, second paragraph).

The arguments presented by the Appellants in that statement and in further written submissions dated 9 February 2001 and 29 May 2001 may be summarized as follows:

(i) Document D1 represented the closest prior art in that it disclosed ethylene terpolymers which comprised the features of the initial passage of Claim 8 as well as features (a), (b), (d), (e), (i) and (k). In the Appellant's view, features (c), (f), (g), (h), (j), (l) and (m), whose anticipation was in dispute, were either known from or obvious over D1 and/or D9 (features (c), (f), (g)), or were not critical for the subject-matter of Claim 8 which, therefore, lacked an inventive step.

With regard to the features in dispute the Appellant essentially relied on the following arguments:

- (i-1) Feature (c) ("contents of units derived from comonomers (b) and (c) such that the ratio by weight of the quantity of comonomer (c) to the quantity of comonomer (b) is comprised between 0.1 and 1.5"):

While this feature was not as such disclosed in D1 it could be calculated from the information in D1 that this ratio was from 0.05 to 18.8 and that it was 1.01 according to Example 5 and 1.52 according to Example 4.

Furthermore, in the Appellant's view, this feature did not give rise to any unexpected effect (cf. sub-point (ii-3) below).

- (i-2) Feature (f) ("content of copolymers soluble in n-hexane at 50°C less than or equal to 2.0% by weight, when the copolymer has a density equal to or greater than 0.918"):

According to column 4, lines 16 to 18 of D1 this content was preferably < about 4.0%;

According to D9, Example 1 a value of 1.1% was disclosed for a density of 0.924, and according to Example 2 a value of 0.8% for a density of 0.925.

Moreover, feature (f) was in any case a mere desideratum, since low hexane extractables meant a less sticky polymer during the reaction and a less blocking film.

- (i-3) Feature (g) ("a total content in comonomers (b) and (c) present in the fraction of the copolymers which is soluble in boiling n-hexane which does not exceed by more than 15% the

total content in comonomers (b) and (c) present in the fraction of the copolymer which is insoluble in boiling n-heptane"):

The Appellant admitted that this feature was not known from the prior art but contended that it covered a desideratum which merely took account of the well-known necessity (e.g. from D1 and D9) of a balance between on the one hand the desired mechanical and optical properties and on the other hand the cost aspect which favoured the use of less expensive comonomers (b) over the use of more expensive comonomers (c). In this respect the Appellant again pointed to relevant information in D1 and D9.

Alternatively, (g) was to be considered as an artificial construct not derivable from the evidence of the patent in suit.

The Appellant contested the Respondent's position that feature (g) was a measure of the homogeneity of the claimed polymers (cf. sub-point (iii) below).

(i-4) Feature (h) ("an ethylenic unsaturation level of the vinyl, vinylene and vinylidene type of less than 0.2 ethylenic double bond per 1000 carbon atoms"):

This feature overlapped with the information on column 4, lines 13 to 15 of D1 which disclosed a range of from 0.1 to 0.6 double bonds per 1000 carbon atoms. Moreover, in the Appellant's view, this feature was not critical, since inventive Example 2 and comparative Example 5 exhibited the same unsaturation value of 0.17.

- (i-5) Feature (j) ("a structure with a low level of long branchings, such that $g^* \geq 0.90$, $g^* = (\eta) : (\eta_1)$, (η) being the intrinsic viscosity of the copolymer and (η_1) being the intrinsic viscosity of a linear polyethylene having the same weight average molecular weight as that of the said copolymer"):

In the Appellant's view, this feature was also not critical for the claimed invention because it had been well known from document D4 (column 2, lines 39 to 42) that LLDPE had a low chain branching comprising values of g^* of 0.80 to 1.0.

- (i-6) Feature (l) ("a bulk density comprised between 0.30 and 0.45 g/cm³"):

The disclosures of D1 and D9 covered the same bulk densities (D1, column 4, lines 48 to 50: 14 to 31 lb/cu.ft = 0.22 to 0.50 g/cm³, Examples 1, 2, 4 and 6; D9, Example 1).

Moreover, nascent bulk density was not important for the making of films, since normally the polymer was pelletized prior to its use.

- (i-7) Feature (m) ("an inorganic residue content less than 350 ppm"):

Firstly, in the Appellant's view, this feature could not be critical for the claimed invention because it was not even mentioned in the Examples of the opposed patent.

Secondly, feature (m) was even implicitly comprised by the disclosures of D1 and D9, because it represented the inverse of the productivity data: the higher the productivity, the lower the inorganic (i.e. catalyst) residues (cf. document D7, column 6, lines 3 to 6; D1, column 4, lines 19 to 40). Thus, Example 3 of D1 disclosed a value of inorganic residue of 357 ppm and Example 3 of D9 disclosed a value of inorganic residue of < 146 ppm.

In evaluating these values it was furthermore to be considered that the polymers of D1 contained less undesired titanium and chloride impurities than the polymers of the claimed invention and that the higher silica content of D1 would not have any negative impact on the polymers because silica was even purposely added as slip and antiblock additive before their extrusion into films (cf. D12).

- (ii) Since features (h), (j), (l) and (m) would not be critical, an inventive step could only be based on features (c), (f) and (g). However, the evidence in the patent in suit could not prove that these features gave rise to any unexpected effects.
- (ii-1) This was particularly apparent from the fact that many properties of the "inventive" polymers of Example 8 were worse than those of the polymers of comparative Example 5.
- (ii-2) Even the Respondent's comparison of the properties of "inventive" Examples 1 and 2 with "comparative" Example 5, all relating to polymers having the same density of 0.918,

showed that the "invention" did not provide a consistent improvement because the tearing strengths in transverse direction of the "inventive" Examples was much worse and the same applied to the haze value of "inventive" Example 2.

- (ii-3) The reliance of the decision under appeal on an improvement of the optical properties was thus at variance with the data reported in the patent in suit. In point of fact the differences between the haze and gloss values of the inventive and comparative polymers were minimal.
- (ii-4) In the Appellant's view, there was also no convincing proof for the Respondent's contention that the choice of feature (c) was responsible for an unexpected non-stickyness of the polymer particles because the reported stickyness of the particles of comparative Examples 4 and 5 not only was at variance with the conditions of their preparation (12 hours at 80°C; sticky particles would fuse at these conditions) but was also inconsistent with the fact that the copolymers of Example 5 of D1, which had a feature (c) value of 1.01, could, without stickyness problems, be prepared at an even higher (and thus stickyness-enhancing) temperature of 85°C.
- (ii-5) Nor was the Respondent's argument convincing that the claimed invention for the first time achieved high bulk density (feature (l)) and low inorganic residue (feature (m)).

This conclusion was drawn by the Appellant because, in its opinion,

- (a) the high bulk density of the "inventive" copolymers was only achieved at the expense of a low productivity,
 - (b) the Respondent's interpretation of D1, namely that it evidenced lower bulk densities for higher productivities, was at variance with Examples 1 to 4 of this document, and
 - (c) nothing could be concluded from a comparison of the "inventive" Examples 1 and 2 and of "comparison" Example 8 because they all had the same bulk densities and inorganic residue contents (= titanium contents \approx productivities).
- (iii) The further argument of the Opposition Division, namely that the inventive terpolymers were distinguished from the heterogeneous polymers of D1 by their homogeneous structure was, in the Appellant's view, based on a false interpretation of the use of the term "homogeneous" on page 5, lines 21 to 24 of the patent in suit, which only related to the physical state of the polymers and not to the comonomer distribution between different polymer chains. It was, however, the latter meaning of the term "heterogeneous" on which D1 relied by reference to D6: according to the latter document, in a heterogeneous copolymer the ethylene/comonomer ratios were different among the polymer chains, while they were identical in a homogeneous copolymer.

(iii-1) In the Appellant's view, it was however clear from D6 and D11 (post-published) that the polymers according to present Claim 8, as well as those of D1 and D9, were heterogeneous because all these copolymers had been prepared with Mg/Ti-based catalysts, not with V-based catalysts or metallocene catalysts.

(iii-2) A further indication of the heterogeneous structure of of the "inventive" copolymers resided in their high melting points between 122 and 123°C as compared to the melting points of homogeneous copolymers having the same densities (cf. Figure 1 of D6).

(iii-3) Furthermore, the high Mw/Mn ratios and MFR values of the "inventive" copolymers also confirmed their heterogeneous structure.

X. The Respondent (Proprietor of the patent) presented its counterstatement in a written submission dated 14 September 2000.

Therein it referred as Annexes 1 to 4 to four "information sheets" which had already been submitted at the second oral proceedings before the Opposition Division on 27 October 1999.

XI. The arguments of the Respondent can be summarized as follows:

(i) The new documents D11 and D12 should not be considered because they were only introduced at the appeal stage and had been published after the priority date of the patent in suit.

- (ii) The subject-matter of Claim 8 was novel over D1. This conclusion must particularly be drawn because, apart from features (f), (g), (h), (j) and (m), this document did not disclose or even suggest a combination of features (c), (l) and (m) of Claim 8.
- (iii) The problem underlying the patent in suit was the provision of an ethylene copolymer in the form of a non-sticky powder which was easy to handle, had a high bulk density, a low inorganic residue content as well as improved mechanical and optical properties.
- (iv) According to the Respondent, these properties were achieved by features (c) and (f) which provided a low content of sticky oligomers/copolymers, feature (g) which provided a homogeneous copolymer structure, and feature (l) which referred to the fact that the polymer particles were unburst, thus contributing to a high bulk density.
- (v) Furthermore, a correct comparison of the "inventive" Examples 1 and 2 with "comparative" Example 5, all relating to copolymers having the same density, showed a significant increase of the perforation strength and also an improvement of haze and gloss. A comparison with commercial products, especially those which came 10 or 15 years later on the market (i.e. D12), was irrelevant.
- (vi) Moreover, the fact that the inventive copolymers simultaneously comprised high bulk density and very low inorganic residue content was not

suggested by D1, which showed an abrupt decline of the bulk density at high productivity (i.e. low inorganic residue content) (cf. Annex 4).

In this respect the Respondent stressed that the only Example in D1 which related to a copolymer which met feature (c) of present Claim 8, i.e. Example 5, exhibited a very low bulk density.

The further argument of the Appellant, namely that the amount of e.g. silica in the inorganic residues could not be regarded as a critical feature because silica was anyway added during the ensuing fabrication process, was of no interest for the desired high productivity.

(vii) Although document D9 in general terms referred to an improvement of the bulk density and the optical properties, it could not suggest the subject-matter of present Claim 8, because it did not disclose features (c), (h), (j), (h) and (g).

XII. With a submission dated 24 April 2002 the Appellant informed the Board (i) of the withdrawal of its request for oral proceedings, (ii) of its intention not to attend the oral proceedings scheduled for 8 May 2002, and (iii) of its maintenance of the appeal.

The Respondent, in a submission dated 26 April 2002, agreed to withdraw its request for oral proceedings, if before such proceedings the Board of Appeal was able to reach a decision in the Respondent's favour.

By EPO form 3014, dated 6 May 2002, the parties were informed that the scheduled oral proceedings were cancelled.

XIII. The Appellants requested that the decision under appeal be set aside and that the European patent No. 164 215 be revoked.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible. It only attacks the subject-matter of Claims 8 to 10 and does not raise any objection against Claims 1 to 7.
2. In application of Article 114(2) EPC, documents D11 and D12, submitted by the Appellant together with the Statement of Grounds of Appeal, as well as the Appellant's experimental results which allegedly illustrate the products of D12 (cf. page 7, last paragraph of the Statement of Grounds of Appeal) are not taken into consideration because D11 was published about ten (10) years after the priority date of 2 May 1984 of the patent in suit and because D12, which does not carry a publication date, concerns a commercial product of the Respondent at the time of the submission of the Statement of Grounds of Appeal (February 2000), i.e. more than fifteen (15) years after said priority date. There is no evidence for the Appellant's implicit contention that any of these disclosures was available at the effective date of the opposed patent.
3. The Respondent's Annexes 1 to 4 are considered by the Board because (i) they had already been submitted at the oral proceedings before the first instance and (ii) because the information therein only represents a synopsis of some data of the prior art (Annexes 1, 2 and 4) or of the patent in suit itself (Annex 3).

4. Citations

4.1 Document D1

Claim 1 of this document relates to an ethylene based hydrocarbon polymer comprising ethylene, C_a monomer and C_b monomer, wherein the C_a monomer is selected from propylene, butene-1 and mixtures thereof, and the C_b monomer is selected from one or more C_5 to C_8 alpha monoolefins which contain no branching closer than the fourth carbon atom (Claim 4: hexene-1),

- the molar ratio in the polymer of (C_a/C_2) being about 0.006 to 0.09,
- the molar ratio of (C_b/C_2) being about 0.003 to 0.07,
- the Branch Chain Factor being about 0.2 to 0.8,
- the polymer being heterogeneous,
- having a density of about 0.91 to 0.94,
- an n-hexane extractables content at 50°C of less than about 5.5 weight percent,
- a melt index of about 0.5 to 5.0,
- a ratio Mw/Mn of about 2.7 to 4.3, and
- a melt flow ratio of about 22 to 36.

Claim 6 relates to a film formed from the polymer of Claim 1.

4.2 Document D9

Claim 1 of this document relates to a process for preparing an ethylene copolymer having a melt index of 0.1 to 10 and a density of 0.900 to 0.945, which process comprises copolymerizing (1) ethylene, (2) propylene and/or butene-1 and (3) an α -olefin having 6 to 12 carbon atoms in a substantially solvent-free vapor phase and in the presence of a catalyst comprising a solid substance and an organoaluminium compound, said solid substance containing magnesium and titanium and/or vanadium while maintaining the total amount of said components (2) and (3) in the range of from 1 to 40 mol% of said component (1) and the molar ratio of said component (2) to said component (3) in the range of from 0.01 : 0.99 to 0.90 : 0.10.

5. *Novelty of the subject-matter of Claim 8*

5.1 Document D1

There is no reference in D1 to features (g) and (j). Furthermore, there is no conjoint disclosure in this document of features

- (c) (only Example 5 of D1 realizes a value of 1.01 which is within the "inventive" range of "0.1 to 1.5"),
- (f) (overlap of D1 range of "< about 5.5" (column 4, lines 16 to 18) vs. "inventive" range of $\leq 2\%$),
- (h) (overlap of D1 range of "0.1 to 6" (column 4, lines 13 to 15) vs. "inventive" range of $\leq 2\%$),

- (l) (overlap of D1 range of "0.22 to 0.50 g/cm³" (= 14 to 31 lb/cu.ft: column 4, lines 48 to 50) vs. "inventive" range of 0.30 to 0.45 g/cm³), and
- (m) (overlap of D1 range whose lower limit may be considered to correspond to a value of 250 ppm, as calculated by taking the inverse of the productivity maximum of 1,000,000 set out in column 4, lines 40 to 42 vs. "inventive" range of < 350 ppm).

5.2 Document D9

This document does not disclose features (e), (g), (h), (i) and (j). As to feature (c) there is a reference only in Claim 1 to a (b)/(c) comonomer ratio within the broad range of from "0.01 : 0.99 to 0.90 : 0.10".

5.3 While the above analysis is not exhaustive, it is apparent that neither of documents D1 and D9 anticipates the subject-matter of present Claim 1.

5.4 Since Claim 9 is dependent on Claim 8 and since Claim 10 relates to an application of the copolymer according to Claim 8, the conclusion of novelty also applies to the subject-matter of these claims.

6. *Problem and solution*

6.1 There was agreement between the parties that D1 represents the closest prior art and the Board sees no reason to deviate from that conclusion.

6.2 The problem underlying the subject-matter of Claim 8 vis-à-vis that state of the art is the provision of similar low density terpolymers from ethylene, propylene/1-butene and C₅ to C₈ α-monoolefins in the form of a non-sticky powder which is easy to handle and

which may be fabricated to films having improved mechanical and optical properties (cf. page 2, lines 3 to 6; page 3, lines 19 to 22; page 5, lines 21 to 24; page 6, lines 6 to 17).

6.3 In the Board's judgment, a more ambitious problem vis-à-vis D1 which furthermore would include the provision of higher bulk densities and lower inorganic residue contents is not clearly supported by the evidence in the patent in suit.

6.4 The same conclusion applies to the alleged "homogeneous nature" of the claimed copolymers (cf. page 5, lines 21 to 24):

Firstly, there is not any information in the patent in suit concerning the concrete meaning of the term "homogeneous nature", nor for the Respondent's contention that the use of this term was directed to homogeneous copolymers as defined in D6 (column 2, lines 23 to 28), i.e. to copolymers wherein the comonomer units are randomly distributed within a given molecule and wherein, furthermore, all the copolymer molecules have the same ethylene/comonomer ratio; and

secondly there is no convincing reason for the Respondent's further contention that such a structure was reflected by feature (g), i.e. by a parameter relating to the ratio of the comonomer contents in different solvent extraction fractions.

6.5 The existing technical problem as set out in point 6.2 supra is to be solved, according to Claim 8, by the combination of features (a) to (m), especially by the combination of features (c), (f), (g), (h), (j), (l) and (m) which are not disclosed in D1 as such and/or in combination with one another.

6.6 A comparison of "inventive" Examples 1 and 2 with "comparative" Example 5 shows that terpolymers complying with the "inventive" characterisations of features (c) (i.e. ratio of comonomer units (c)/(b)), (f) (i.e. solubles in n-hexane at 50°C) and (g) (difference of comonomer contents in solubles in boiling n-hexane and insolubles in boiling n-heptane) exhibit improved properties when compared to a terpolymer which does not meet these inventive requirements. The improvements concern in particular the stickyness of the powder particles and the following properties of films derived from these powder particles: tearing strength in machine direction according to ASTM D 1922, perforation strength according to ASTM D 781, perforation strength according to ASTM D 1709 and gloss (cf. page 6, lines 48 to page 8, lines 6; pages 12 to 13, Tables 1 and 2).

6.7 In the Board's judgment, this evidence demonstrates that ethylene terpolymers which comply with the requirements of features (c), (f) and (g) are capable of solving the afore-mentioned technical problem.

It is of no relevance in this context that the afore-mentioned evidence also shows that the tearing strength in transverse direction of the "inventive" samples is worse and that their haze properties are not consistently improved because these results cannot detract from the overall improvement of the tested properties as manifested by the experimental evidence. In this respect, it has to be borne in mind that the structural complexity of organic polymers necessarily causes a complex interrelation of properties with the consequence that what can be achieved in most cases is an optimum balance of properties.

6.8 In view of this situation there is no need to examine the conflictive issues of bulk density (feature (l)) and inorganic residue content (feature (m)).

7. *Obviousness*

7.1 In opposition proceedings (including opposition appeal proceedings) the burden rests on the Opponent/Appellant to establish that all features of a claimed subject-matter are obvious in the specifically claimed combination. An opposition/appeal must, therefore, already be unsuccessful if the Opponent/Appellant fails to establish the obviousness of a sub-combination of some of the features of a claimed combination. In this case, the obviousness or not of any further features is irrelevant for the outcome of the opposition/appeal.

7.2 In the present case the issue of inventive step therefore turns upon the question whether it is obvious to achieve the solution of the existing technical problem, i.e. provision of low density ethylene terpolymers in the form of a non-sticky powder which is easy to handle and which may be fabricated to films having improved mechanical and optical properties, by the sub-combination of the features (c), (f) and (g) whose contribution to the solution of the existing technical problem has been established (cf. point 6.6 supra).

7.3 From Claim 1 of document D1 feature (c) of present Claim 8, i.e. the ratio by weight of the quantity of comonomer (c) to the quantity of comonomer (b), may be calculated to range from 1.328 to 36.879 weight % (cf. page 7 of the opposition brief dated 22 May 1990). This range only marginally overlaps the range of 0.1 and 1.5 of present Claim 8 and there is only one worked

Example in D1 (i.e. Example 5) for which a (c)/(b) ratio within the "inventive" range, namely a ratio of 1.01, can be calculated (cf. Annex 2 as filed by the Respondent with its written appeal submission).

- 7.3.1 This fact clearly demonstrates that the disclosure of D1 does not attach any particular importance to the "inventive" choice of feature (c) and the skilled person had no reason to expect from this selection any positive impact on the range of properties referred to in point 6.6 supra.
- 7.3.2 The Appellant's contention that the "inventive" improvement of the stickyness was not credible in view of the absence of such problems at the more severe conditions of Example 5 of D1 (cf. point (ii-4) of Section IX supra) is not convincing because the polymerisation conditions used according to said Example 5 of D1 deviate from those of "inventive" Example 1 of the patent in suit. In contrast thereto, the polymerisation conditions of "comparative" Example 5 of the patent in suit which exhibits "a relatively sticky character" of the copolymer powder (cf. page 9, lines 1 to 2 of the patent specification) are identical to those of "inventive" Example 1.
- 7.4 The conclusion drawn in sub-point 7.3.1 supra with respect to feature (c) also applies to feature (f) of Claim 8 which sets an upper limit of 2 % by weight of n-hexane solubles for copolymers having a density \geq 0.918 because according to Claim 1 of D1 the n-hexane extract may go up to less than 5.5 % by weight, and because it is demonstrated by the experimental evidence in Table 1 of the patent specification that the properties of the ethylene terpolymers of "comparative"

Example 5 having a content of n-hexane solubles of 4.4 % by weight are in many aspects worse than those according to "inventive" Examples 1 and 2 having, respectively, 1.7 and 1.8 % by weight of n-hexane extractables.

7.5 Finally, it is plausible from a comparison of the same Examples that the upper limit of feature (g), a parameter that is unsuspected in D1, also contributes to the superior properties of the "inventive" terpolymers.

7.5.1 The Appellant's contention that feature (g) should be considered as an "artificial construct" (cf. third paragraph of point (i-3) of Section IX supra) is at variance with the experimental evidence in Table 1 of the patent specification which illustrates a correlation of the "inventive" and "comparative" (g)-values of Examples 1, 2 and 5 with the property improvements discussed in point 6.6 supra. It is irrelevant in which way the inventor arrived at the critical importance of this parameter (g), as a result of an intellectual forecast or by induction from empirical knowledge.

7.6 While there is, thus, evidence in the patent in suit which links the definitions of the "inventive" features (c), (f) and (g) to certain beneficial properties of the terpolymers and the ensuing products, there is no evidence for the Appellant's counter-contentions, namely that feature (c) did not cause any unexpected effect, that feature (f) was non-critical for the claimed invention, and that feature (g) covered a mere desideratum (cf. points (i-1), (i-2) and (i-3) of Section (IX)). Being unfounded allegations, these contentions are therefore unsuitable to discharge the Appellant's/Opponent's burden of proof.

7.6 The above analysis shows that the Appellant failed to establish that the subject-matter of present Claim 8 is obvious over the disclosure of D1.

7.7 This conclusion is not invalidated by the disclosure of D9 because this document is unable to supplement the teaching of D1 with any information which would be relevant for the definition in present Claim 8 of the "inventive" features (c), (f) and (g).

This results from the facts that D9 suffers from the same disclosure deficiencies as D1, namely that it is silent about feature (g), and that features (c) and (f) cover relatively broad ranges [Claim 1: feature (c): weight ratio comonomers (b)/(c) = 0.01 : 0.99 to 0.90 : 0,10; page 3, lines 40 to 43: feature (f) \leq 5.5 % by weight].

7.8 The Board, therefore, decides that, in the light of the existing evidence, the subject-matter of Claim 8 is non-obvious over the cited prior art.

7.9 The same conclusion of non-obviousness applies a *fortiori* to the subject-matter of Claim 9 which is dependent on Claim 8 and to the subject-matter of Claim 10 which relates to an application of the copolymer according to Claim 8.

8. The grounds of opposition as maintained in this appeal do not, therefore, prejudice the maintainance of the patent in the form as amended according to the decision under appeal.

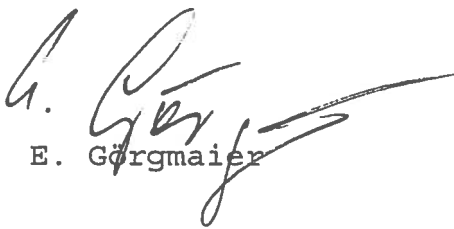
Order


For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:


E. Görgmaier


P. Kitzmantel

