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D E C I S I O N
of 1 March 2000

Case Number: T 0726/98 - 3.3.3

Application Number: 91917626.3

Publication Number: 0548257

IPC: C08F 4/642

Language of the proceedings: EN

Title of invention:

Supported monocyclopentadienyl transition metal olefin
polymerization catalysts

Patentee:

EXXON CHEMICALS PATENTS INC.

Opponent:

THE DOW CHEMICAL COMPANY

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 83, 87

Keyword:

"Priority (yes) - correctly claimed from first foreign
application"

"Novelty (yes) - prior disclosure - implicit features (no)"

"Inventive step (yes) - non-obvious contribution of known
features"

Decisions cited:

T 0150/82, T 0188/83, T 0198/84, T 0026/85, T 0114/86,
T 0124/87, T 0296/87, T 0027/89, T 0666/89, T 0012/90,
T 0279/90, T 0953/92

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0726/98 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 1 March 2000

Appellant:
(Opponent) The Dow Chemical Company
2030 Dow Center
Midland, Michigan 48674 (US)

Representative: de Jong, Nicolaas Henricus Maria
Dow Benelux N.V.
Patent Department
Herbert H. Dowweg 5
4542 NM Hoek (NL)

Respondent:
(Proprietor of the patent) EXXON CHEMICAL PATENTS INC.
1900 East Linden Avenue
Linden
New Jersey 07036-0710 (US)

Representative: van Heesch, Helmut Werner
Uexküll & Stolberg
Patentanwälte
Beselerstrasse 4
D-22607 Hamburg (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 12 May 1998, issued
in writing on 22 May 1998 rejecting the
opposition filed against European patent
No. 0 548 257 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
 J. C. M. De Preter

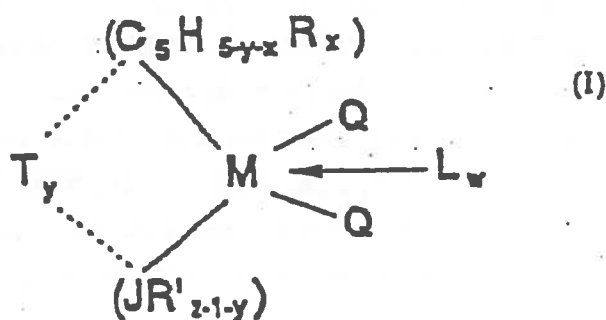
Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 548 257, in respect of European patent application No. 91 917 626.3, based on International application No. PCT/US91/06669 (International publication No. WO 92/05203), filed on 13 September 1991 and claiming a US priority of 13 September 1990 (US 581869), with 23 claims, was published on 3 January 1996 (Bulletin 1996/01). Claim 1 read as follows:

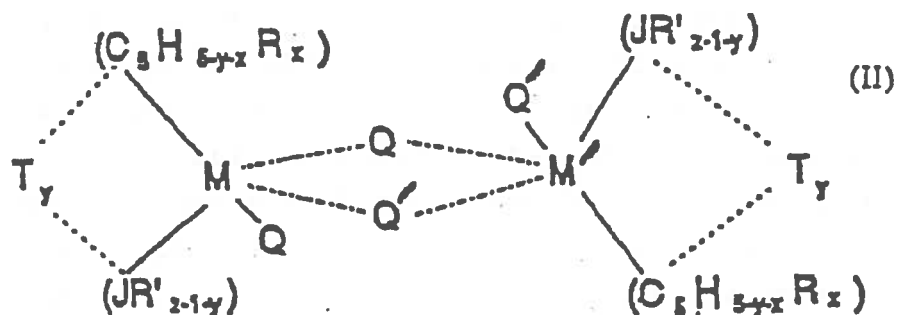
"A catalyst system comprising:

(A) an inert support of a resinous support material or an inorganic oxide

(B) a transition metal compound of the formula:



or



wherein M is Zr, Hf, or Ti in its highest formal oxidation state:

$(C_5H_{5-y-x}R_x)$ is a cyclopentadienyl ring which is substituted with from zero to five substituent groups R, "x" is 0, 1, 2, 3, 4 or 5 denoting the degree of substitution, and each substituent group R is, independently, a radical selected from a group consisting of C_1-C_{20} hydrocarbyl radicals; substituted C_1-C_{20} hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by a halogen radical, an amido radical, a phosphido radical, an alkoxy radical, an alkylborido radical, or a radical containing a Lewis acidic or basic functionality; C_1-C_{20} hydrocarbyl-substituted metalloid radicals wherein the metalloid is selected from the Group IV A of the Periodic Table of Elements; and halogen radicals, amido radicals, phosphido radicals, alkoxy radicals, alkylborido radicals, or a radical containing Lewis acidic or basic functionality; or $(C_5H_{5-y-x}R_x)$ is cyclopentadienyl ring in which two adjacent R-groups are joined forming C_4-C_{20} ring to give a saturated or unsaturated polycyclic cyclopentadienyl ligand;

(JR'_{z-1-y}) is a heteroatom ligand in which J is an element with a coordination number of three from Group V A or an element with a coordination number of two from Group VI A of the Periodic Table of the Elements, each R' is, independently a radical selected from a group consisting of C_1-C_{20} hydrocarbyl radicals; substituted C_1-C_{20} hydrocarbyl radicals wherein one or more hydrogen atom is replaced by a halogen radical, an amido radical, a phosphido radical, an alkoxy radical, an alkylborido radical, or a radical containing a Lewis acidic or basic functionality; and "z" is the coordination number of the element J;

each Q is, independently, an univalent anionic ligand including halide, hydride, or a substituted or unsubstituted C₁-C₂₀ hydrocarbyl, alkoxide, aryloxy, amide, arylamide, phosphide, or arylphosphide, provided that where Q is a hydrocarbyl ligand such Q is different than the (C₅H_{5-y-x}R_x) or both Q together are an alkylidene, a cyclometallated hydrocarbyl or a divalent anionic chelating ligand;

"y" is 0 or 1 when "w" is greater than 0; "y" is 1 when "w" is 0; when "y" is 1, T is a covalent bridging group containing a group IV A or V A element;

L is a neutral Lewis base where "w" denotes a number from 0 to 3 or (in formula II) L represents a second compound of general formula type I wherein M' and Q' have the same definitions as M and Q respectively such that M and M' are bridged by Q and Q'; and

(C) an alumoxane either deposited on the support by combining the transition metal compound (B), the alumoxane (C) and

the support (A) in any order in one or more suitable solvents or diluent but excluding combining dehydroxylated silica with (tert-butylamido)dimethyl(tetramethyl- π^5 -cyclopentadienyl) silane titanium dichloride and then adding methylalumoxane or by direct reaction of trialkylaluminum or trialkylaluminum mixtures with a wet gel."

Claims 2 to 14 were dependent claims directed to elaborations of the catalyst system according to Claim 1.

Claim 15, an independent claim, read as follows:

"A process for producing a supported catalyst system according to claim 1 which comprises combining (A), (B) and (C), to form the desired supported catalyst system."

Claims 16 to 23 were dependent claims directed to elaborations of the process according to Claim 15.

II. Notice of Opposition was filed on 3 October 1996 on the grounds of insufficiency (Article 100(b) EPC), and lack of novelty and lack of inventive step (Article 100(a) EPC). The opposition was supported *inter alia* by the documents:

D1: EP-A-0 416 815;

D2: EP-A-0 420 436;

D3: EP-A-0 279 863;

D4: EP-A-0 287 666;

D5: EP-A-0 285 443;

D6: EP-A-0 323 716;

D7: WO-A-91/04257/EP-A-0 491 842;

D9: USA Patent Application No. 533245 (filed 4 June 1990); and

D10: USA Patent Application No. 581 869 (filed 13 September 1990).

III. By a decision which was given at the end of oral proceedings held on 12 May 1998 and issued in writing on 22 May 1998, the Opposition Division rejected the opposition.

According to the decision:

- (i) The objection under Article 100(b) EPC, which had been based solely on arguments relevant to Article 84 EPC, which was not a ground for opposition, was rejected.
- (ii) The subject-matter of the claims of the patent in suit was supported by the contents of the relevant document D10 from which priority had been claimed, and not by an earlier foreign application, in particular D9, since the latter did not disclose all the features of the claimed subject-matter, in particular an inert support for the catalyst according to Claim 1.
- (iii) Documents D1, D2 and D7, which thus became state of the art only by virtue of Article 54(3) EPC, did not deprive the claimed subject-matter of novelty, since the novelty-threatening Example 78 of D1 had been disclaimed, and neither D2 nor D7 disclosed the necessary inert support. Furthermore, whilst documents D3, D4, D5 and D6 formed state of the art in the sense of Article 54(2) EPC, none of them disclosed all the features of the independent claims of the patent in suit, the subject-matter of which was therefore novel.

- (iv) As to inventive step, although D3, D4 and D5 each disclosed a transition metal catalyst, a relevant carrier and an alumoxane, the catalyst was in each case only very generally described, and only bis(cyclopentadienyl) metallocenes were exemplified. Moreover, whilst D6, which was regarded as the closest state of the art, mentioned monocyclopentadienyl compounds, these did not comprise the heteroatom group "JR'_{z-1-y}". This meant that the very specific monocyclopentadienyl transition metal catalyst compound having a specific combination of structural elements, one of which had to be the "JR'_{z-1-y}" group, was not suggested.

IV. On 21 July 1998, a Notice of Appeal against the above decision was filed, the prescribed fee having been paid already on 17 July 1998.

In the Statement of Grounds of Appeal, filed on 30 September 1998, the Appellant (Opponent) argued in substance as follows:

- (a) Insofar as the skilled person was not able to determine whether the claimed subject-matter extended to catalyst systems having dicyclopentadienyl or tricyclopentadienyl-containing Group IVB transition metal compounds, or the extent of the limitation imposed by the process features of Claim 1, the disclosure did not meet the requirements of Article 100(b) EPC.

- (b) The decision under appeal had been wrong to conclude that the earlier foreign application D9 did not disclose the use of an inert support, because the reference to gas phase polymerisation directly and unambiguously implied the use of such a support. Consequently, the patent in suit was not entitled to its priority date.
- (c) Even if the patent was entitled to its priority date, the decision under appeal had been wrong to conclude that its subject-matter was novel in the light of D1, D2 and D7. The inclusion of a disclaimer in D1 was not effective to establish novelty, because of the general reference, in D1, to the use of the catalyst supported on a suitable support, such as alumina. Since, furthermore, 30 of the 32 compounds exemplified in D1 fell within the definition in Claim 1 of the patent in suit, it did not involve a selection from the disclosure of D1 to arrive at the claimed subject-matter. Reference was made in this connection to a number of Board of Appeal decisions relating to situations of overlap and selection. Analogously, D2 and D7 implicitly disclosed that the respective catalyst could be supported on an inert support.
- (d) The decision under appeal had been wrong to conclude that D3, D4 and D5 failed to suggest that a monocyclopentadienyl transition metal compound could be used successfully as a catalyst compound for copolymerising olefins to obtain polymers with high molecular weight, narrow molecular weight distribution and high comonomer incorporation where the catalyst has good catalyst activity. Documents D3 to D5 all taught the use of supported catalyst systems, which, except for the requirement for unbridged compounds to contain a neutral Lewis base ($L; w \geq 1$), would have been

within the scope of Claim 1 of the patent in suit. There was no evidence that the selection of monocyclopentadienyl compounds in the catalyst systems generally defined in D3, D4 or D5 performed better than or differently from dicyclopentadienyl catalysts, nor that the presence of the neutral Lewis base in an unbridged monocyclopentadienyl transition metal compound would produce any change in catalyst activity.

Nevertheless, D3 did teach the optional presence of an electron donor, such as an ether, which could thus provide the neutral Lewis base, in the exemplified transition metal compounds.

- (e) The patent in suit did not exemplify any catalyst system having an unbridged transition metal compound ($y = 0$), and the results obtained for systems having bridged transition metal compounds could not be extrapolated to such unbridged systems. On the contrary, unbridged such compounds referred to in the patent in suit were excluded by the requirement of Claim 1 that such compounds must be bridged in the absence of a neutral Lewis base ($L; w = 0$).

- (f) The decision under appeal had been wrong to choose D6 as closest state of the art, since it was limited to the *in situ* preparation of alumoxane on silica. The closest state of the art was on the contrary D3, since the general formula of the transition metal compound would overlap with the definition in Claim 1, apart from the requirement for the neutral Lewis base. Nevertheless, whether one started out from D6 or D3, the claimed subject-matter was obvious in view of their combination.

- (g) The decision under appeal was wrong in stating that D6 did not disclose monocyclopentadienyl compounds comprising a heteroatom group "JR'_{z-1-y}" as required by Claim 1 of the patent in suit. The latter requirement was fulfilled by such compounds having a hydrocarboxy group.

The Statement of Grounds of Appeal was accompanied by a series of Annexes (I to XI) setting out the identity of particular transition metal compounds exemplified in the patent in suit (Annexes I and II) and in D1 (Annex III), as well as the location of references to relevant compounds disclosed in D2 and D9 (Annex IV); and reviews of the relevant disclosures of D1, D2/D9, D3, D4, D5, D6 and D7 (Annexes V to XI, respectively).

V. The Respondent (Patentee) disagreed, in a submission filed on 14 April 1999, with the arguments of the Appellant, in terms substantially similar to those in the decision under appeal, and argued in essence as follows.

- (a) As to the issue under Article 100(b) EPC, as far as it related to the question of whether Claim 1 covered transition metal compounds having more than one cyclopentadienyl group, reference was made to the definition of Q as being different from the earlier mentioned (C₅H_{5-y-x} R_x) group.
- (b) As to the process feature limitation, this was for the purpose of disclaiming Example 78 of D1, and merely reflected the wording used therein.

- (c) With regard to novelty, there was no additional teaching in D1 of any method for preparing a supported catalyst system other than that disclaimed. Consequently, the skilled person, to be able to arrive at a system falling under Claim 1 of the patent in suit, would need to make a series of choices.
- (d) In the case of inventive step, a number of choices would again need to be made, to construe, from D3 or D6, a transition metal compound having only one cyclopentadienyl substituent and the further structural features required by the patent in suit. Furthermore, D3 to D5 in particular favoured the bis- cyclopentadienyl compounds over the only theoretically comprised monocyclopentadienyl compounds. When starting from D6 and considering the object to be solved, of providing a catalyst which would catalyse the incorporation of higher contents of alpha-olefin copolymers, the absence of any disclosure suggesting the claimed cyclopentadienyl transition metal catalysts meant that there was no case of obviousness.

VI. The parties were summoned, with a communication issued by the Board on 23 August 1999, to oral proceedings scheduled to take place on 1 March 2000. With a submission received on 7 February 2000, the Appellant informed the EPO that it would not be attending the oral proceedings.

VII. With a submission received on 21 February 2000, the Respondent filed three further sets of Claims 1 to 23, forming a first, second and third auxiliary request, respectively.

VIII. Oral proceedings were held on 1 March 2000, the sole party attending being the Respondent. Following the expression, by the Board, of certain doubts concerning the distinction over the state of the art of the subject-matter of Claim 15 as granted, the Respondent submitted an amended text of the patent in suit as sole request.

IX. The Appellant had requested, in writing, that the decision under appeal be set aside, and the patent in suit revoked in its entirety or at least amended in response to the grounds submitted in opposition (Statement of Grounds of Appeal, point 17.1).

The Respondent requested that the appeal be dismissed and the patent maintained on the basis of the documents submitted during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.
2. *Text underlying the decision*

The text of the patent in suit forming the basis of the decision is the amended text, filed at the oral proceedings held on 1 March 2000, consisting of a revised set of Claims 1 to 23 and description pages 2 to 17.

3. *Admissibility of amendments*

Amendments compared with the version of the patent in suit as granted have been effected only in Claim 1, Claim 15, the method of preparation of the supported catalyst systems on page 4 at line 44, the description of the preferred embodiment on page 5, and the final paragraph of description on page 17.

3.1 Claim 1 as so amended differs from the version as granted, in that the words "Q is different than the $(C_5H_{5-y-x}R_x)$" have been replaced by "Q is different from $(C_5H_{5-y-x}R_x)$".

This amendment finds a basis, in the sense of Article 123(2) EPC, in the summary of the invention on page 4, at line 15, where the latter wording is used.

The effect of the amendment is to exclude from Claim 1 any group Q falling within the terms of the formula $(C_5H_{5-y-x}R_x)$, rather than only a specific group Q which would otherwise be identical, in a particular compound falling under the terms of the claim, with the $(C_5H_{5-y-x}R_x)$ group defined in the earlier part of the claim. Thus, the terms of the exclusion have been expanded, so that the number of transition metal compounds falling within the scope of Claim 1 is reduced. In other words, there is no objection to the amendment under Article 123(3) EPC.

Finally, the amendment provides consistency with the general description that only one cyclopentadienyl type group can be associated directly with the transition metal atom M. It consequently meets the requirements of Article 84 EPC.

3.2 Claim 15 has been amended to read:

"A process for producing a supported catalyst system according to claim 1 which comprises combining (A), (B) and (C) in any order in one or more suitable solvents or diluent but excluding combining dehydroxylated silica with (tert-butylamido)dimethyl(tetramethyl- π^5 -cyclopentadienyl) silane titanium dichloride and then adding methylalumoxane or by direct reaction of trialkylaluminum or trialkylaluminum mixtures with a wet gel, to form the desired supported catalyst system."

The claim differs from the version as granted in that the method steps constituting the product-by-process exclusion forming the disclaimer at the end of Claim 1 as granted have been incorporated explicitly in the method according to Claim 15. It has not been disputed that the disclaimer acceptably reflects the content of Example 78 of D1, a view which the Board shares. Furthermore, it results in a restriction on the scope of Claim 15. It consequently meets the requirements of Article 123(2) and 123(3) EPC.

Since, furthermore, the wording reflects that already present in Claim 1, the passage is also unexceptionable from the point of view of Article 84 EPC.

3.3 The description on page 4 of the patent in suit has been amended at line 44 to incorporate a passage corresponding to the disclaimer in Claim 1. The basis is found in Claim 1 as granted and again the effect is restrictive. Consequently, no objection arises under Article 123(2) or 123(3) EPC to this amendment. Nor does any objection arise under Article 84 EPC, since the effect of the amendment is merely to provide consistency between the claims and description.

3.4 The word "preferably" on page 5 at line 21 has been deleted. This is solely to provide consistency with the definition of the Group IV B transition metal compound in Claim 1, which must be either of formula I or formula II.

3.5 The description on page description on page 17 has been amended by deletion of the final sentence, at lines 5 to 7. Since this sentence referred to unspecified changes to the disclosure in a vague and speculative way ("which do not depart from the scope and spirit of the invention..."), and thus tended to throw doubt on the scope of the claims, its deletion does not give rise to an objection under Article 123 or 84 EPC.

3.6 In summary, the amendments are admissible and meet the requirements of Articles 123 and 84 EPC.

4. *Sufficiency*

The decision under appeal found, correctly in the Board's view, that the objection by the Appellant of lack of sufficiency was based on alleged ambiguities and inconsistencies in the claims and therefore amounted to an objection under Article 84 EPC (Reasons for the decision, points 2.1, 2.2).

4.1 The relevant previously existing inconsistency, which was in the definition of the transition metal compound in Claim 1 (B) has, however, been removed by amendment, and this in a manner to meet the requirements of Article 84 EPC (section 3.1, above). Consequently, the basis for any suspicion that the claimed subject-matter might extend to compounds having two or three cyclopentadienyl groups directly coordinated to the central Group IVB transition metal atom (section IV.(a), above) has been removed.

- 4.2 As to the associated argument that the skilled person would have been unable to determine the extent of the limitation imposed by the process features of Claim 1, such a claim is to be interpreted, according to the consistent jurisprudence of the Boards of Appeal, as including all the characteristics imparted by the process (T 150/82 OJ EPO 1984, 309). In this connection, it has not been alleged, let alone demonstrated, that the skilled person would have had any difficulty in carrying out the process steps referred to, and therefore in arriving at an identifiable product fulfilling the terms of Claim 1. Consequently, no lack of sufficiency, or of clarity, is implied by the process features of Claim 1.
- 4.3 The argument that the patent in suit did not exemplify any catalyst system having an unbridged transition metal compound ($y = 0$) and that the results obtained for systems having bridged transition metal compounds could not be extrapolated to such unbridged systems (section IV.(e), first sentence, above) does not amount to a demonstration that the disclosure is insufficient, since the question of extrapolation is an assertion not supported by any evidence. On the contrary, the patent in suit contains a statement, following detailed instructions as to how the bridged compounds are to be prepared (page 7, last line to page 8, line 12) as to how the unbridged compounds are to be prepared (page 8, lines 13 to 14). The onus at this stage was on the Opponent (here the Appellant) to prove its case, which in this respect at least it has not done.
- 4.4 The further argument, that the unbridged compounds referred to in the patent in suit were excluded in the absence of a neutral Lewis base (section IV.(e), last sentence, above) is not convincing, for the following reasons. The unbridged compounds specifically identified as being allegedly excluded are EM7, EM8,

EM9 and EM10 set out in Annex II to the Statement of Grounds of Appeal. These in turn correspond to chemical names appearing in the general description in the patent in suit on page 8, lines 21/22, line 22, lines 22/23 and line 26, respectively. Closer examination of the passage containing these chemical names shows, however, that they are mentioned in the general context of Table 1 on page 7, depicting representative constituent moieties for the "Group IV B transition metal component", which may be permuted to generate compounds of formula I according to Claim 1 of the patent in suit (page 5, line 57 to page 6, line 1). According to the introduction to this table, however, it is stated, "For illustrative purposes, the above compounds and those permuted from Table 1 do not include the neutral Lewis base ligand (L)" (page 6, lines 5 and 6). Consequently, the compounds EM7 to EM10 identified in Annex II accompanying the Statement of Grounds of Appeal must be interpreted in the light of this general statement, as requiring the further addition of the relevant neutral Lewis base ligand. In other words, such compounds are not excluded from the scope of Claim 1 of the patent in suit, and consequently do not give rise to any uncertainty as to the scope of the latter or, therefore, the sufficiency of the disclosure supporting it.

4.5 Consequently, the requirements of Article 100(b) EPC are held to be met.

5. *Priority*

The Board sees no reason to diverge from the finding, in the decision under appeal, that the patent in suit is entitled to benefit from its priority date of 13 September 1990, since the priority document D10

relied upon to establish the relevant priority date admittedly disclosed all the features of Claim 1, whereas D9 did not disclose the presence of an inert support (A) as defined in Claim 1 (Reasons for the decision, points 3.1 to 3.3).

- 5.1 The argument of the Appellant, that the disclosure of D9 did not exclude such a support is irrelevant, since the question is not whether such a feature is excluded, but rather whether it is disclosed.

- 5.2 The further argument, that the reference in D9, on page 16, line 6, to gas phase polymerization clearly and unambiguously implied the use of the relevant supported catalyst type is not convincing, since it is undisputed that such a catalyst may be supported on a reactive support, such as magnesium chloride, or, if the catalyst itself is in the form of a solid, may be unsupported. Consequently, an unelaborated reference to "gas phase polymerization" does not unambiguously imply, let alone disclose, the use of an inert support as required by the patent in suit.

- 5.3 Finally, the argument that the use of a relevant support according to the patent in suit as opposed to any other support or no support at all was not a difference "in substance" does not reflect the reality that whether a catalyst compound is supported on one kind of support, or not supported at all, is quite literally a matter of substance.
 - 5.3.1 The references by the Appellant to two decisions of the Boards of Appeal (T 114/86, OJ EPO 1987, 485 and T 953/92 of 26 September 1995, not published in OJ EPO) cannot assist its case, because these decisions, quite apart from the fact that they do not address the issue

of priority, but rather of novelty, concern situations in which different wording had been used to describe the same objective reality. In the present case, however, as pointed out above, the objective reality is different.

5.3.2 The argument that the feature of the support (A) is conventional and therefore does not impart any meaningful restriction on the scope of Claim 1 is not clear to the Board. Whether a feature is inventive or not does not determine whether it has limiting character on a claim. In the present case, the feature represents a limitation on the catalyst system according to the patent in suit, since it requires the presence of a specific further physical integer (the particular kind of support) which is not disclosed in D9.

5.4 In summary, D9 does not disclose the subject-matter claimed in Claim of the patent in suit and therefore does not support the objection under Article 87(4) EPC.

5.5 Hence, the claims of the patent in suit are entitled to the relevant priority date of 13 September 1990.

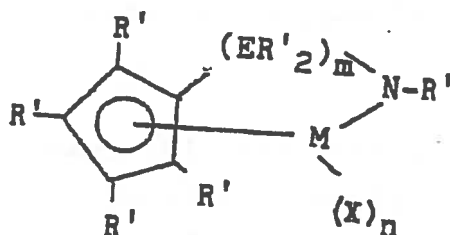
6. *Novelty*

It follows from the above, that documents D1, D2 and D7 form state of the art only by virtue of Article 54(3) EPC, whereas D3, D4, D5 and D6 form state of the art by virtue of Article 54(2) EPC. The logic of this conclusion has not in itself been disputed by the Appellant.

6.1 According to D1 there is disclosed a metal coordination complex comprising a metal of Group 3 (other than scandium), 4-10 or the lanthanide series of the Periodic Table of the Elements and a delocalised π -

bonded moiety substituted with a constrain-inducing moiety, the complex having a constrained geometry about the metal atom such that the angle at the metal between the centroid of the delocalised, substituted π -bonded moiety and the centre of at least one remaining substituent is less than such angle in a comparative complex differing only in that the constrain-inducing substituent is replaced by hydrogen, and provided further that for such complexes comprising more than one delocalised, substituted π -bonded moiety, only one thereof for each metal atom of the complex is a cyclic delocalised, substituted π -bonded moiety (Claim 1).

According to a preferred embodiment, the metal coordination complex may be an amidosilane or amidoalkanediy l compound corresponding to the formula:



wherein M is titanium, zirconium or hafnium, bound in a η^5 bonding mode to the cyclopentadienyl group;

R' at each occurrence is hydrogen or a moiety selected from silyl, alkyl, aryl, and combinations thereof having up to 10 carbon atoms or silicon atoms or an adjacent pair of R' groups form a hydrocarbyl ring fused to the cyclopentadienyl moiety;

E is silicon or carbon;

X is hydride, halo, alkyl, aryl, aryloxy or alkoxy of up to 10 carbons;

m is 1 or 2; and

n is 1, 2 or 3 depending on the valence of M

(Claim 11; and page 7, lines 34 to 54).

A suitable catalyst may comprise:

- (a) a metal coordination complex as defined above, and
- (b) an activating cocatalyst

(Claim 20; and page 8, lines 36 to 37).

The cocatalyst may comprise an aluminum compound, such as alkylaluminum, aluminum alkyl, aluminum halide, or aluminum alkylhalide, a Lewis acid, ammonium salt, or a noninterfering oxidising agent (Claims 21 to 23).

The catalyst may be used as is or supported on a suitable support such as alumina, $MgCl_2$, or silica to provide a heterogeneous supported catalyst (page 8, lines 51 to 52).

In the majority of the more than 100 examples, an unsupported catalyst was used together with a cocatalyst. According to Example 78, however, a slurry of dehydroxylated silica in a C_6 alkane solvent was combined with a toluene solution of (tert-butylamido) dimethyl (tetramethyl- η^5 -cyclopentadienyl) silane titanium dichloride and a toluene solution of methylalumoxane (MAO) added.

- 6.1.1 It is thus evident that the definitions of the catalyst and cocatalyst compounds are broader in some respects and narrower in others, than the corresponding integers (B) and (C), respectively, according to Claim 1 of the patent in suit. Furthermore, both are generally defined in the absence of a support. This is reflected by the vast majority of the examples, in which the catalyst compound and cocatalyst are used without a support. Finally, the specific combination of catalyst compound,

cocatalyst compound and support according to Example 78 of D1 (which has been excluded from the scope of both the relevant independent Claims 1 and 15 of the patent in suit by an acceptable disclaimer) is not a general disclosure. It is therefore evident that there is no generality disclosed in D1 from which the combination of the inert support (A), the transition metal catalyst (B) and alumoxane cocatalyst (C) according to Claim 1 of the patent in suit could be regarded as a selection. Thus, the question of criteria for selection does not arise.

On the contrary, the passage relied upon by the Appellant (page 8, lines 51 to 52) is a list of specific options relating to how the catalyst is to be applied, which includes the possibility that it is used either "as is", i.e. without a support, or with a reactive support, such as $MgCl_2$, as well as with an inorganic oxide support. These options are extrinsic to the generalities referred to. Consequently, the submission of the Appellant, that "it is not a selection over D1 to decide to use a supported catalyst" is indeed correct. Such a decision is rather one of combining features from two mutually independent sets.

It follows from the above, that the combination of the features (A), (B) and (C) according to Claim 1 of the patent in suit is not derivable by direct selection from D1.

- 6.1.2 The argument of the Appellant, that there was no prejudice against using a resinous support or inorganic oxide as the inert support in the supported catalyst type to which the patent in suit relates (Statement of Grounds of Appeal, page 6, point 7.1, third sentence), is irrelevant to the question of novelty, i.e. whether or not such a support is disclosed in the relevant combination of catalyst and cocatalyst.
- 6.1.3 The further argument, that there was no surprising effect arising from the use of such a support (ibid., point 7.1, fourth sentence), could only be of significance for novelty, if the claimed combination were a pure selection from a range or similar generalisation disclosed in D1. This is not, however, the case, for the reasons given (section 6.1.1, above).
- 6.1.4 The argument of the Appellant, that examples are only specific embodiments of a broader teaching and must therefore be considered in conjunction therewith and in the light of general knowledge (Statement of Grounds of Appeal, page 14, point 13.4), is irrelevant, since the teaching represented by the single pertinent example has been excluded from the claims by disclaimer, and no basis has been shown for regarding the remaining generality as implying some further specific teaching.
- 6.1.5 Nor is the situation comparable with that according to decision referred to in this connection: T 188/83 (OJ EPO 1984, 555), referred to in the Statement of Grounds of Appeal (point 13.4). Here, it was held that disclaimed values of a range of such values would be understood not as individual values but in the sense of a narrower or wider range, and were so scattered

through a broader range as to destroy the novelty of that range (Reasons for the decision, point 5). The present case does not, however, concern values within a range, but rather a combination of independent features (section 6.1.1, above).

- 6.1.7 Although the Board has been unable to trace a reference to T 26/85 in T 27/89 of 10 May 1989 (not published in OJ EPO), as mentioned in the Statement of Grounds of Appeal (point 12.4.1), examination of the former decision (OJ EPO 1990, 022) shows that it also is concerned with novelty of specific values of a parameter within a range. Similar considerations apply also to T 279/90 of 3 July 1991 (not published in OJ EPO) and T 198/84 (OJ EPO 1985, 209), referred to in the same connection. These decisions are therefore irrelevant to the present case, for reasons analogous to those given in relation to T 188/83 (section 6.1.6, above).
- 6.1.8 Decision T 124/87 (OJ EPO 1989, 491) referred to in the Statement of Grounds of Appeal (point 12.4.1, second paragraph) is stated to have been taken in the context of classes of compounds (Reasons for the decision, point 3.5) and is therefore strictly irrelevant to the result of combining compounds with other, independent, application-related features, as in the case under consideration. In any event, it concerns the selection of values associated with a range and is therefore irrelevant to the facts of the present appeal.
- 6.1.9 As to decision T 666/89 (OJ EPO 1993, 495), this extends the concept, set out in T 26/85, to which it specifically refers, of lack of novelty in the case of overlapping numerical ranges of certain parameters between a claim and a prior art document, to other kinds of overlap, whilst retaining the criterion of whether the skilled person would, in the light of all

the technical facts at his disposal, **seriously contemplate** applying the technical teaching of the prior art document in the range of overlap (Statement of Grounds of Appeal, point 12.4.1, third paragraph; and Reasons for the decision, point 7). The overlap in that case, however, concerned particular, preferred components falling within a generalisation forming part of the disclosure of the prior art document. Furthermore, it was held that there was no disclosure or indication in the prior art document that particular rules had to be observed when combining the respective components (Reasons for the decision, point 4).

In the present case, in contrast, it is evident, both from the wording of the passage relied upon by the Appellant and from the fact that the overwhelming majority of the examples concern non-supported catalysts, that the supported form of the catalyst is not preferred according to D1. Nor can an absence of adherence to particular rules of embodiment be assumed, since the manner in which a catalyst is embodied depends very much on the process in which it is applied. Finally, there is no generalisation, in D1, which could provide the basis for the kind of selection addressed in the case of T 666/89 (section 6.1.1, above).

Consequently, the facts of T 666/89 do not correspond to those of the present case.

6.1.10 As to the argument in the Statement of Grounds of Appeal (point 12.4.2) with reference to the mention, in decision T 12/90 of 23 August 1990 (not published in OJ EPO), of decision T 296/87 (OJ EPO 1990, 195), closer examination of the text of the latter decision shows that it draws a sharp distinction between the purely intellectual content of an item of information and the

material disclosed in the sense of a specific teaching with regard to technical action, whereby only a technical teaching of the latter kind can be prejudicial to novelty. It concludes "If any such teaching is to apply in the case of a chemical substance, **an individualised description is needed**" (Reasons for the decision, point 6.1; emphasis by the Board). Extension of this approach to the combination claimed in the patent in suit merely confirms the absence, from the relevant disclosure of D1, of a novelty destroying disclosure.

6.1.11 This is not altered by the statements made in T 114/86 and T 953/92, for the reasons already given in relation to the question of priority (section 5.3.1, above).

6.1.12 In summary, the catalyst system according to Claim 1 is not derivable from D1 by simple selection. On the contrary, the relevant combination of the inert support (A) with the transition metal catalyst compound (B) and alumoxane cocatalyst (C) according to Claim 1 of the patent in suit requires a number of independent choices to be made amongst mutually independent options according to D1. Consequently, the claimed combination is not directly and unambiguously derivable from the disclosure relied upon. It follows from this, that the subject-matter according to Claim 1 of the patent in suit is novel over the disclosure of D1.

6.2 According to D2, there is disclosed a metallocene compound containing a single cyclopentadienyl mono- or polycyclic ligand and a Group V A or VI A element heteroatom ligand joined to a Group IV B transition metal atom (Claim 1). According to a further aspect, there is disclosed a catalyst system for olefin polymerisation comprising (A) such a metallocene compound and (B) an alumoxane or (C) a reaction product

of such a compound, an aluminum alkyl and water (Claim 10). A process for preparing an olefin polymer uses such a catalyst system (Claim 12). In a preferred embodiment of the process, the catalyst system is utilised in liquid phase (slurry, solution, suspension or bulk phase and combination thereof), high pressure fluid phase or gas phase polymerisation of an olefin monomer (page 9, lines 26 to 29).

- 6.2.1 Whilst it is not disputed that the single cyclopentadienyl metallocene compound corresponds to that defined as component (B) in the patent in suit, and the alumoxane (B) or reaction product (C) thereof to component (C) according to the patent in suit, there is no mention of a support, let alone an inert support as required by the patent in suit.
- 6.2.2 The argument of the Appellant, that the reference to gas phase polymerisation (page 9, lines 26 to 29) amounted to such a disclosure, is not convincing for the reasons given in relation to the analogous passage in D9 (section 5.2, above).
- 6.2.3 Consequently, D2 does not disclose all the features of the catalyst system, as claimed in Claim 1 of the patent in suit, the subject-matter of which is thus novel over the disclosure of D2.
- 6.3 According to D7, there are disclosed compounds *inter alia* corresponding to those of D2, but there is equally no mention of a support within the meaning of the patent in suit. Consequently, the subject-matter of Claim 1 of the patent in suit is novel over the disclosure of D7.

6.4 The finding, in the decision under appeal, that the claimed subject-matter is novel in the light of the disclosures of D3, D4 and D5, has not been further disputed in the appeal. Nor does the Board see any reason to diverge from the finding of the decision under appeal in this respect. Consequently, the catalyst system according to Claim 1 of the patent in suit is held to be novel over these disclosures.

6.5 In summary, the subject-matter according to Claim 1 of the patent in suit is novel. Since, furthermore, the preparative process according to Claim 15 results in the formation of the catalyst system according to Claim 1, this subject-matter is also novel. It follows that the subject-matter of the remaining dependent Claims 2 to 14 and 16 to 23 is novel.

7. *Inventive step*

The Board sees no reason to diverge from the choice, in the analysis of inventive step in the decision under appeal, of D6 as the closest state of the art, for the following reasons.

7.1 The argument of the Appellant, that D3, D4 and D5 were more appropriate as starting points than D6, since they each taught that catalyst systems which would be within the scope of Claim 1, except for the requirement that unbridged transition metal compounds contain a neutral Lewis base, were catalysts for the polymerisation of polyolefins (Statement of Grounds of Appeal, point 15.1), is not supported by the disclosure of these documents.

- 7.1.1 On the contrary, according to D3, a catalyst for polymerisation of alpha-olefins is formed, in pre-polymerisation of an olefin, by using a solid catalyst comprising (A) a solid catalyst component composed of a compound of a transition metal of Group IV B of the periodic table, such as Ti, Zr or Hf, supported on a carrier, and (B) an aluminoxane (Claims 1, 2).

Thus, the catalyst compound according to D3 can be almost anything comprising a transition metal. Even in the preferred embodiment, the compound is defined as having in principle up to four cyclopentadienyl-type groups directly coordinated to the central transition metal atom (Claim 3 in conjunction with page 7, lines 23 to 29). Finally, according to the examples, only bis-cyclopentadienyl type such compounds are disclosed.

Consequently, there is no hint to, let alone a disclosure of, a specific compound falling within the definition in Claim 1 of the patent in suit.

- 7.1.2 The further argument, that there was no evidence that the selection of **monocyclopentadienyl** compounds in the catalyst systems generally described in D3 performed better or differently as olefin catalysts than the **dicyclopentadienyl** transition metal catalysts, is irrelevant, since, for the reasons given above, D3 does not identify any monocyclopentadienyl compound, let alone provide data on its performance as an olefin polymerisation catalyst. Even if it had, the onus would have been on the Appellant to show the lack of advantage. This has not been done, however. Similar considerations apply to the question of any surprising effect produced by the presence of a neutral Lewis base (Statement of Grounds of Appeal, point 15.1).

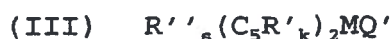
- 7.1.3 The disclosures of D4 and D5 do not come closer than that of D3 to the subject-matter claimed in the patent in suit.
- 7.1.4 Consequently, there was no justification for taking D3, D4 or D5 as closest state of the art.
- 7.1.5 On the contrary, the finding of the decision under appeal, that D6 not only had more or less the same objects as the patent in suit but also, unlike D3, D4 and D5, explicitly mentioned monocyclopentadienyl compounds (Reasons for the decision, points 7.1 to 7.4), has not been refuted.
- 7.1.6 The argument that D6 described only the *in situ* preparation of alumoxane on silica (Statement of Grounds of Appeal, point 15.4) is irrelevant, since the presence of further, non-anticipated alternatives of the cocatalyst/support would not save the claim, to the extent that the document disclosed the relevant transition metal complexes.
- 7.1.7 In summary, the decision under appeal was correct to take D6 as the closest state of the art.
- 7.2 According to D6, there is disclosed a process for preparing a supported metallocene alumoxane catalyst for gas phase polymerisation of olefins, comprising the steps of:
- (a) adding undehydrated silica gel to a stirred solution of an aluminum trialkyl in an amount sufficient to provide a mole ratio of aluminum trialkyl to water of from 3:1 to 1:2 and allowing the mixture to react;
 - (b) adding a metallocene to the reacted mixture;

- (c) removing the solvent;
- (d) drying the solids to a free flowing powder
(Claim 1).

The metallocene may be of the formula:



wherein Cp is a cyclopentadienyl ring, M is a Group 4b or 5b transition metal, R is a hydrocarbyl group or hydrocarboxy group having from 1 to 20 carbon atoms, X is a halogen, and m is a whole number from 1 to 3, n is a whole number from 0 to 3 and q is a whole number from 0 to 3;



wherein $(C_5R'_k)$ is a cyclopentadienyl or substituted cyclopentadienyl, each R' is the same or different and is hydrogen or a hydrocarbyl radical containing from 1 to 20 carbon atoms, a silicon-containing hydrocarbyl radical, or a hydrocarbyl radical wherein two carbon atoms are joined together to form a C₄ - C₆ ring, R'' is a C₁ - C₄ alkylene radical, a dialkyl germanium or silicone, or an alkyl phosphine or amine radical bridging two $(C_5R'_k)$ rings, Q is a hydrocarbyl radical having 1 to 20 carbon atoms, hydrocarboxy radical having 1 to 20 carbon atoms or halogen and can be the same or different, Q' is an alkylidene radical having from 1 to about 20 carbon atoms, s is 0 or 1, g is 0, 1 or 2; when g is 0, s is 0; k is 4 when s is 1 and k is 5 when s is 0 and M is as defined above (page 4, lines 22 to 38).

Zirconocenes and titanocenes are most preferred, illustrative examples including monocyclopentadienyl titanocenes such as cyclopentadienyl titanium trichloride and pentamethylcyclopentadienyl titanium trichloride (page 4, lines 44 to 47).

Generally, however, the use of a metallocene which comprises a bis(substituted cyclopentadienyl) zirconium will provide a catalyst complex of higher activity than a corresponding titanocene or a monocyclopentadienyl metal compound. Hence bis(substituted cyclopentadienyl) zirconium compounds are preferred for use as the metallocene (page 5, lines 22 to 25).

All the illustrative examples employ a bis-substituted cyclopentadienyl-type metallocene.

- 7.3 The technical problem arising, in common with that addressed by the patent in suit (cf. page 3, lines 22 to 29), is to provide a catalyst system permitting the production of higher molecular weight polyolefins of narrow molecular weight distribution which catalyse the incorporation of higher contents of alpha olefin comonomers, whilst reducing metal residue left in the product.

The solution proposed according to Claim 1 of the patent in suit is to replace the bis-cyclopentadienyl substituted metallocene exemplified according to D6 by a mono-cyclopentadienyl coordinated compound of formula (I) or (II) as defined in Claim 1 of the patent in suit.

- 7.4 That the proposed catalyst system provides an improved incorporation of alpha-olefin comonomer is demonstrated, in relation to a gas phase polymerisation of ethylene and hexene-1, by a comparison of Table II in D6 with Example 8 according to the patent in suit,

which show that 9 mole percent of comonomer are incorporated according Example 8, compared with a maximum, according to D6, of 6 per cent (minutes of the oral proceedings held on 12 May 1998 before the Opposition Division, page 5, first full paragraph). Clearly, the higher comonomer incorporation necessarily implies a more efficient use of catalyst and therefore a relatively lower residue of catalyst in the product, and it is common ground that the high molecular weight and narrow molecular weight distribution are in any case effectively provided.

- 7.4.1 The argument of the Appellant, that favourable levels of comonomer incorporation were shown in D3, is irrelevant, firstly since the appropriate comparison is always with the closest state of the art, which, for the reasons given, is not D3, but D6, and secondly, because it has in any case not been shown in what respect, if any, the conditions applied according to the examples of D3 could be regarded as comparable with those in examples of the patent in suit. The onus of doing this was with the Appellant, which it has not discharged.
- 7.4.2 The further argument, that the patent in suit did not have any exemplification of catalyst systems having unbridged transition metal compounds ($y = 0$) and that the results could not be obtained by extrapolation of those obtained for bridged transition metal compounds, is irrelevant, for reasons analogous to those given in relation to sufficiency (section 4., third paragraph, above). In particular, the statement that the presence of the bridging group "T" was of great significance in the catalytic performance (Statement of Grounds of Appeal, point 15.3) amounts, in absence of relevant evidence, to a mere assertion which cannot discharge the Appellant's onus of proof.

- 7.4.3 Since the accuracy of the comparison with D6 has not itself been challenged, let alone refuted, it is credible to the Board that the technical problem is effectively solved by the claimed measures.
- 7.5 In the light of the above, the relevant question to be answered in the assessment of inventive step is whether the skilled person, starting from D6, would expect a higher comonomer incorporation together with the other relevant desirable effects to be obtained by replacing the dicyclopentadienyl metallocene by a cyclopentadienyl compound according to Claim 1 of the patent in suit.
- 7.6 There is no hint in this direction in D6, since (i) the only mono cyclopentadienyl derivatives mentioned are trichlorides which do not contain the relevant (JR'_{z-1-y}) group, (ii) it is the di-cyclopentadienyl substituted metallocenes which are stated to be generally preferred, and (iii) only the latter such species are exemplified according to D6. Quite apart from these considerations, the general formulae in D6 (section 7.2, above) do not embrace a relevant mono-cyclopentadienyl coordinated such compound, since there is no provision for the presence of a Lewis base group (L).
- 7.6.1 The argument of the Appellant, that the compounds according to D6 can indeed contain a group (JR'_{z-1-y}) , specifically when Q in the formula is hydrocarboxy (Statement of Grounds of Appeal point 15.5), whilst correct as far as it goes, is nevertheless irrelevant to the issue of inventive step, since it does not associate the presence of this group with a metallocene having only one cyclopentadienyl group coordinated to the transition metal atom, as required by the patent in suit.

- 7.6.2 On the contrary, the emphasis in D6 is overwhelmingly on bis cyclopentadienyl transition metal complexes. Consequently, the skilled person, looking for improved catalyst efficiency in the sense of the stated problem, would be led away from the less preferred mono-cyclopentadienyl compounds.
- 7.7 Nor is there any hint to use such a monocyclopentadienyl substituted transition metal compound in any one of D3, D4 and D5, since these are even less concerned with mono- cyclopentadienyl transition metal compounds.
- 7.7.1 In this connection, the optional presence of an electron donor which could function as a neutral Lewis base (section IV.(d)), last sentence, above) is irrelevant, since such a donor is not associated, in D3, with a monocyclopentadienyl substituted transition metal compound.
- 7.7.2 The more general argument that the compounds according to the patent in suit were not narrowly defined (Statement of Grounds of Appeal, point 15.2) is also irrelevant, since the restriction to one cyclopentadienyl-type group coordinated to the central transition metal according to Claim 1 of the patent in suit is not identified, or even hinted at, in D3, D4 or D5 (section 7.1.1, above).
- 7.7.3 This shows that D3, D4 and D5 are more remote still from the subject-matter claimed in the patent in suit, than is D6 (sections 7.1.1 to 7.1.6, above) and that, consequently, these citations cannot contribute to the solution of the above-defined technical problem.

7.8 Consequently, the solution of the stated problem does not arise in an obvious way, starting from D6. Evidently, the result would not have been different had one started instead from D3, D4 and D5, since these documents teach even more strongly away from the mono cyclopentadienyl-type substituted transition metal compounds according to the patent in suit than does D6 (section 7.7, above).

7.9 Hence, the subject-matter according to Claim 1 involves an inventive step within the meaning of Article 56 EPC. A similar conclusion applies to independent Claim 15 and, by the same token, also to the remaining dependent Claims 2 to 14 and 16 to 23, for reasons analogous to those given in relation to novelty (section 6.5, above).

Order

For these reasons it is decided that:


1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of the following documents submitted during the oral proceedings:


Claims: 1 to 23

Description: pages 2 to 17.

The Registrar:


E. Görgmaier

The Chairman:


C. Gérardin

