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Datasheet for the decision of 30 April 2008

Case Number: T 1196/05 - 3.3.03

Application Number: 97928038.5

Publication Number: 0906344

IPC: C08F 4/80

Language of the proceedings: EN

Title of invention:
Elevated pressure polymerization processes with late transition metal catalyst systems

Patentee:
ExxonMobil Chemical Patents Inc.

Opponent:
E.I. Du Pont de Nemours and Company

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty - enabling disclosure - no"
"Inventive step - yes"
"Entitlement to priority - no"
"Amendments - added subject-matter - no"

Decisions cited:
G 0002/98, T 0198/84, T 0026/85, T 0279/89, T 0666/89, T 0245/91

Catchword:

-

Case Number: T 1196/05 - 3.3.03

DECISION
of the Technical Board of Appeal 3.3.03
of 30 April 2008

(Opponent)	E.I. Du Pont de Nemours and Company 1007 Market Street Wilmington, Del. 19898 (US)
Representative:	Kirsch, Susan Edith Carpmaels & Ransford 43 Bloomsbury Square London WC1A 2RA (GB)
Respondent: (Patent Proprietor)	ExxonMobil Chemical Patents Inc. 5200 Bayway Drive Baytown TX 77520-5200 (US)
Representative:	UEXKÜLL & STOLBERG Patentanwälte Beselerstrasse 4 D-22607 Hamburg (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office dated 23 June 2005 and posted 6 July 2005 concerning maintenance of European patent No. 0906344 in amended form.**

Composition of the Board:

Chairman:	R. Young
Members:	M. C. Gordon H. Preglau

Summary of Facts and Submissions

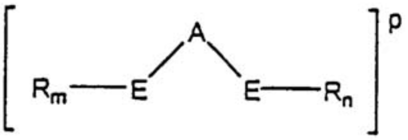
I. Mention of the grant of European Patent No. 0 906 344 in the name of Exxon Chemical Patents Inc, later ExxonMobil Chemical Patents Inc. in respect of European patent application No. 97928038.5, filed on 17 June 1997 as international application No. PCT/US97/10419, published as WO-A-97/48737 on 24 December 1997 was announced on 30 August 2000 (Bulletin 2000/35).
The patent claimed priority from two earlier US patent applications:

- US 60/020,095 dated 17 June 1996 (hereinafter "PR1") and
- US 60/020,199 dated 21 June 1996 hereinafter "PR2").

The patent contained 12 claims. Independent claim 1 read as follows:
"A process for the polymerization of olefins comprising contacting ethylene and optionally, one or more ethylenically unsaturated monomers, with an unsupported late transition metal catalyst system comprising an activated Group 8, 9, 10 or 11 transition metal compound stabilized by a bidentate ligand, the late transition metal compound of the formula:

$$LMX_r$$

wherein M is a Group 8, 9, 10 or 11 metal; L is a bidentate ligand defined by the formula:



wherein A is a bridging group containing a Group 13-15 element; each E is independently a Group 15 or 16 element bonded to M; each R is independently a C_1-C_{30}

containing radical or diradical group which is a hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, hydrocarbyl-substituted organometalloid, halocarbyl-substituted organometalloid, m and n are independently 1 or 2 depending on the valency of E; and p is the charge on the bidentate ligand such that the oxidation state of MX_r is satisfied;

each X is, independently, a hydride radical, a hydrocarbyl radical, a substituted hydrocarbyl radical, a halocarbyl radical, a substituted halocarbyl radical, hydrocarbyl-substituted organometalloid or halocarbyl-substituted organometalloid; or two X's are joined and bound to the metal atom to form a metallacycle ring containing from 2 to 20 carbon atoms; a neutral hydrocarbyl containing donor ligand; a halogen, an alkoxide, an aryloxide, an amide, a phosphide, or other univalent anionic ligand; or two X's are joined to form an anionic chelating ligand; or a neutral non-hydrocarbyl atom containing donor ligand; and r is 0, 1, 2 or 3;
at an ethylene pressure of at least 200 bar ($2.03x10^4$ kPa) and a reaction temperature equal to or greater than 120°C."

Dependent claims 2-12 were directed to preferred embodiments of the process of claim 1.

II. A notice of opposition to the patent was filed on 24 May 2001 by E.I. DuPont de Nemours and Company. The grounds of opposition pursuant to Art. 100(a) EPC (lack of novelty and lack of inventive step) and Art. 100(c) EPC (extension of subject matter) were invoked. *Inter alia* it was submitted that the patent

was not entitled to either of the claimed priority dates.
The following documents were cited in support of the opposition:

D1: WO-A-96/23010
D2: US-A-5 408 017
D3: WO-A-92/14766
D4: WO-A-95/07941
D5: US-A-4 716 206

In its rejoinder to the notice of opposition (letter of 18 March 2002) the patentee referred, in relation to the issue of inventive step, to the following document, which is discussed in paragraph [0004] of the patent in suit and was cited in the international search report:

D6: Johnson, L.K., Killian, C. M., Brookhart, M., "New Pd(II)- and Ni(II)-Based Catalysts for Polymerization of Ethylene and α-Olefins", JACS **1995**, *117*, 6414-6415.

III. In a decision announced orally on 23 June 2005 and issued in writing on 6 July 2005 the opposition division held that the patent could be maintained in amended form on the basis of a set of 11 claims, designated "Set A'", filed as main request during the oral proceedings.
Claim 1 of the main request differed from claim 1 as granted in that:

- the claim was restricted to M being a group 9 or 10 transition metal;
- the wording:

> "with the proviso that when Lewis-acid activators which are capable of donating an X ligand to the transition metal component are used or when the ionic activator is capable of extracting X, one or more X may additionally independently be"

was inserted after the definition of the permissible values for r in line 45 of the claim;

- the wording "a halogen, an alkoxide…donor ligand" immediately preceding said definition of r was moved to follow the inserted text.

Accordingly the final part of the claim read as follows: "… each X is, independently, a hydride radical, a hydrocarbyl radical, a substituted hydrocarbyl radical, a halocarbyl radical, a substituted halocarbyl radical, hydrocarbyl-substituted organometalloid or halocarbyl-substituted organometalloid; or two X's are joined and bound to the metal atom to form a metallacycle ring containing from 2 to 20 carbon atoms; a neutral hydrocarbyl containing donor ligand; and r is 0, 1, 2 or 3; with the proviso that when Lewis-acid activators which are capable of donating an X ligand to the transition metal component are used or when the ionic activator is capable of extracting X, one or more X may additionally independently be a halogen, an alkoxide, an aryloxide, an amide, a phosphide, or other univalent anionic ligand; or two X's are joined to form an anionic chelating ligand; or a neutral non-hydrocarbyl atom containing donor ligand;
at an ethylene pressure of at least 200 bar ($2.03x10^4$ kPa) and a reaction temperature equal to or greater than 120°C."

Further claim 12 of the patent as granted, which specified that the bidentate ligand stabilised a square planar geometry had been deleted.

According to the decision, the claims of the main request met the requirements of Art. 84 EPC. It was further held that:

(a) Neither of the claims to priority was valid. Priority document PR1 did not relate to a polymerisation process employing unsupported catalysts.
Priority document PR2 disclosed the polymerisation of ethylene at an ethylene pressure of from at least 50 bar and at a temperature of from at least 120°C in the presence of polymerisation catalysts having the bidentate ligands as specified in claim 1 and transition metals of Group 9, 10 or 11. The preferred ethylene pressures were from 200 to 3000 bar and from 500 to 2500 bar. It could not be derived directly and unambiguously from PR2 that the ethylene pressure should be at least 200 bar and the temperature at least 120°C. Accordingly the requirements set out in G 2/98 (OJ EPO 2001, 413) were not met.

(b) The requirements of Art. 123(2) and (3) EPC were held to be fulfilled. With respect to Art. 123(2) EPC it was held that the feature that the bidentate ligand stabilised square planar geometry did not need to be included in claim 1 as the formula of the bidentate ligand was more specific than this requirement. Further there was no restriction to square planar stabilising ligands in claims 1 and 13 as originally filed.

(c) With regard to Art. 54 EPC it was held that D1 was a document comprised in the state of the art pursuant to Art. 54(2) EPC (due to the invalidity of the priority claims). This document disclosed the polymerisation of ethylene in the presence of transition metal catalysts of group 3, 4, 5, 6, 8 and 9 transition metals and bidentate ligands of the general formula of claim 1 of the patent in suit. The polymerisation temperature could range from -100°C to 200°C, preferably from -20 to 80°C or from 0 to 150°C, preferably from 25 to 100°C. The ethylene pressure could range from atmospheric pressure to 275 MPa ($27.5x10^4$ kPa, 2750 bar). There was no example where ethylene polymerisation was carried out at a temperature of at least 120°C. The 537 examples disclosed a polymerisation at temperature from 0 to at most 80°C. One example - example 88 - disclosed polymerisation in a Schlenk flask at a pressure of 20.7 MPa ($2.07x10^4$ kPa, 207 bar) at 23°C. All other 536 examples employed pressures far below 20 MPa. Although D1 disclosed broad ranges of temperatures and ethylene pressures, the skilled person would not seriously contemplate applying the technical teaching in the range of overlap in which the temperature and pressure were far away from the worked examples. Taking into account decision T 26/85 (OJ EPO 1990, 022) D1 could not be considered to be novelty destroying for the subject matter of the main request.

Accordingly novelty was acknowledged.

(d) With respect to inventive step the decision held that the closest prior art was represented by the teaching of D1. The problem to be solved compared

to this teaching was to identify the process conditions of ethylene polymerisation processes using transition metal catalysts having bidentate ligands in order to achieve process advantages.
This problem was solved by conducting ethylene polymerisation at temperatures of at least 120°C and at ethylene pressures of at least 20 MPa which allowed polymerisation in a homogeneous single phase or two fluid phases and provided the polymer above the melting point of the polymer (with reference to paragraph [0033] of the patent in suit).
The examples of D1 were all run at temperatures and pressures far below those specified in the operative claims. In this connection, the aforementioned example 88 of D1 was disregarded as it was held to be unclear how the stated pressure could be attained in a "mere" Schlenk flask. The skilled person would not have contemplated working at temperature and pressure conditions which were neither in the preferred ranges of D1, nor exemplified therein. Even if the skilled person would have worked at temperature and pressure conditions far removed from those employed in the examples of D1, there was no hint in D1 to employ a **combination** of high temperature and high pressure (emphasis of the decision). Moreover, examples 101 and 102 of D1 which employed ethylene pressures of 2.8 MPa and 5 MPa respectively resulted in tacky or sponge-like products, leading away from the use of high pressures. The combination of the teaching of D1 with that of other documents cited in the opposition procedure also did not make it obvious that the

polymerisation conditions of ethylene using the specified catalysts could be improved when working at high temperatures and high ethylene pressures.

(e) Accordingly it was held that the patent could be maintained in amended form on the basis of the main request.

IV. A notice of appeal against this decision was filed by the opponent on 16 September 2005, the requisite fee being paid on the same day.

V. The statement of grounds of appeal was filed on 7 November 2005.
Under the heading "Documents and Evidence relied upon" the appellant listed explicitly the aforementioned documents D1-D6.

(a) The appellant indicated its agreement with the findings of the opposition division with respect to the non-entitlement to priority (see section III.(a) above).

(b) It was submitted that the operative claims did not meet the requirements of Art. 123(2) EPC.
This objection related to the feature "the bidentate ligand stabilises a square planar geometry", disclosed at page 3, lines 9-10 of the application as filed. This was submitted to be a statement of an absolute position, not a preferred feature. The formula as specified in operative claim 1 was disclosed in the passage starting at page 3 lines 25ff to be a preferred embodiment.
It was submitted, with reference to a number of generic formulae in D1 that the specified bidentate ligand did not necessarily result in a square planar geometry, i.e. this was not a

feature inherent to the defined ligands. In this connection it was submitted that whether a compound formed a square planar geometry was not only influenced by the type of ligands bonded thereto but also by the type and electronic configuration of the co-ordinated metal atom. Only certain metals in certain oxidation states could give rise to square planar configurations. The operative claim however covered all oxidation states of group 9 and 10 metals, thus extending to compounds which could not form square planar configurations. Further, claim 1 was not limited to a tetracoordinate compound which was a prerequisite for square planar geometry. This was shown by the fact that the index r could take values 0, 1, 2 or 3.

Accordingly the specification of "square planar" was an essential feature, and the absence of this from the operative claims resulted in an extension beyond the content of the application as filed.

(c) With respect to novelty it was submitted that the temperature range disclosed in D1 on page 75 was from -100°C to 200°C, the preferred range being from 0°C to about 150°C. D1 disclosed or individualised the specific temperatures 150°C and 200°C as the upper limits of these ranges. These temperatures disclosed the feature "at least 120°C".

The discussion of pressure in D1, which immediately followed the discussion of temperature disclosed a range of from atmospheric pressure to about 275 MPa.

Thus D1 disclosed the required combination of temperature and pressure, i.e. 150°C and 200°C in combination with any pressure from atmospheric (0.00101325 x 10^4 kPa) to 275 MPa (27.5 x 10^4 kPa). It was submitted that, with respect to the established case law on so-called "selection inventions" reference being made to T 198/84 (OJ EPO 1985, 209) and T 279/89 (3 July 1991, not published in the OJ EPO), that for a novel selection to be acknowledged the selected sub-range had to be narrow, sufficiently removed from the preferred part of the known range and purposive.

Two of the values for temperature individualised in D1 (150°C and 200°C) fell within the requirement of "at least 120°C" and hence took away the novelty of the feature "at least 120°C". D1 taught that pressure was not critical and hence made available each of the specific temperatures of 150°c or 200°C in combination with any pressure from 1 atmosphere to 275 MPa. Thus the only selection, if any, was for the pressure being at least 2.03x10^4 kPa. The - alleged - selection in operative claim 1 covered 92% of the pressure range specified in D1. The exclusion of 8% of the range - particularly when pressure was taught not to be critical - could not be considered to result in a narrow sub-range or a range far removed from the preferred part of the known range.

The alleged selection was arbitrary. It had not been shown that there was any advantage associated with working in the claimed range. The ability to carry out the claimed polymerisation in solution did not constitute a purposive selection as it was devoid of any surprising technical effect. It derived from the well known fact that a polymer would stay in solution (in appropriate solvents) at or above the melting point of the polymer. Following T 666/89 (OJ EPO 1993, 495) in assessing novelty it was necessary to consider the entirety of a citation and not merely the examples thereof. No reason had been provided why the skilled person would be dissuaded from carrying out the teaching of D1 in the range of overlap with the opposed patent - there was no teaching in D1 that working in the upper temperature and pressure ranges would lead to an undesirable result (with reference to T 26/85). Accordingly the skilled person would have seriously contemplated applying the technical teaching of D1 in the range of overlap with the patent in suit.

(d) With regard to inventive step, it was maintained that the closest prior art was D1. It was submitted that the patentee had modified the formulation of the technical problem during the course of the opposition proceedings (see section III.(d) above). In particular it was submitted that in the written proceedings (letter of 18 March 2002, i.e. rejoinder to the notice of opposition) the problem to be solved with respect to D1 had been presented as to increase molecular weight and productivity and to decrease branching. During the oral proceedings before the opposition division however it had instead been argued that the problem to be solved was to identify the process conditions for ethylene polymerisation processes using transition metal catalysts having bidentate ligands to obtain "process advantages", which problem was said to be derivable from paragraph [0033] of the patent in suit, in which reference was made to prior art high temperature and high pressure processes. An argument of the patentee that the skilled person would not consider such prior art high temperature and high pressure processes since these related to metallocene catalyst systems rather than late transition metal systems was dismissed as incorrect. The appropriate skilled person was a general polymer catalysis specialist, not a late transition metal specialist. Further, in a relatively new area of catalysis, such as late transition metal catalysts the skilled person would be more likely to draw on teachings from more established fields, which was in fact what the patentee had done. The patent employed a number of components routinely included in early transition metal olefin catalysts. It was incorrect to argue that the skilled person would consider selectively these aspects of early transition metal catalysis while disregarding the conditions of temperature and pressure conventionally used therein.

The question of whether a polymer would stay in solution was related to the properties of the polymer, not the catalyst. Accordingly the skilled person seeking "process advantages" would not restrict consideration to prior art processes employing the same catalyst, but would consider other teachings, e.g. the process conditions disclosed in D2-D5.

It was disputed that D1 taught away from carrying out high temperature/high pressure processes simply because the examples did not disclose a process carried out at a temperature of higher than 80°C or pressures higher than 5 MPa. This would not dissuade the skilled person from working in the area of overlap - there was no teaching in D1 of some foreseeable negative result relating to such conditions.

There was no teaching in D1 that the highest temperatures disclosed in D1 (150°C and 200°C) would not be effective, and no implication in D1 that the process could not be scaled up to industrial scale temperature and pressure ranges, as shown by the broad ranges disclosed in D1 (see section III.(c) above). Experiments to determine the optimum conditions were routine.

The examples of D1 were carried out under laboratory conditions, as was clear from the use of Schlenk apparatus. As stated in paragraph [0033] of the patent the use of high temperatures and pressures in industrial processes was well known. The skilled person would know that in order to scale the examples of D1 up to an industrial scale the first consideration would be how to recover the product efficiently.

It was further submitted that the most obvious and only reasonable way to run a solution polymerisation to form a crystalline polyolefin under industrial conditions was to operate at or above the melting point of the polyolefin as taught in D2-D5. D1 disclosed melting and glass transition temperatures, thus disclosing both that the polymers of D1 could be melted and also the temperatures at which this could be achieved.

It was further submitted that D1 taught to concomitantly increase the pressure and the temperature. With regard to the written submissions of the patentee during the opposition proceedings that low branching, high yield and high polymer molecular weight were desirable, it was submitted that D1 taught that:

- increased pressure led to decreased branching (page 91, lines 35-37);
- increased temperature led to increased branching (page 92, lines 6-9);
- increased pressure led to increased yield and molecular weight (page 92, lines 1-3);
- increased temperature led to lower molecular weight (page 92, lines 7-10).

Accordingly D1 explicitly taught that in order to produce a high molecular weight polymer in good yield and having low branching it was necessary to increase the pressure and decrease the temperature. However the skilled person was obliged to use higher temperatures in order to be able to recover the product. D1 taught that if higher temperatures were used then the pressure had to be increased in order to ameliorate the temperature-associated problems of decreasing molecular weight, yield and increased branching.

With respect to examples 101 and 102 carried out at relatively high pressures (2.8 and 5 MPa respectively), which as submitted by the patentee resulted in tacky or sponge-like products (see section III.(d) above), it was submitted that the skilled person faced with the problem of preparing high molecular weight polymers would not be dissuaded from doing so simply because the polymers might be solids. D1 disclosed that increasing pressure resulted in increased yield and molecular weight. Hence the skilled reader of

D1 and seeking to provide high molecular weight polymers in high yield would not be dissuaded from employing a high pressure.

(e) *Overly broad claims.*

It was also objected, with reference to a statement at page 120 lines 29-33 of D1 that the effectiveness of some of the compounds as catalysts arose at least partly because the bidentate ligands had sufficient steric bulk on both sides of the coordination plane (square planar geometry) that the operative claims were overly broad. Since the operative claims were not limited to such geometry the claims lacked an essential technical feature. The examples of the patent exemplified a single compound. The operative claims were however not limited to compounds of this type. It was known from prior art teachings, e.g. D6 that modifying the ligands affected the structure of the polymers. The evidence of D1, pages 91 and 92 (see above) also showed that even in the case of closely related metals (Pd, Ni) replacing one metal by another resulted in different and unpredictable catalyst activities.

VI. The patentee - now the respondent - replied with a letter dated 16 May 2006. Three sets of claims designated B'-D' as first - third auxiliary requests were submitted. These are however not of relevance for the present decision.

With regard to the documents relied upon by the appellant it was submitted that only D1-D4 had been correctly introduced into the appeal procedure. No ground of appeal had been based on D6. With regard to

D5, it was submitted that although the appellant's submissions on inventive step contained a reference to "D2-D5", in its argumentation reference had been made (by patent number) not to "D5" but to a different document. Thus it was submitted that in fact the appellant had intended to refer only to D2-D4, but not to D5.

(a) No submissions were made with respect to the entitlement to priority.

(b) With regard to Art. 123(2) EPC it was submitted that claim 1 as originally filed did not specify that the bidentate ligand stabilised a square planar geometry. Operative claim 1 was based on original claim 13 which referred to a bidentate ligand and likewise did not specify that the ligand stabilised a square planar geometry. The definition of the ligand in the claim was literally identical with the definition in the A-publication from page 3, line 25 to page 4, line 7. Further, the definition of the ligand by a general formula was consistent with the functional statement in the A-publication at page 3, lines 9-10. The bidentate ligand defined by the formula was capable of stabilising a square planar geometry and of charge balancing the oxidation state of MX_r. Thus the further addition of the functional feature would be redundant. With respect to the objection of the appellant concerning the permissible values of r (see section V.(b) above), it was submitted that this objection equally applied to page 3, lines 3-23 of the A-publication. It was emphasised that the application as filed did not specify that the transition metal compound had to have a square planar geometry.

(c) With regard to the objection of lack of novelty with respect to D1, it was noted that the only passage explicitly referred to was page 75, lines 6-10 of D1. It was submitted that D1 had 501 pages and 537 examples, all of which were, according to the discussions in the first instance proceedings, outside the scope of claim 1 of the patent as granted. This indicated that the cited passage did not directly and unambiguously disclose the claimed invention.

The examples of D1 employed temperatures of from 0°C to 80°C and pressures that were far below 20.3 MPa. The reference in example 88 of D1 to a pressure of 20.7 MPa was considered to be a typographical error since the reaction was reported as being carried out in a Schlenk flask (cf III.(d) above). This was confirmed by comparison with example 89 which was also carried out in a Schlenk flask and employed a pressure of 20.7 kPa. It was also observed that example 87 of D1, employing a pressure of 1.31 MPa, was carried out in an autoclave.

The opponent had therefore failed to discharge the burden of demonstrating that D1 disclosed a process carried out at the same temperature and pressure as specified in the operative claims.

The passage on page 75 of D1 referred to by the appellant (see section V.(c) above) disclosed that the more preferred temperature was 25 to 100°C which was below the lower limit in operative claim 1 (120°C). The pressure was stated not to be critical. Thus the combination of high temperature and pressure was not disclosed. In order to arrive at a process according to operative claim 1 it was necessary to make two independent selections from two independent numerical ranges.

It was submitted that the decisions T 198/84 and T 279/89, cited by the appellant related to the selection of a sub-range from a single numerical range. The present case was different since two parameters had to be selected independently from two different numerical ranges. According the cited decisions were not relevant.

With regard to decisions T 26/85 and T 666/89 it was submitted that T 26/85 concerned the overlap between a single numerical range in a claim and a single numerical range disclosed in a prior art document. This decision was hence not relevant to the present case. With regard to T 666/89, which related to the question of whether a skilled person would find it difficult to carry out a prior art teaching in the area of overlap between that teaching and the subject matter claimed, it was submitted that the present case differed since selecting process conditions for a polymerisation reaction was a considerably more complex problem than that underlying decision T 666/89. In particular it was emphasised that increasing the temperature increased the energy in the reaction system. Increasing the pressure had the same effect. Selecting both a high reaction temperature and a high reaction pressure resulted in severe reaction conditions. It was most unlikely that a skilled person would seriously contemplate combining a high reaction temperature above the more preferred range of D1 (25 to 100°C, page 75 line 7) and considerably above the temperatures used in the examples of D1 (0°C to 80°C) with a high pressure also considerably above the pressures used in the examples of D1.

(d) With regard to inventive step, in agreement with the decision under appeal and the position of the appellant, D1 was considered to represent the closest state of the art. The claimed invention differed from the teaching of D1 in the claimed combination of high pressure (at least 20.3 MPa) and high temperature (equal or greater than 120°C). The objective technical problem was submitted to be to identify process conditions in which the catalysts of D1 could be used in an industrially relevant continuous process for polymerising olefins.

The problem was solved by identifying the set of process conditions (temperature and pressure) specified in the operative claim.

It was surprising that the catalysts of D1 could be used under the extreme conditions specified. This could not have been predicted on the basis of the information provided in D1.

With reference to examples 101 and 102 of D1, referred to by the appellant (see section V.(d) above), it was submitted that the product of example 101 was a rubbery copolymer which was tacky, while the product of example 102 was a granular sponge growing all over the walls and head of the autoclave, which product had to be scraped out. The products of other examples of D1 - carried out at lower pressure - had more desired properties for production on an industrial scale.

Thus D1 alone did not present any incentive to use high pressure.

Examples 361, 362 and 363 of D1, which all employed the same monomer and catalyst demonstrated that increasing the temperature (from 65°C to 80°C) resulted in a reduction in yield, and that increasing the pressure (from 690 kPa to 2.1 MPa) had no beneficial effect on the yield, which result was consistent with the statement at page 75 of D1 that the pressure was not critical. Thus with regard to the examples of D1 there was a clear disincentive to employ a combination of high temperature and high pressure.

With regard to the arguments based on the combination of D1 with any one of D2-D4 it was submitted that these all related to polymerisation processes using metallocene catalysts. The skilled person would not transfer teachings from metallocene catalysts to other types of catalyst systems. The prior art further disclosed that certain metallocene catalyst systems were unstable under high pressure/high temperature conditions. Thus D2-D4 did not provide any teaching as to the stability of the catalyst system of the patent in suit towards extreme reaction conditions.

(e) With regard to the objection that the claims were overly broad, it was submitted that the burden was on the appellant/opponent to demonstrate that embodiments falling under claim 1 did not solve the technical problem, which burden had not been discharged.

VII. On 21 January 2008 the Board issued a summons to attend oral proceedings.

(a) In the accompanying communication setting out the preliminary, provisional view of the Board it was stated that the question of entitlement to priority appeared to require further discussion and submissions of the parties in this respect were invited. In particular it was noted that there had been an explicit request for a decision on this aspect by one of the parties at the oral proceedings before the first instance, as recorded in section 5.2 of the minutes thereof.

(b) Further it was provisionally considered that the operative claims met the requirements of Art. 123(2) EPC. In particular it was considered that the definition of ligand "L" in operative claim 1 was a subset of the general definition of L given at page 3, line 9 of the application as published. Since the most general definition of L required that it stabilised a square planar geometry and the embodiments of L now specified were a subset within this general definition, the disputed feature was inherently part of the subject matter of the claim.

VIII. The appellant made a further submission in a letter dated 19 March 2008.

(a) With respect to the question of entitlement to priority it was submitted that the respondent had at no time presented any arguments in defence of the priority claims and had not contested the conclusions of the opposition division in this respect.

With regard to the substance of this issue, it was submitted that the priority document PR1 related

to a supported catalyst whereas the operative claim related to an unsupported catalyst.
The priority document PR2 disclosed a number of different polymerisation processes. The first, preferred process, disclosed at page 11, line 37, was conducted at high pressure (200-3000 bar). No temperature range was disclosed for this embodiment. An alterative process, i.e. a different embodiment, disclosed at page 12, line 17 was conducted at pressures of 20 to 200 bar and temperatures at or above 90°C to 120°C. Claim 3 and page 2, line 37 - page 3, line 4 of the second priority document disclosed a process employing a temperature of at least 120°C and a pressure of at least 50 bar. This claim was not however directed to a pressure of at least 200 bar. Thus there was no basis in the second priority document for a process requiring the pressure and temperature as specified in the operative claim and hence the operative claims were not entitled to the claimed priority.

(b) With regard to Art. 123(2) EPC the interpretation of the Board was disputed (see section VII.(b) above). It was not inevitable that all compounds falling within the original definition of L resulted in a square planar geometry. Reference was made to the submissions made in the statement of grounds of appeal (see section V.(b) above). The correct interpretation of the statement at line 9 of page 3 of the A-publication was that suitable ligands of formula L were those that stabilised a square planar geometry. The reference by the respondent to originally filed claim 13 (see section VI.(b) above) was dismissed since this claim did not require that the bidentate ligand had formula L.

The two requirements in respect of the ligand, i.e. the formula and the stabilising of a square planar geometry were not taught in the application as filed as being alternatives; further neither was stated to be optional. Rather both were essential requirements of the ligand.

IX. Together with a letter dated 28 March 2008 the respondent submitted two further set of claims, designated Set E and F, as new first and second auxiliary requests. The previously submitted sets of claims according to sets B'-D' became the third-fifth auxiliary requests. The details of the newly submitted sets of claims are not relevant for the present decision.

With regard to the question of entitlement to priority of the main request it was submitted that the pressure range of operative claim 1 was disclosed at page 11, line 38 and in claims 1 and 3 of the priority document PR2 and that the reaction temperature was disclosed in claim 3 and at page 3 line 3 of said priority document. The consequence of the entitlement to priority was that D1 was comprised in the state of the art pursuant to Art. 54(3) EPC and hence had to be disregarded in the examination for inventive step.

X. Oral proceedings were held before the Board on 30 April 2008.

The appellant submitted that the sets of claims designated "Set E" and "Set F" had been filed late and requested that these not be admitted to the procedure.

(a) With regard to the question of entitlement to priority, the appellant submitted that the priority document PR1 was not relevant as this related to supported catalyst systems; the document to consider was therefore PR2. This position was not disputed by the respondent.

The appellant submitted that PR2 disclosed several different embodiments, which could not be combined:

- A first "high pressure" embodiment at page 11 last 2 lines, employing a pressure of 200-3000 bar in a homogeneous single phase. The temperature was specified to be above the melting point of the polymer. There was no disclosure of a temperature of at least 120°C;
- A second "solution process" embodiment in the paragraph starting at page 12, line 17, carried out at temperatures of 90 to 120°C and pressures of 20 to 200 bar;
- A third "medium pressure" embodiment disclosed in the following paragraph on page 12, relating to a process carried out temperatures of at least 10°C greater than the melting point of the polymer being prepared, e.g. 80 to 250°C and at pressures of at least 50 bar.

The respondent disputed that the third process was an embodiment of the invention of the priority document since this was presented as being the teaching of a co-pending application. It was however acknowledged that PR2 did relate to a plurality of process embodiments.

The Board invited the parties to comment on the relationship between the disclosure of page 3, lines 1-4 of PR2, specifying a temperature of at least 120°C and a pressure of at least 50 bar and the passage commencing at page 11, line 37 and continuing to page 12. The first part of this passage specified that "A preferred process of polymerisation is that conducted at high pressure, that is at from 200 to 3000 bar, preferably from 500 to 2500 bar…[in single phase or two fluid phases with or without unreactive diluents or solvents]…at temperatures generally above the melting point of the polymer being produced." (emphasis by the Board).

The respondent submitted:

(i) That the passage at page 11 followed directly from the cited passage at page 3, the intervening text having dealt with a different aspect of the invention, i.e. the catalyst;

(ii) that the presence of the two commas (emphasised in the above recitation of the text) in the first part of the passage at page 11 indicated that the embodiment "200 to 3000 bar" was separate and distinct from that which followed.

The appellant disputed this interpretation, stating that the two parts of said passage on page 11 were connected and that the interpretation of the respondent would result in inconsistencies between the temperature of 120°C specified at page 3 and the reference in the cited passage bridging pages 11 and 12 to a temperature of above the melting point (see above).

Following deliberation the Board announced its decision that the patent in suit was not entitled to either of the claimed priorities.
As a consequence, D1 was comprised in the state of the art pursuant to Art. 54(2) EPC.

(b) With regard to Art. 123(2) EPC the appellant relied on the written submissions (see sections V.(b) and VIII.(b) above) and in particular emphasised the argument that it was not inevitable that ligands of the specified formula L would stabilise a square planar geometry.
The respondent submitted that the requirement of stabilising a square planar geometry was present in the first, most general definition of the ligand. The formula represented a preferred embodiment of the ligand L and thus encompassed the requirement of being capable of stabilising a square planar geometry. It was emphasised that this wording did not mean that the complex had to have a square planar geometry. In view of the permissible values of the index r, it was difficult to see how the ligand L itself would force the complex to have a square planar geometry.
Following deliberation the Board announced that the claims of the main request satisfied the requirements of Art. 123(2) EPC.

(c) With regard to Art. 54 EPC the appellant submitted that there was no dispute that the features of the catalyst were disclosed in D1. The question to be answered was whether the claimed combination of temperature and pressure was disclosed. In D1 the temperature ranges of -100 to 200°C, preferably 0 to 150°C were explicitly disclosed, both of which ranges included the claimed range of equal to or greater than 120°C. There were also disclosures of pressure in the required range. It was however acknowledged that there was no explicit mention of e.g. a temperature of 150°C in combination with a pressure of 200 bar. Regarding the argument that the subject matter claimed corresponded to selections from two - independent - lists it was submitted that in fact only a single selection was necessary - that of the disclosed pressure of 2.03×10^4 kPa. According to the pertinent case law cited in the written proceedings (see section V.(c) above) this did not constitute a novel selection. There was no statement in D1 dissuading the skilled person from working in such ranges. In this connection reference was made to the reported influence of pressure and temperature on the product properties, reported on pages 91 and 92 of D1 and referred to by the appellant in the written submissions on inventive step (See section V.(d) above). Although there was no single example employing both pressure and temperature within the claimed range, it was submitted, with reference to part 5 of the reasons of T 666/89, that the claimed combination of features was made available by the teaching of D1. Further the selection of a pressure of at least 200 bar did not satisfy any of the three criteria for novelty by selection set out in T 279/89. In particular, the operative claims were not directed to a small portion of the range for the pressure disclosed in D1; on the contrary there was a 92% overlap between the pressure range disclosed in D1 and that now claimed. Thus it was difficult not to work in the area of overlap. Further there was no evidence that the selected range of pressure was purposive.

The respondent disputed that either the description or the examples of D1 disclosed the use of high temperature and high pressure in combination. With respect to the discussion at pages 91 and 92 of D1 concerning the effect of increasing pressure and temperature it was submitted that the effects were presented as differing depending on the metal present. Further it could be deduced from the discussion in D1 that the effects on branching arising from increasing pressure and temperature would cancel each other out. This was consistent with the examples in D1 some of which demonstrated high pressure in combination with low temperature and *vice versa*. Thus it was disputed that D1 disclosed simultaneously to increase the pressure and temperature.

Regarding the further features to be selected, such as the monomer, and the nature of the catalyst (metal and ligands) the appellant submitted that such combination was disclosed at pages 4, 5, 75 and 92 of D1. The preferred ligands II and III were disclosed on pages 57 to 59, where it was also disclosed that the metal to use was either Pd(II) or Ni(II).
The respondent disputed that the list of catalysts specified on page 75 of D1 were limited to those reported in the preceding "Table II" or that the disclosure of D1 could be interpreted such that

all the catalysts disclosed in said table were to be employed specifically with ethylene monomer. In this context it was noted that according to page 72, lines 18 and 19 of D1 the most preferred monomer was ethylene. According to page 75 the most preferred temperature was from 25-100°C. It was disputed that there was a basis in D1 for the combination of the most preferred monomer with the least preferred temperature range.

Following deliberation the Board announced that the subject matter of the claims of the main request was novel (Art. 54 EPC).

(d) With regard to Art. 56 EPC the appellant submitted that D1 was the closest state of the art. It was further submitted that the technical problem presented by the respondent in the response to the statement of grounds of appeal (see section VI.(d) above) arose from a reformulation of the problem presented during the oral proceedings before the opposition division (see also section V.(d) above). It was submitted that there was no reason why the process of D1 could not be scaled up. It was difficult to identify which technical effect was associated with the differences in the process compared to D1. Thus no objective technical problem could be formulated with respect to D1. In any case the examples in the patent in suit were carried out at laboratory scale, not at industrial scale. There was no evidence that the claimed process could be scaled up to industrial scale.
It was further submitted that it was standard and hence obvious to work at temperatures above the

melting point of the polymer. D1 also taught that the undesirable effects of working at high temperature - namely increased branching - could be counteracted by increasing the pressure. Thus once the decision to operate at high temperature had been made D1 provided a clear teaching also to increase the pressure. It was not inventive to select the claimed pressure range which encompassed all but the lowest 8% of the range disclosed in D1. It was misleading to consider only the yield.
It was emphasised that the examples of D1 were performed on a laboratory scale which explained the low pressure employed (see section V.(d) above).

The respondent disputed that the technical problem had been reformulated. On the contrary the formulation of the technical problem had been consistent throughout the opposition procedure. This was apparent from page 5 of the decision under appeal, paragraph 7.2 of the counterstatement to the statement of grounds of appeal and paragraph [0006] of the patent in suit. In all cases the technical problem was presented as being to identify process conditions suitable for industrial production. The evidence of the patent in suit showed that this problem had been solved, and in particular that the polymer remained in a homogeneous phase and could be discharged from the reactor without clogging. It could not have been predicted that the catalyst system would be stable under these conditions. There was no incentive to work at temperatures above the preferred range of 25°C to 100°C disclosed on page 75 of D1, in particular not in combination with high pressure. D1 did not provide any incentive simultaneously to increase pressure and temperature particularly in view of the opposite effects on branching explained at page 92 of D1. As evidence of this reference was again made to examples 361-363 (employing as the catalyst the composition designated "TM-2" in the patent in suit) which showed that operating under conditions of high pressure and high temperature led to poor results (see section VI.(d) above).

Following deliberation the Board announced its conclusion that the subject matter of the claims of the main request was founded on an inventive step.

XI. The appellant (opponent) requested that the sets of claims designated as set E and set F submitted with the letter dated 28 March 2008 should not be admitted, that the decision under appeal be set aside and that the European patent No. 0906344 be revoked.

The respondent (patentee) requested that the appeal be dismissed (main request) or in the alternative that the patent be maintained on the basis of the sets of claims designated set E or set F submitted with the letter 28 March 2008 or set B', set C' or set D' filed with the letter dated 16 May 2006 in that order.

Reasons for the Decision

1. The appeal is admissible.

Regarding the documents in the appeal procedure (cf submissions of the respondent in the rejoinder to the statement of grounds of appeal - section VI above) the appellant stated in the statement of grounds of appeal that it wished to rely on all of D1-D6, identifying these documents by explicit reference to their bibliographic data (patent numbers in the case of D1-D5 and citation data in the case of D6). These documents thus were presented as forming the "facts" relied on by the appellant (cf Art. 10a(2) Rules of Procedure of the Boards of Appeal in the version in force at the time of filing the appeal - OJ EPO 2004 541).
Accordingly there can be no doubt that all of D1-D6 were introduced into the appeal procedure.

Main Request

2. *Entitlement to priority*

2.1 Claim 1 of the main request is directed to a process for the polymerisation of olefins characterised *inter alia* by the following features:

- an unsupported catalyst is employed
- the polymerisation is carried out at an ethylene pressure of at least 200 bar (2.03 x 10^4 kPa) and a reaction temperature equal to or greater than 120°C.

2.2 The patent in suit claims priority from two earlier US patent applications, US 60/020,095 of 17 June 1996 ("PR1") and US 60/020,199 of 21 June 1996 ("PR2").

2.2.1 PR1 is directed to a catalyst system which is immobilized on a solid particle support, i.e. a supported catalyst. This document therefore cannot provide a basis for a priority claim for the subject matter of the operative claims which is directed to a process employing an unsupported catalyst. This has not been disputed by the respondent (see section X.(a) above).

2.2.2 PR2 is directed according to claim 1 thereof to a process for the polymerisation of ethylene polymers employing an unsupported catalyst. This is therefore the document which is to be considered with respect to the entitlement to priority.

2.3 As noted during the oral proceedings before the Board this document contains a number of disclosures relating to the pressure and temperature conditions to employ. The disclosure of interest in view of the operative claims is that of the so-called "high pressure process" (see section X.(a) above).

2.4 According to the "Summary of Invention" on page 2 of PR2 the invention comprises a process for the polymerisation of ethylene polymers comprising contacting ethylene and optionally other - defined - olefin monomers and other suitable monomers with an unsupported late transition metal catalyst system at elevated ethylene pressures, preferably at least 60 psia (413.7 kPa). This corresponds to 0.0413 x 10^4 kPa or 4.13 bar (cf operative claim 1). It is further stated that typically the contacting can be carried out in a solvent or suspension at a temperature of at least 30°C. An additional embodiment, disclosed in the sentence commencing in the last line of page 2 of PR2 is to work with or without diluent or solvent in an elevated pressure process wherein said contacting is done at a temperature of at least 120°C and a pressure of at least 50 bar (5000 kPa, i.e. $0.5x10^4$ kPa).

2.5 The following part of PR2, commencing at page 3 under "Detailed Description of the Invention" and continuing to page 11, line 35 relates to the catalyst to be employed.

2.6 Commencing at page 11, line 37 is the discussion of the processes which was considered at the oral proceedings (see section X.(a) above). This is the first discussion of the reaction conditions after the "Summary of the Invention" on page 2. Accordingly this section follows directly on from said "Summary".

The first part of this section, commencing at line 37 of page 11, has been reproduced in section X.(a) above. The question to be answered is whether the reference in the final line of page 11 to a pressure range of 200 to 3000 bar is independent from the remainder of the sentence, in particular the disclosure of a pressure range of 500 to 2500 bar at page 12, line 1 and the reference at page 12, line 3 to "temperatures generally above the melting point of the polymer being produced". It had been discussed at the oral proceedings whether the presence of the two commas (emphasised in the presentation in section X.(a) above) indicated that the reference to 200 to 3000 bar was a separate and independent embodiment, distinct from the embodiments set out in the following part of the sentence. If this were the case, it would have the consequence that the disclosure of the range of 200 to 3000 bar was not to be read in conjunction with the further features of said passage, and hence could be - independently -

combined with other parts of the disclosure, in particular the disclosure of a temperature of at least 120°C at page 3, line 3. Under these circumstances, the priority document would disclose the combination of pressure and temperature as specified in the operative claim 1.

2.7 The Board takes the view that although this is indeed one possible interpretation of the disclosure of PR2, an alternative, and equally valid interpretation is that the range of 200 to 3000 bar is simply the most general case of the pressure to be employed in the process embodiment disclosed in the passage bridging pages 11 and 12, this process including the feature that the temperature to be employed is defined not as an absolute value (as in the "Summary of Invention") but in relation to the polymer, i.e. as being above the melting point thereof. Based on this interpretation the passage bridging pages 11 and 12 relates to a different embodiment from that disclosed under "summary of Invention". Interpreting the disclosure of PR2 in this manner would lead to the conclusion that PR2 did not provide a disclosure of a process operated at the combination of temperature and pressure as required by the operative claims of the patent in suit.

2.8 In view of this the fact that this aspect of the disclosure of PR2 is susceptible to a plurality of - differing and incompatible - interpretations regarding the pressure and temperature conditions to be employed it cannot be concluded that the skilled person can derive the subject matter of the operative claim directly and unambiguously using common general knowledge from the previous application as a whole.

Hence it cannot be concluded that PR2 relates to the same invention as that specified in the operative claims (cf G 2/98).

2.9 Accordingly it is concluded that neither of the claims to priority is valid.

2.10 The consequence of this is that the application date of the patent in suit, i.e. 17 June 1997 is the effective filing date for the claims of the main request. D1, with a publication date of 1 August 1996 is therefore comprised in the state of the art pursuant to Art. 54(2) EPC and hence is citable under Art. 56 EPC.

3. *Art 123(2) EPC*

The objections raised under Art. 123(2) EPC were directed to the specification of the ligand L in operative claim 1. In particular it was objected that the absence of the feature that the ligand stabilised a square planar geometry resulted in an extension of the subject matter of the claim beyond the content of the application as filed.

3.1 Independent claim 13 as originally filed specified that the process was carried out with a catalyst system comprising a group 8, 9 or 10 transition metal compound stabilized by a bidentate ligand, under the conditions of pressure and temperature specified in operative claim 1.

3.2 On page 3 of the A-publication the catalyst was disclosed as being of the formula LMX_r. L was specified as being a bidentate ligand **that stabilizes a square**

planar geometry and charge balances the oxidation state of MX_r (emphasis of the Board).
In the section of page 3 starting at line 25 it is disclosed that in a preferred embodiment the bidentate ligand L is defined by the formula which is now specified in lines 26 to 39 of operative claim 1.

3.3 Therefore in the application as filed the formula now specified in operative claim 1 is disclosed as being a preferred embodiment, i.e. a subset of the class of ligands L which, according to the more general disclosure, stabilized a square planar geometry.

3.4 Since it is inherent in view of the presentation of the subject matter in the A-publication that the ligands corresponding to the defined formula stabilise a square planar geometry it is not necessary, and would be redundant, to specify this property (again).
Therefore the absence of this term in operative claim 1 does not result in subject matter extending beyond the scope of the application as filed.

3.5 As a further line of argument the appellant submitted that not all ligands falling within the scope of the formula did in fact stabilise a square planar geometry (See section V.(b) above).
The appellant has however advanced no evidence in support of this argument. In particular there is no teaching or disclosure in this respect in D1.
Accordingly this argument is not supported by the facts and must be dismissed.

3.6 A further consideration in this context is the scope and meaning of the phrase "is a bidentate ligand that stabilises a square planar geometry" (page 3 line 9 of the A-publication). There is no statement linking this property to the transition metals specified in the application. Further this appears to be an extrinsic property of the ligand, i.e. a property which arises as a result of the interaction of the ligand with other entities which are not specified in the description. Under these circumstances it becomes apparent that the phrase "is a bidentate ligand that stabilises a square planar geometry" does not in fact provide a technical limitation of any kind beyond that which is inherent in the definition of LMX_r itself. In particular, it cannot be regarded as implying that the catalyst including the ligand L must itself actually have a square planar geometry. The corollary of this conclusion is that the absence of this wording from the claims cannot result in an extension beyond the content of the application as filed. This position is consistent with the submissions of the respondent with respect to the value of r at the oral proceedings before the Board (see section X.(b) above).

3.7 The subject matter of the claims of the main request therefore meets the requirements of Art. 123(2) EPC.

4. *The patent in suit, the technical problem, its solution*

4.1 According to paragraph [0002] of the patent in suit the invention relates to polymerisation of olefins using late transition metal catalyst systems. In the following section of the description entitled "Background of the Invention" reference is made to early transition metal catalysts, typical examples of which are the Ziegler-type catalysts based on Group 4 and Group 5 compounds. It is explained that late transition metal catalyst systems had not offered the same level of activity or molecular weight capability for olefin polymerisation and further work was published to address this. In paragraph [0004] reference is made to D6 which relates to the use of catalyst systems prepared from square-planar precursors incorporating substituted bidentate diimine ligands, the catalysts being in the form of Ni and Pd complexes thereof. D6 is reported to disclose solution polymerisation processes. The reaction temperatures employed do not exceed 25°C. It is stated that according to this document an increase of the temperature from 0°C to 25°C results in a significant increase in branching and a significant decrease in M_n and T_m.

It is further taught in paragraph [0005] of the patent in suit that homogeneous processes such as high temperature solution and high pressure, high temperature polymerisation processes have shown particular suitability with metallocene systems. These processes give advantages deriving from the improved productivity that occurs with greater reactivities at high temperature. The high pressure maintains an essentially single phase reaction medium, while permitting the use of higher temperatures. The temperatures exceed 120°C and these solution processes are preferably conducted at pressures of 500 to 3500 kg/cm^2 (490 to 3432 bar, 4.9x10^4 to 34.32x10^4 kPa). Accordingly it is stated in paragraph [0006] of the patent in suit that it would be industrially desirable to identify conditions under which late transition metal catalysts could be effectively utilised.

This then is the technical problem underlying the patent in suit.

4.2 According to paragraph [0007] of the patent in suit the technical problem is solved by the combination of measures specified in operative claim 1.
This is also explained in paragraph [0033] of the patent in suit, to which reference was made in the decision under appeal (see section III.(d) above) and by the appellant in the statement of grounds of appeal (See section V.(d) above). Specifically, it is disclosed that a preferred process of polymerisation is that conducted at high pressure, i.e. from 200 to 3000 bar, in a homogeneous single phase or two fluid phases, with or without unreactive diluents or solvents at temperatures generally above the melting point of the polymers, e.g. 120°C-225°C.
Examples 1-8 of the patent in suit demonstrate the production of polyethylene in a process operated in a continuous manner under these conditions of temperature and pressure and hence establish that the technical problem as set out in the patent in suit is effectively solved by the claimed measures.

4.3 Regarding the submission of the appellant that the respondent had, during the course of the opposition proceedings, modified the technical problem with respect to that presented in the patent in suit (see sections V.(d) and X.(d) above), the Board notes that in section 6.2 of the response to the notice of opposition the problem was presented as being to identify conditions under which late transition metal olefin polymerisation catalysts could be effectively utilized, which problem corresponds to that set out in the patent in suit as explained in section 4.1 above. The same problem was presented at the oral proceedings before the opposition division (paragraph 7.2 of the minutes thereof). In section 7.2 of the response to the statement of grounds of appeal the problem was presented as being to identify process conditions at which the catalysts of D1 could be used in an industrially relevant continuous process for polymerising olefins. Accordingly variations in the terminology employed notwithstanding, the technical problem has been consistently presented as being to identify conditions under which the catalysts of D1 could be effectively utilised in particular with reference to "industrial" conditions. Accordingly the contention that the technical problem has been modified by the respondent over the course of the opposition proceedings is not supported by the facts.

5. *The prior art*

Polymerisation processes employing late transition metal catalysts are known from D1 which by common consent represents the closest state of the art.

5.1 D1 relates according to the section "Field of the invention" to novel homo- and co-polymers of ethylene and/or one or more acyclic olefins, and/or selected cyclic olefins; to selected transition metal containing polymerisation catalysts and to processes for making such polymers.

5.2 *The catalyst*

According to page 4 line 17ff of D1 the process for polymerising olefins of D1 comprises contacting a transition metal complex of a bidentate ligand, which according to the disclosure of D1 can be, but is not mandatorily, a ligand having two nitrogen groups.
The transition metal is disclosed at page 5, lines 11-13 of D1 as being selected from the group consisting of Ti, Zr, Sc, V, Cr, a rare earth metal, Fe, Co, Ni or Pd. Of these only the last three named (Co, Ni and Pd) fall within the scope of operative claim 1.
During the oral proceedings, it was submitted by the appellant, and not disputed by the respondent that the catalyst of D1 corresponded to that specified according to the operative claim (see section X.(c) above). As is apparent from the foregoing, this is true for a subset of the catalysts disclosed but is not the case for the whole disclosure of D1.

5.3 *The monomers*

The permissible monomers are disclosed at page 5, lines 6-10 of D1 as being selected from the group consisting of ethylene, an olefin of the formula $R^{17}CH=CH_2$ or $R^{17}CH=CHR^{17}$ (R^{17} being hydrocarbyl or substituted hydrocarbyl - D1 page 6, line 16), cyclobutene, cyclopentane, norbornene or substituted norbornene.
In contrast thereto, operative claim 1 requires as the monomer mandatorily ethylene and optionally one or more ethylenically unsaturated monomers.

5.4 *The reaction conditions*

The disclosure of D1 in the sections entitled "Background of the Invention" (starting on page 1) and the section entitled "Details of the Invention" (starting on page 53) in respect to the temperature is, as will be explained in the following section detailed and differentiated with respect to variants of the catalyst system. However with regard to the pressure either D1 is silent or it is specifically stated that this is not critical and may range from atmospheric (i.e. 1 bar, 101.3 kPa) to about 275 MPA ($27.5x10^4$ kPa, 2750 bar), i.e. over a range of 4 orders of magnitude (e.g. D1 page 67 lines 18-20, page 75, lines 8-10, page 135, lines 29-32).

5.4.1 The first reference to the reaction conditions, specifically the temperature to be employed is on page 8 line 10 of D1 where it is stated that the olefins are contacted at a temperature of about -100°C to about +200°C in the presence of a catalyst one component of which is a cyclic diimine coordinated to a metal defined as indicated in section 5.2 above. The same temperature range is repeated on page 9 at line 23 where it is further disclosed that the monomer is selected from a group of olefins defined in part by specific compounds, and in part by generic formulae. Ethylene is specifically mentioned as one of the possible monomers. This section of the presentation of D1 is silent with respect to the pressure. The indicated temperature range is repeated over the following pages, in each case in connection with variations of the bidentate ligand catalyst structure.

5.4.2 In the section entitled "Details of the Invention", which commences on page 53 of D1, the catalysts and

reaction conditions are discussed in more detail. On page 67, starting at line 7 reference is made to a catalyst which is a Ni or Pd complex based on a diimine corresponding to the formula of the ligand set out in operative claim 1 of the patent in suit ("Compound I" on page 56 of D1). It is taught that the polymerisation is carried out at a temperature of about -100°C to +200°C, preferably about -20°C to +80°C.
A similar teaching is provided on pages 75 and 135 of D1. Here however the temperature is disclosed as being preferably about 0°C to about 150°C, more preferably about 25°C to 100°C. In all these instances it is explicitly stated that the pressure is not critical, as reported in section 5.4 above.

5.4.3 Commencing at page 91, line 29 of D1 is the discussion of how temperature and pressure affect the outcome, to which reference was made by the appellant in the Statement of Grounds of Appeal (see section V.(d) above). Specifically it is taught that:

- Higher pressure often affects the microstructure by reducing branching especially in ethylene containing polymers. This effect is taught to be more pronounced for Ni catalysts than for Pd based catalysts;
- Under certain (unspecified) conditions higher pressures seem to give higher productivities and higher molecular weight;
- Higher temperatures usually increases branching with Ni catalysts, but often has little effect with Pd catalysts;
- With Ni catalysts higher temperatures appear often to decrease the molecular weight.

It is conspicuous to the Board that this discussion does not include any explicit consideration of the interplay of these two parameters. Thus whilst the appellant perceives in this presentation an indication to choose a particular combination of (high) pressure and (high) temperature (see section V.(d) above) there is in fact not the slightest hint regarding which measures might be taken in order to compensate for the effects reported. Thus the position of the appellant in this respect amounts to a synthetical construction which is not directly and unambiguously derivable from the disclosure relied upon.

Therefore the conclusions which the appellant seeks to draw from this discussion on pages 91 and 92 of D1 are not supported by the disclosure thereof.

5.5 *The examples*

D1 contains a total of 537 examples.

5.5.1 None of the examples of D1 employs a temperature in the range specified by operative claim 1. The highest temperature employed is 80°C in examples 362 and 363. The pressure applied in these examples is 690 kPa ($0.069x10^4$ kPa) and 2.1 MPa ($0.21x10^4$ kPa) respectively and thus at least an order of magnitude lower than that specified in the operative claims.

5.5.2 None of the examples of D1 employs an ethylene pressure in the claimed range. In all cases it is lower by at least one order of magnitude.

5.5.3 Examples 101 and 102, both relating to ethylene polymerisation, demonstrate the effect of employing pressures higher than those in the majority of the examples of D1, although still below the minimum specified in the operative claims namely 2.8 MPa (0.28×10^4 kPa) and 5.2 MPa (0.52×10^4 kPa) respectively. Example 101 was carried out at a temperature of 35°C and yielded a rubbery polymer which was quite tacky. It is not disclosed at which temperature example 102 was carried out. This example resulted in a granular sponge rubber growing all over the walls of the autoclave which had to be scraped off.

5.5.4 The effects of varying temperature and pressure is shown by examples 361-363 of D1, also relating to ethylene polymerisation. These employed the same conditions with respect to catalyst, concentration, monomer etc as each other. The catalyst employed was that designated "TM-2" in the patent in suit. The temperature and pressure was varied: temperatures of 65°c and 80°C and pressures of 690 kPa (0.069×10^4 kPa) and 2.1 MPa (0.21×10^4 kPa) were employed, i.e. temperatures and pressures below the minimum values specified according to the operative claims. The results of these experiments is presented in the following table:

Example	Temp.	Pressure	yield
361	65°C	690 kPa	7.6g
362	80°C	690 kPa	1.0g
363	80°C	2.1 MPa	1.05g

The evidence provided by these examples is that increasing the temperature from 65°C to 80°C leads to a ca 7-fold drop in yield. Increasing the pressure however has only a minimal effect on the yield.

6. *Novelty*

6.1 From the foregoing presentation of D1, it is evident that not only is there no explicit disclosure of the combination of features forming the subject matter of operative claim 1, it is not even the case that the individual elements of this subject matter, i.e. the catalysts, the monomers or the reaction conditions - each taken alone - are directly and unambiguously derivable from the disclosure of D1.

6.2 The argument of the appellant concerning the fact of the overlap between the broad ranges of temperature and pressure referred to in D1 and those specified in the definition of these parameters of claim 1 of the patent in suit is not convincing for the following reasons:

6.3 In such a case of overlap where a number of ranges of parameters are to be considered it is necessary to carry out a careful comparison in order to assess whether or not the subject matter of the claimed invention, i.e. the **combination** of selected ranges, was made available to the skilled person by the cited document (point 2.4 of the reasons of T 245/91, 21 June 1994, not published in the OJ EPO).
It is further explained in T 245/91 (reasons 2.5) that, as emphasised in T 666/89, point 8 of the reasons novelty must be decided by reference to the total information content of a cited prior document. This means that the enabling disclosure of a document is not restricted to the worked examples, but extends to the

whole description. Vice versa, this means also that the specific disclosure in the examples must not be neglected when interpretation of the specification is necessary for the assessment of the subject matter that was unambiguously available, since the examples in most cases contain guidance as to what the actually promising solutions of the underlying technical problem are which knowledge is indispensable for the evaluation of what the enabling disclosure in a prior art document is. Only under this aspect can the concept of "seriously contemplating" explained in T 26/85 and T 666/89 be applied.

6.4 As is apparent from the analysis of D1 in section 5 above, the teaching of the description of D1 reveals that the preferred range of temperature is from 25°C to 100°C. The examples are consistent with this, in that the highest temperature employed is 80°C. Although broader ranges of temperature, in some cases extending into the scope of the operative claims are disclosed in D1 (see sections 5.4.1 and 5.4.2 above), these are not presented as the most preferred embodiments, and are not exemplified in the examples. Accordingly there is no indication in the broader disclosure of D1 to employ temperatures within the claimed range.
It is explicitly stated in D1 that the pressure is not important. This statement is consistent with the very broad range disclosed for this parameter (see section 5.4 above). Further as explained in section 5.4.3 above there is no teaching in D1 to employ a particular combination of high temperature and high pressure.

6.5 Regarding the examples of D1, as noted in section 5.5.1 above, there is not a single example which employs a temperature within the range specified by the operative claims. Similarly, as reported in section 5.5.2 above there is no example which employs an ethylene pressure within the claimed range.

6.6 Accordingly based on the examples of D1 it is apparent that the inventors thereof considered that the most promising solutions to its underlying technical problem involved processes conducted at temperatures below the minimum specified in operative claim 1.

6.7 Accordingly neither the examples, nor the general disclosure of D1 provide a disclosure of a process operated under the conditions of temperature and pressure as specified in operative claim 1.

6.8 Therefore in the light of the facts discussed in sections 6.3 to 6.5 above and with respect to the considerations of T 245/91 it must be concluded that the entire disclosure of D1 does not make available a process carried out under the pressure and temperature conditions specified in the operative claims, i.e. an ethylene pressure of at least 200 bar (2.03×10^4 kPa) and a temperature equal to or greater than 120°C.

6.9 Regarding the further argument of the appellant concerning the degree of overlap between the pressure range disclosed in D1 and that specified by the operative claims (see section X.(c) above) and the argument that it was "difficult not to work in the area of overlap" the Board observes that this argument relates to the probability of the skilled person working according to the teaching of D1 employing a pressure within the claimed range. It is however the case that Art. 54 EPC requires that there be a direct, unambiguous disclosure of the claimed subject matter, not merely a probability thereof. In any case, even if this line of argument were, nevertheless to be followed, it still would not lead to a finding of lack of novelty since in any case the required temperature is not disclosed by D1, as explained above.

6.10 It is also to be noted that further selections from the disclosure of D1 are required, i.e. in respect of the catalyst (ligand and metal) and in respect of the monomer, i.e. that ethylene be mandatorily present.

6.11 The subject matter of the claims of the main request is therefore novel.

7. *Inventive step*

7.1 *The objective technical problem, its solution*

7.1.1 As noted in section 5 above, by common consent D1 is the closest state of the art.

7.1.2 As explained in section 6 above, D1 however does not disclose the conditions of pressure and temperature specified in the operative claims.

7.1.3 The most relevant starting point in the disclosure of D1 would appear to be examples 361-363 since as reported in section 5.5.4 above these employ the highest combination of temperature and pressure in D1 and are reported to provide a useful product.

7.1.4 Examples 101-102 which employ an even higher pressure but a lower temperature than examples 361-363 do not represent an appropriate starting point for the analysis of inventive step since these conditions gave unsatisfactory results, as explained in section 5.5.3 above.

7.1.5 According to examples 361-363 the highest pressure employed is 2.03 MPa and hence ca one order of magnitude lower than the minimum specified in operative claim 1 while the highest temperature employed is 80°C, i.e. 40°C lower than the minimum specified in the operative claims (see section 5.5.4 above). In order to arrive at the industrially relevant conditions represented by claim 1 of the patent in suit it would thus be necessary to modify (i.e. increase) both the temperature and the pressure employed in said examples 361-363.

7.1.6 As explained in sections 4.1 and 4.2 above, examples 1-8 of the patent in suit establish that the technical problem as set out in the patent in suit is effectively solved by the claimed measures, i.e. the specified combination of temperature and pressure.

7.1.7 The problem as set out in the patent in suit can thus be adopted as the objective technical problem to be solved.

7.2 *Obviousness*

It must now be decided whether the claimed solution to the problem of identifying industrially relevant conditions in which the catalysts of D1 could be effectively utilised for the polymerisation of ethylene is obvious with respect to the closest prior art D1. In particular the question to be answered is whether D1 would render it obvious to operate the polymerisation process at conditions of both high temperature and high pressure ("extreme conditions" - cf submission of the respondent in the rejoinder to the statement of grounds of appeal, section VI.(d) above), i.e. whether D1 provides any indications that the skilled person would expect any benefits to arise by operating under such conditions.

7.3 Firstly there is no reference in D1 to "industrial" conditions in general or to the specific conditions defined in operative claim 1 in particular. On the contrary, the examples of D1 are carried out under laboratory conditions, as explicitly acknowledged by the appellant in the statement of grounds of appeal and at the oral proceedings (see sections V.(d) and X.(d) above). Accordingly the objective technical problem is not even addressed in D1.

7.4 Quite apart from this, the evidence provided by the examples of D1 is that increasing the temperature and/or pressure does not bring any benefits, but on the contrary leads to a reduction in either product quality or yield.
As shown by examples 101 and 102 - discussed in section 5.5.3 above, operating at pressures higher than those employed in the majority of the examples of D1 - but still below the minimum specified in operative claim 1 - results in a poor product quality.
Examples 361-363, (discussed in section 5.5.4 above) employing temperatures at the upper limit of those

exemplified in D1 but still below the minimum specified in operative claim 1 demonstrate that increasing the temperature from 65°C to 80°C reduces the yield to ca 1/7th of that at the lower temperature. This series of examples also shows that the increasing the pressure does not compensate for this reduction in yield.

7.5 Accordingly, not only is there no suggestion or teaching in D1 to employ - individually or simultaneously - conditions of high temperature and high pressure, the evidence of the examples of D1 is that doing so would actually be detrimental both in terms of product quality and product yield. Accordingly the submission made by the appellant in the statement of grounds of appeal - albeit with respect to novelty - that there was no teaching that working in the upper ranges of temperature and pressure disclosed in D1 would lead to an undesirable result (see section V.(c) above) is not supported by the facts.

7.6 The appellant also submitted that the specified temperature would be obvious upon consideration of the melting point of the polymer in respect to the process requirements.

In the statement of grounds of appeal (see section V.(d) above) it was submitted that "the most obvious and only reasonable way" to run a solution under industrial conditions was above the melting point of the polyolefin whilst at the oral proceedings (see section X.(d) above) it was submitted that it was standard to work at temperatures above the melting point of the polymer, so rendering the claimed temperature range obvious. In the latter connection it was submitted that D1 taught that the effects arising from such conditions,

namely increased branching could be counteracted by increasing the pressure.
Firstly, it has not been shown that the requirement of working above the melting point of the polymer necessarily and inevitably corresponds to a minimum temperature of 120°C.
Secondly, as explained in section 7.4 above the clear teaching of D1 is that such an approach would not lead to the desired result. The evidence of the patent in suit shows, in contrast to the teaching of D1, that it is feasible to work at pressures and temperatures even higher than those shown by the examples of D1 to be associated with a reduction in product quality and yield.

7.7 Regarding the submissions of the appellant concerning the interplay of temperature and pressure, as explained in section 5.4.3 above, D1 fails to provide any teaching in respect thereof, let alone any guidance as to which measures might be taken to compensate for the reported effects.
In any case it is necessary to consider these statements in the context of the teaching of D1. As explained above D1 does not provide any teaching to work - individually or in combination - at the temperature and pressure conditions defined in operative claim 1. Thus even if the discussion on pages 91 and 92 of D1 had been interpreted as petitioned by the appellant, there still remains a gap, namely, based on this interpretation to arrive, in the absence of any teaching - express or implied - in D1, at the conclusion that it would be necessary and desirable to work simultaneously at conditions of high temperature and high pressure neither of which is even individually

preferred and insofar as they are exemplified in D1 are shown to give rise to unsatisfactory results.
Another consideration which further militates against employing such conditions in combination is, as submitted by the respondent (see section VI.(c) above) that simultaneous use of high pressure and high temperature would lead to a large increase in the energy requirements. It is simply not credible that the skilled person would take such a step of increasing the energy demands unless there was a clear teaching in the prior art that this would be expected to lead to some advantage. As explained above (section 5.4.3) there is no such indication in D1.

7.8 Accordingly there is no disclosure in D1 which would lead the skilled person to adopt the conditions of pressure and temperature specified in operative claim 1.

7.9 No different conclusion is reached by considering the teachings of D1 in combination with any of the other documents D2-D5 referred to by the appellant in the statement of grounds of appeal.
D2-D4 relate to polymerisation processes involving metallocene catalysts.
D2 reports that the metallocene catalyst is capable of maintaining a high level of activity at temperatures of 140°C, preferably 160°C or greater (col. 5 lines 64-68), which are stated to be temperatures exceeding the melting point temperature. The preferred minimum temperature is twice the highest temperature employed in the examples of D1. In column 6, line 7 it is disclosed that pressures of 500 up to 5000 bar ($5x10^4$ kPa to $50x10^4$ kPa) can be employed.

D3 relates to a process for killing such catalysts. In the inventive examples (4-7) temperatures of 140 to 180°C and pressures of 1300-1500 bar ($13x10^4$ kPa - $15x10^4$ kPa) are employed.

D4 relates specifically to the ligands employed in such catalyst systems. The lowest temperatures disclosed in the inventive examples of D4 (top/bottom of reactor) are 160°C and 189°C in example 6. All examples were carried out at a pressure of 1300 bar ($13x10^4$ kPa) (D4, page 16, line 10).

D5 relates to a titanium catalyst/cocatalyst system composed of different organoaluminium compounds, an electron donor compound containing a hetero atom and an aromatic ester compound, i.e. a non-metallocene catalyst system different both from that of D1 and those of D2-D4. According to col. 6 lines 17-20 of D5 the polymerisations are carried out at temperatures of from -80°C to +150°C, preferably +40°C to +120°C at pressures of from 1 to 60 atmospheres ($0.01x10^4$ kPa to $0.6x10^4$4 kPa).

Accordingly none of D2-D5 relates to the same catalyst system as that specified in the operative claims. Nor is there any statement in any of these documents which establishes a link between the reaction conditions employed in these documents and the catalyst system specified in operative claim 1. Accordingly all that these documents establish is that conditions within the scope of the operative claims can be employed with a different catalyst system (e.g. metallocene).

In fact, the only document which establishes a link between the catalyst systems generally disclosed in D1 and the reaction conditions employed in D2-D4 is the patent in suit itself. In other words the purported relevance of the teachings of D2-D4 appears not by

consideration of these documents and D1 but requires knowledge of the claimed invention, i.e. is only arrived at in an *ex post facto* fashion.
Accordingly also the combination of D1 with any of D2-D5 does not render the subject matter of the operative claims obvious.

7.10 It was further objected in the context of inventive step that the claims of the patent in suit were overly broad, reference being made to the nature of the catalyst (see section V.(e) above).

7.10.1 The appellant has however advanced no evidence to support its allegations in this respect. It is an established principle of the case law developed by the Boards of Appeal of the EPO that the burden of proving the facts it alleges lies with the party invoking these facts. If a party, whose arguments rest on these alleged facts, is unable to discharge its onus of proof, it loses thereby. In the absence of any pertinent evidence presented by him, the Appellant has not discharged the burden of proof which is upon him, with the consequence that the Board does not accept his allegation.
Accordingly this objection must be dismissed.

7.10.2 During the oral proceedings before the Board the appellant objected that there was no evidence that scaling up to an industrial scale was possible (see section X.(d) above). The appellant has however submitted no evidence - documentary or experimental - to support its contention in this respect.
Accordingly, for the same reasons as explained in section 7.10.1 above this objection must be dismissed.

7.11 Hence it is concluded that the subject matter of the claims of the main request is founded on an inventive step.

8. *Admissibility of claim sets E and F*

Since the claims according to the main request are found to meet the requirements of the EPC it is not necessary to consider any further sets of claims. Accordingly it is not necessary for the Board to decide on the request of the appellant that claim sets E and F not be admitted (section X above).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:	The Chairman:
E. Görgmaier	R. Young