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D E C I S I O N
of 29 July 2003

Case Number: T 0876/00 - 3.3.3
Application Number: 91912554.2
Publication Number: 0551277
IPC: C08F 4/76
Language of the proceedings: EN

Title of invention:

Aluminum-free monocyclopentadienyl metallocene catalysts for olefin polymerization

Patentee:

ExxonMobil Chemical Patent Inc.

Opponent:

THE DOW CHEMICAL COMPANY
Sumitomo Chemical Co., Ltd.

Headword:

-

Relevant legal provisions:

EPC Art. 54(3), 87, 88, 89
EPC R. 88

Keyword:

"Novelty (yes) - prior European applications"

Decisions cited:

G 0002/98, T 0012/81, T 0305/87, T 0789/89, T 0642/97,
T 0616/98

Catchword:

-



Case Number: T 0876/00 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 29 July 2003

Appellant: ExxonMobil Chemical Patents Inc.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 12 April 2000 and
issued in writing on 30 June 2000 revoking
European patent No. 0551277 pursuant to
Article 102(1) EPC.

Composition of the Board:

Chairman: R. Young
Members: A. Däweritz
E. Dufrasne

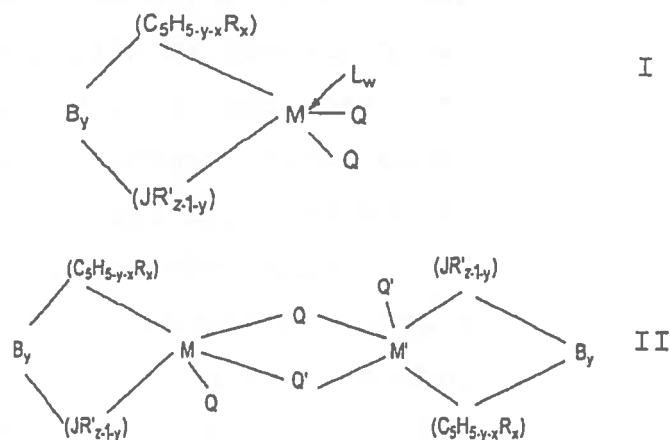
Summary of Facts and Submissions

I. The grant of European patent No. 0 551 277 in respect of European patent application No. 91 912 554.2, based on International patent application No. PCT/US91/04390, filed on 21 June 1991 and claiming priority of 22 June 1990 of an earlier application in the USA (542236), was announced on 15 January 1997 (Bulletin 1997/03) on the basis three sets of claims. The first set ("Set A") for the designated Contracting States AT, CH, LI, and DK, and the second set ("Set B") for the designated Contracting States BE, DE, FR, GB, IT, NL and SE, each containing 26 claims. The third set ("Set C") for the designated Contracting State ES had 11 claims.

Claims 1, 10, 16 and 18 of "Set B" as granted read as follows:

"1. An ionic catalyst system for the production of polyolefins obtainable by combining:

A. a Group IV-B transition metal component of one of the two general formulae



wherein

M is Zr, Hf or Ti and is in its highest formal oxidation state (+4, d^0 complex);

$(C_5H_{5-y-x}R_x)$ is a cyclopentadienyl ring which is substituted with from zero to four radical R groups, "x" is 0, 1, 2, 3, or 4 denoting the degree of substitution, and 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 atoms is replaced by a halogen atom, C_1-C_{20} hydrocarbyl-substituted metalloid radicals wherein the metalloid is selected from the Group IV-A of the Periodic the Group IV-A of the Periodic [sic] Table of Elements, and halogen radicals; or $(C_5H_{5-y-x}R_x)$ is a cyclopentadienyl ring in which two adjacent R-groups are joined forming a C_4-C_{20} ring to give a polycyclic cyclopentadienyl ligand;

(JR'_{z-1-y}) is a heteroatom ligand in which J is an element in 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 Elements, and 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 atoms is replaced by a halogen atom, and "z" is the coordination number of the element J;

each Q may be independently, hydride, C₁-C₅₀ hydrocarbyl radicals, substituted hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by an electron-withdrawing group such as a halogen atom, or alkoxide radical, or C₁-C₅₀ hydrocarbyl-substituted metalloids wherein the metalloid is selected from the Group IV-A of the Periodic Table of Elements, provided that where any Q is a hydrocarbyl such Q is different from (C₅H_{5-y-x}R_x), or both Q together may be an alkylidene, olefin, acetylene or a cyclometallated hydrocarbyl;

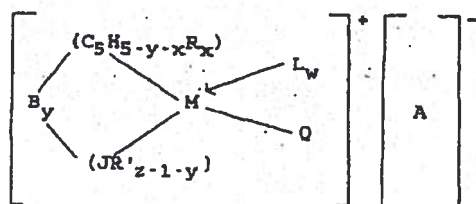
"y" is 1 and B is a covalent bridging group containing a Group IV-A or V-A element; "w" is a number from 0 to 3; and L is a neutral Lewis base; or L represents a second transition metal compound of the same type such that the two metal centers M and M' are bridged by Q and Q', wherein M' has the same meaning as M and Q' has the same meaning as Q to provide a compound represented by the formula II; and

B. an activator compound comprising

(1) a cation which will irreversibly react with at least one ligand contained in said Group IV-B metal compound to form a Group IV-B metal cation and

(2) a labile, bulky anion which is a single coordination complex having a plurality or [sic] lipophilic radicals covalently coordinated to and shielding a central charge-bearing metal or metalloid core."

"10. A composition of matter for use as a catalyst for the production of a polyolefin comprising the following general formula:



wherein:

M is a Group IV-B transition metal selected from Zr, Hf or Ti and is in its highest formal oxidation state (+4, d⁰ complex); (C₅H_{5-y-x}R_x) is a cyclopentadienyl ring which is substituted with from zero to four substituent groups R, "x" is 1, 2, 3, or 4 denoting the degree of substitution, and each substituent group R is, independently, a radical selected from a group consisting of C₁-C₂₀ hydrocarbyl radicals, substituted C₁-C₂₀ hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by a halogen atom, C₁-C₂₀ hydrocarbyl-substituted metalloid radicals wherein the metalloid is selected from the Group IV-A of the Periodic Table of Elements, and halogen radicals, or (C₅H_{5-y-x}R_x) is a cyclopentadienyl ring in which two adjacent R-groups are joined forming a C₄-C₂₀ ring to give a polycyclic cyclopentadienyl ligand;

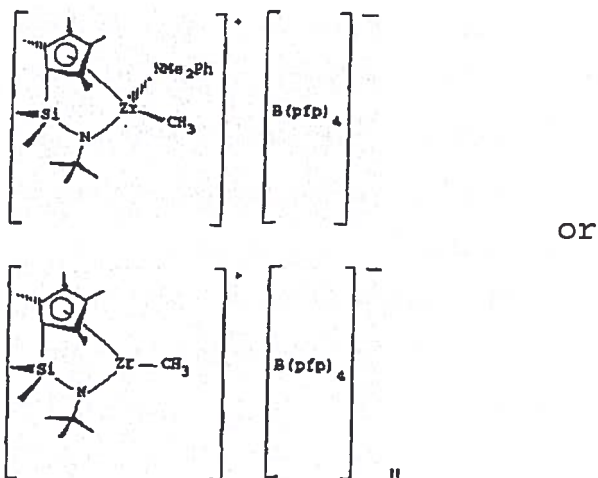
(JR'_{z-1-y}) is a heteroatom ligand in which J is an element with a co-ordination number of three from Group V-A or an element with a co-ordination number of two from Group VI-A of the Periodic Table of Elements, and each R' is, independently a radical selected from a group consisting of C₁-C₂₀ hydrocarbyl radicals, substituted C₁-C₂₀ hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by a halogen atom, and "z" is the coordination of [sic] number of the element J;

Q may be independently, hydride, a C₁-C₅₀ hydrocarbyl radical, a substituted hydrocarbyl radical wherein one or more hydrogen atom is replaced by an electron-withdrawing group such as a halogen atom, or an alkoxide radical, or a C₁-C₅₀ hydrocarbyl-substituted metalloid radical wherein the metalloid is selected from the Group IV-A of the Periodic Table of Elements; provided that where any Q is a hydrocarbyl such Q is different from (C₅H_{5-y-x}R_x);

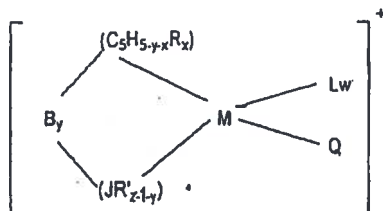
"y" is 1 and B is a covalent bridging group containing a Group IV-A or V-A element, L is a neutral Lewis base; and "w" is a number from 0 to 3, and

[A]⁻ is a labile bulky anion which is a single coordination complex having a plurality of lipophilic radicals covalently coordinated to and shielding a central charge-bearing metal or metalloid core."

"16. Composition of matter for use as a catalyst system for the production of a polyolefin of the formula



"18. Process for the production of homo- or co-polyolefins comprising polymerising one or more olefinically unsaturated monomer(s) in the presence of a catalyst system comprising



wherein:

M is a Group IVB transition metal selected from Zr, Hf or Ti and is in its highest formal oxidation state (+4, d⁰ complex); (C₅H_{5-y-x}R_x) is a cyclopentadienyl ring which is substituted with from zero to four substituent groups R, "x" is 0, 1, 2, 3 or 4 denoting the degree of substitution, and each substitution group R is, independently, a radical selected from a group consisting of C₁-C₂₀

hydrocarbyl radicals, substituted C_1-C_{20} hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by a halogen atom, C_1-C_{20} hydrocarbyl-substituted metalloid radicals wherein the metalloid is selected from the Group VI-A of the Periodic Table of Elements; and halogen radicals; or $(C_5H_{5-y-x}R_x)$ is a cyclopentadienyl ring in which two adjacent R-groups are joined forming a C_4-C_{20} ring to give a 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 IV-A of the Periodic Table of Elements, and 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 atoms is replaced by a halogen atom, and "z" is the coordination of [sic] number of the element J;

Q may be independently, hydride, a C_1-C_{50} hydrocarbyl radical, a substituted hydrocarbyl radical wherein one or more hydrogen atom is replaced by an electron-withdrawing group such as a halogen atom, or an alkoxide radical, or a C_1-C_{50} hydrocarbyl-substituted metalloid radical wherein the metalloid is selected from the Group IV-A of the Periodic Table of Elements; provided that where any Q is a hydrocarbyl such Q is different from $(C_5H_{5-y-x}R_x)$;

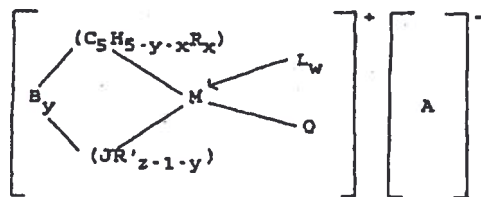
"y" is 1 and B is a covalent bridging group containing a Group IV A or V A element, L is a neutral Lewis base; and "w" is a number from 0 to 3, and

[A]⁻ is a labile bulky anion which is a single coordination complex having a plurality of lipophilic radicals covalently coordinated to and shielding a central charge-bearing metal or metalloid core."

The claims of "Set A" differed from the wordings of the corresponding claims in "Set B" by an extension of "y" to the value of "0". This caused a corresponding extension of the maximum number of substituent groups R in the cyclopentadienyl ligand to 5 ("x", thus, being 0, 1, 2, 3, 4, or 5).

Claim 1 of "Set C" read as follows:

"1. Process for the production of a homo- or co-polyolefin comprising polymerising one or more olefinically unsaturated monomer(s) in the presence of a catalyst system comprising



wherein:

M is a Group IVB transition metal selected from Zr, Hf or Ti and is in its highest formal oxidation state (+4, d⁰ complex); (C₅H₅-y-xR_x) is a

cyclopentadienyl ring which is substituted with from zero to four substituent groups R, "x" is 0, 1, 2, 3 or 4 denoting the degree of substitution, and each substituent group R is, independently, a radical selected from a group consisting of C₁-C₂₀ hydrocarbyl radicals wherein one or more hydrogen atoms is replaced by a halogen atom, C₁-C₂₀ hydr[o]carbyl substituted metalloid radicals wherein the metalloid is selected from the Group IV-A of the Period Table of Elements, and halogen radicals, or (C₅H_{5-y-x}R_x) is a cyclopentadienyl ring in which two adjacent R-groups are joined forming a C₄-C₂₀ ring to give a 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 Elements, and each R' is, independently a radical selected from a group consisting of C₁-C₂₀ hydrocarbyl radicals, substituted C₁-C₂₀ hydr[o]carbyl radicals wherein one or more hydrogen atoms is replaced by a halogen atom, and "z" is the coordination of [sic] number of the element J;

Q may be independently, hydride, a C₁-C₅₀ hydrocarbyl radical, a substituted hydrocarbyl radical wherein one or more hydrogen atom is replaced by an electron-withdrawing group such as a halogen atom, or an alkoxide radical, or a C₁-C₅₀ hydrocarbyl-substituted metalloid radical wherein the metalloid is selected from the Group IV-A of the Periodic Table of Elements; provided that

where any Q is a hydrocarbonyl such Q is different from $(C_5H_{5-y-x}R_x)$,

"y" is 1 and B is a covalent bridging group containing a Group IV-A or V-A element, L is a neutral Lewis base; and "w" is a number from 0 to 3, and an anion $[A]^-$ which is a labile bulky anion which is a single coordination complex having a plurality of lipophilic radicals covalently coordinated to and shielding a central charge-bearing metal or metalloid core."

II. On 3 and 15 October 1997, respectively, Notices of Opposition were filed by two Opponents in which revocation of the patent in its entirety was requested on the grounds of lack of novelty within the meaning of Articles 100(a), 52(1) and 54 EPC and insufficiency of disclosure according to Article 100(b) EPC (both opponents). Furthermore, an objection under Article 100(c) EPC was raised by Opponent 1.

(a) The objections were supported by six documents (D1 to D6), including

D1: EP-A-0 418 044,

D2: EP-A-0 416 815,

D3: EP-A-0 421 659,

and three copies of priority documents for each of these documents

- D1: "US1", US patent application 07/407 169 of 14 September 1989,
- D2: "US2", US patent application 07/401 344 of 31 August 1989 and
- D3: "US3", US patent application 07/498 162, of 22 March 1990.

- (b) Oral proceedings were held before the Opposition Division on 12 April 2000. In an annex to the summons dated 15 June 1999, the parties had been informed that D1 to D3 were intermediate documents to be considered under Article 54(3) and 4 EPC as far as they benefited from a priority date before the priority date of the patent in suit, and that cited documents D4 to D6 were published too late. These documents did not play any role in the further proceedings.

In the oral proceedings, a new main request (Annex II to the decision under appeal) was filed wherein "Set A" and "Set B" had been consolidated within the narrower scope of "Set B", designating all the Contracting States previously designated in "Set A" and "Set B". The above "Set C" for the Contracting State ES was also part of this request. They are referred herein below as "Set B" and "Set C", respectively.

In the above claims, the term "may be" in the definitions of Q was replaced by "is" and "are", respectively. Moreover, two clerical errors were corrected in Claims 1 and 2 of "Set B", and the

formula in Claim 18 in this set of claims was brought into line with the formula as shown in Claim 10 of "Set B" and Claim 1 of "Set C".

III. By decision announced at the end of the oral proceedings and issued in writing on 30 June 2000, the Opposition Division rejected the objections under Articles 100(b) and 100(c) EPC (decision: sections 3.3 and 4.1 to 4.3), but revoked the patent in suit for lack of novelty of Claim 10 with respect to D1 (Article 100(a) EPC).

The decision held that the group of cyclopentadienyl compounds taught by D1 vastly overlapped with the composition of matter of the said Claim 10. Thus, the teaching in D1: column 1, lines 26, 29, 30, 45 and 46, column 2, line 46 to column 4 and column 8, lines 36 to 49 as well as Claim 6 clearly enclosed this composition of matter comprising bridged species containing no halogen atom attached to M.

These teachings would benefit from the corresponding priority document "US1" (US application 07/0407169 of 14 September 1989: page 2, lines 20, 26 and 27; page 3, lines 9/10; page 4, last line; page 5, lines 13, 14, 24, 25 and 33 onwards; page 6, lines 24/25; page 13, lines 22 to 26 and Claim 4).

Since "US1" also referred to specific bridged metallocene catalysts wherein the disclosed compounds had no halogen atom attached to M and since, according to column 8 and Claim 7 of D1, "X" was preferably selected among alkyl and alkoxy, the subject-matter of Claim 10 of "Set B" also lacked novelty.

Consequently, the sole request containing Claim 10 could not prevail.

- IV. On 28 August 2000, a Notice of Appeal was lodged by the Proprietor (Appellant) against this decision with simultaneous payment of the prescribed fee. In a letter dated 8 September 2000, the Appellant requested that the above decision be set aside and that the patent be maintained on the basis of the claims according to Annex II (section II(b), above).

In the Statement of Grounds of Appeal, received on 9 November 2000, and in a further letter dated 21 August 2001, the Appellant essentially argued as follows:

- (a) Document D1 was published on 20 March 1991 and therefore state of the art under Article 54(3) and (4) EPC only as far as it was entitled to the priority of "US1". It related to a monocyclopentadienyl or substituted monocyclopentadienyl metal complex containing compound corresponding to the formula



wherein Cp was a single cyclopentadienyl or substituted cyclopentadienyl which was "optionally covalently bonded to M through a substituent" (column 1, lines 22 to 30). This disclosure was considerably broader than the definition of the composition according to Claim 10 of the patent in suit.

- (b) In the above formula of D1, M was a metal of Group 3 to 10 or the Lanthanide series of the Periodic Table of Elements. This definition was much broader than the definition in Claim 10 of the patent in suit, according to which it was a Group IV-B transition metal selected from Zr, Hf or Ti and was in its highest formal oxidation state (+4, d^0 complex).
- (c) Similar arguments were provided with respect to the breadth of the definitions of groups X in D1 and Q in Claim 10 of the patent in suit. In particular, emphasis was put on the argument that Q could not be halogen, alkoxy, aryloxy or siloxy. Compounds containing these groups were not active catalysts, because the respective metal-ligand M-X or M-Q bonds, would not enable olefin insertion to take place, as required in the patent in suit. Even the alleged preference in Claim 7 of D1 did not distinguish between the selection of active (alkyl) and inactive (alkoxy) groups. If a compound with X = Cl or alkoxy was chosen, this would prevent the formation of the required ion pair $CpMX_n^+A^-$, because these radicals were poor leaving groups. Moreover, H-X, which would be formed according to D1: column 8, lines 36 to 49, would be a catalyst poison, whether HCl or the alcohol.
- (d) The only compound disclosed in "US1" which had a bridged structure was (N-t-butylamino)(dimethyl)- η^5 -2,3,4,5-tetramethylcyclopentadienyl)silane zirconium dichloride. This compound would not work.

The list of compounds having a similar structure as listed in D1 encompassed compounds which could be used and many others which would not work. Therefore, D1 did not provide an enabling disclosure.

- (e) In summary, the general disclosure of D1 was in many aspects much broader than the subject-matter of Claim 10 of the patent in suit, so that this claim concerned a novel selection of certain catalyst systems in view of D1, column 1, lines 22 to 47. Moreover, D1 did not describe a "compound having a bridge composed of a covalent bridging group containing a Group IV-A or V-A element and a heteroatom ligand and having no halogen atom attached to M". The statement in the appealed decision that the bridged species having no halogen atom attached to M was enclosed by passages in D1 referred to in the decision was not the appropriate test. The issue was "whether the narrower selection of leaving groups in combination with particular bridged structure is made available in D1." This was not the case.
- (f) Moreover, the disclosure in, on the one hand, "US1" and, on the other, D1 was not the same with regard to "bridged mono-Cp compounds". Therefore, D1 was not entitled to the priority of "US1" in accordance with the Opinion of the Enlarged Board of Appeal G 2/98 (OJ EPO 2001, 413).

Only Example 3 of D1 provided an enabling disclosure of a catalyst which fulfilled the requirements of Claim 10 of the patent in suit. However, "US1" did not contain this example.

- V. By letter dated 29 June 2001, received by fax on the same day, Respondent 1 (Opponent 1) withdrew its opposition.
- VI. On 30 April 2003, the parties were summoned to oral proceedings to be held on 29 July 2003. In an annex to the summons, the Rapporteur gave provisionally his preliminary opinion about the wording of the above main request, which appeared to be inconsistent with the arguments provided in the Statement of Grounds of Appeal.

In reply to the annex, the Appellant presented further arguments in support of the main request and filed an auxiliary request (letter dated 16 May 2003). In this auxiliary request, Claims 1, 2, 10 and 18 of "Set B" differ from the wording of Claims 1, 2, 10 and 18 of "Set B" as quoted in section I, above, and corrected as indicated in section II(b), above, only in that the phrase "such as a halogen atom, or (an) alkoxide radical", respectively, had been deleted from the definition of Q in Claims 1, 10 and 18.

The remaining Claims 3 to 9, 11 to 17 and 19 to 26 of "Set B" remained unchanged in their version as granted.

In "Set C" of this auxiliary request, Claim 1 was amended by deletion of the phrase "such as a halogen atom, or an alkoxide radical" from the definition of Q, whilst Claims 2 to 11 remained unchanged.

- VII. Respondent 2 (Opponent 2) withdrew its opposition by letter dated 23 July 2003, received by Fax on 25 July 2003.
- VIII. Oral proceedings were held on 29 July 2003 in the presence of the Appellant. The Board informed the Appellant that the doubts expressed in the annex to the summons still existed. Thereafter, the Appellant announced that it did not further pursue the main request of 12 April 2000 (section II(b), above; Annex II to the decision under appeal), but replaced it by the auxiliary request as in the preceding section.
- IX. Consequently, the Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request, being the two sets of claims (Claims 1 to 26 for the Contracting States AT, CH, LI, DK, BE, DE, FR, GB, IT, NL, SE; Claims 1 to 11 for the Contracting State ES) filed as auxiliary request with the letter dated 16 May 2003.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural Matters*

With the withdrawal of the opposition during the appeal proceedings, both Respondents ceased to be parties to these proceedings in respect of the substantive issues (T 789/89, OJ EPO 1994, 482, cf. the headnote; T 616/98 of 1 February 2001, section 2.1 of the reasons; T 642/97 of 15 February 2001, Section 2 of the reasons).

3. *Wording of the Claims*

3.1 Article 123(2) EPC

3.1.1 The consolidation of "Set A" and "Set B" does not extend the content of the patent in suit beyond that of the application as originally filed, since it means only the limitation of "y" to the preferred value of "1" (page 12, lines 17/18 of the published application) and the consequential limitation of "x" to an integer value of from 0, 1, 2, 3 or 4, already individually disclosed in Claim 1 as filed.

3.1.2 The replacement of "may be" by "is" and "are", respectively, in Claims 1, 10 and 18 of "Set B" and in Claim 1 of "Set C" limit the definition of Q to the meanings actually disclosed in the respective paragraphs of these claims. Other meanings had never been contemplated, let alone defined in the application from which the patent in suit is derived.

3.1.3 The deletion of the passages "such as a halogen atom, or (an) alkoxide radical" is supported by page 4, lines 5 to 7, page 10, lines 5 to 17, page 11, line 19

to page 12, line 16 and page 13, Table 1 in the published application.

- 3.1.4 The corrections of clerical errors made in Claims 1, 2 and 18 of "Set B" as indicated in section VI, above, comply with Rule 88 EPC for the following reasons:

The wording in these claims as granted were clearly erroneous. Thus, the comparison of the definition of component B.(2) of the said Claim 1 with the definition of the anion [A] derived therefrom in Claims 10 and 18, or of Claim 2 with Claims 11 and 23 further demonstrates that nothing else would have been intended than what has been offered as the correction. The same argument is valid for the formula in Claim 18. It is evident that the anion was missing, which had already been defined in the last paragraph of the claim.

- 3.2 Hence the amended and corrected claims comply with Article 123(2) EPC. The objection that they did not was already held unsuccessful in the decision under appeal (section III, above), and was not further pursued in appeal.

- 3.3 Article 123(3) EPC

From the above considerations, it also is evident that the amendments in the claims always result in a limitation of the scope of the claims, by deletion of alternative embodiments and of a reference to a non-limiting example of such an embodiment, respectively, so that the requirements of Article 123(3) EPC are also met by the present wording of these claims.

3.4 Article 84 EPC

In view of the above amendments, the Board is also satisfied that the above amendments comply with the clarity and conciseness requirements of Article 84 EPC.

4. Article 100(b) EPC

In the decision under appeal, the Opposition Division had come to the conclusion that the requirements of Article 83 EPC had been fulfilled by the patent in suit. In the absence of any arguments from the former Opponents, which have not contested this finding, the Board has no reason to take a different view.

It follows that the requirements of Article 83 EPC are met.

5. Novelty

Since the revocation of the patent in suit was based on the finding that Claim 10 of "Set B" lacked novelty, it is this claim to which reference is made in the following considerations.

5.1 The patent in suit is based on a previous application filed in the USA on 22 June 1990. Each of D1, D2 and D3 was published after that date (D1 on 20 March 1991, D2 on 13 March 1991 and D3 on 10 April 1991).

Moreover, in each of these documents, the priorities of more than one previous patent application were claimed, at least one of which, in each case, had a filing date later than 22 June 1990. Consequently, those parts of

the disclosures of D1, D2 and D3, respectively, derived from previous applications filed on or after 22 June 1990 or not derived at all from any previous patent application are not state of the art with respect to the patent in suit. In other words, only those parts of each of D1, D2 and D3 can be taken into account as state of the art in this decision, for which proof has been provided that they benefit of a filing date prior to 22 June 1990 (Articles 54(3), 87, 88 and 89 EPC).

Together with the Notices of Opposition, copies of previous US patent applications "US1", "US2" and "US3" having filing dates of before 22 June 1990 were filed (section 11(a)).

Consequently, novelty can only be assessed with regard to those parts of the above documents derived from these previous US patent applications for the assessment of novelty under Article 54(3) and (4) EPC.

5.2 However, the disclosure of a given cited document is not limited *a priori* to specific parts of its specification or particular embodiments, hence the skilled person does not disregard those parts, which in the course of further detailed enquiries may turn out as not enjoying a certain priority date. He will take the whole contents of the document into account (cf. T 12/81, OJ EPO 1982, 296, point 5 of the reasons). The only guidance to deviate from this approach to a document is *prima facie* given by clear preferences for specific embodiments in the document. Hence, the document cited as prior art has to be considered at first as disclosed. Those parts which then appear to anticipate the claimed subject-matter have, in a second

step, to be examined whether they are state of the art in the sense of Article 54(3) and (4) EPC. Any other way of examination eg by early removing - in the light of the previous foreign application (priority document) - any "younger" parts of the disclosure from consideration might change the overall information in the cited document and, thus, would include the risk of *ex post facto* analysis (in the sense of T 305/87, OJ EPO 1991, 429; point 5.3 of the reasons).

These considerations are consistent with the Opinion G 2/98 (above), in particular, with regard to the arguments relating to the so-called " 'OR'-claim" (points 6.5, 6.7 and 6.8 of the reasons).

- 5.3 Document D1 as such relates to monocyclopentadienyl or substituted monocyclopentadienyl metal complex containing compounds of the formula



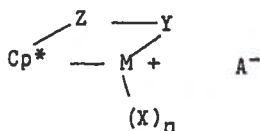
wherein Cp denotes an optionally substituted η^5 -cyclopentadienyl ligand, optionally covalently bound to the metal by a covalent group -Z-Y-, M is a metal of Groups 3 to 10 (or IIIB to VIIB and VIII in terms of the previous denominations of the transition metal groups, as used in "US1") or the Lanthanide Series of the Periodic Table of Elements, each X, independently, relates to hydride or a moiety selected from halo, alkyl, aryl, silyl, germyl, aryloxy, alkoxy, amide, siloxy, combinations thereof and neutral Lewis base ligands, having up to 20 non-hydrogen atoms; or optionally, one X together with Cp forms metallocycle with M of up to 20 non-hydrogen atoms; n is 1 or 2

depending on the valence of M; and A is a non-coordinating, compatible anion of a Bronstedt acid salt. Z is a divalent moiety comprising oxygen, boron or a member of Group 14 (the former IVA main group) and Y is a linking group covalently bonded to the metal comprising nitrogen, phosphorus, oxygen or sulfur, or optionally Z and Y together from a fused ring system.

5.3.1 As argued in the Statement of Grounds of Appeal, D1 encompasses a broad variety of possible combinations of metals and ligands built up from the different subgroups and radicals, each of which requires selections to be made for each group of the formula from the different lists of constituents and radicals (Cp, M, X and A). This is demonstrated by a long list of more than 25 exemplary species in four different sub-lists (column 4, line 25 to column 5, line 7). Only eight compounds in this list relate to compounds having a "bridged" Cp ligand (ie a η^5 -ligand additionally bonded via a -Z-Y-bond to the metal), while fifteen compounds (optionally additionally) contain halogen and/or hydrocarbyloxy ligands (sections IV(a) to (c) and (e), above).

5.3.2 However, the meaning of group -Z-Y- is further specified in D1 as denoting a group of the structure $-(ER''_2)_p-Y'(R''')$ wherein E is carbon, silicon or germanium; Y' is nitrogen or phosphorus; R''' is alkyl, aryl, silyl or a combination thereof having up to 10 carbon or silicon atoms, p is an integer of from 1 to 4 (column 3, lines 27 to 43).

In highly preferred compounds of the formula



M is Zr or Hf, Cp* is a cyclopentadienyl or substituted cyclopentadienyl bound in a η^5 bonding mode to M; Z is SiR^*_2 , CR^*_2 , $\text{SiR}^*_2\text{SiR}^*_2$, $\text{CR}^*_2\text{CR}^*_2$, $\text{CR}^*=\text{CR}^*$, $\text{CR}^*_2\text{SiR}^*_2$, or GeR^*_2 ; Y is a nitrogen or phosphorus containing group of the formulae $-\text{N}(\text{R}''')$ - or $-\text{P}(\text{R}''')$ - (with R* being hydrogen or alkyl, aryl, silyl, halogenated alkyl, halogenated aryl groups and combinations thereof having up to 20 non-H atoms; R''' being C₁₋₁₀ alkyl or C₆₋₁₀ aryl, or two or more R* and R''' groups together form a fused ring system of up to 30 non-H atoms); X is halo, alkyl, aryl, alkoxy, or aryloxy of up to 20 carbons; n is 1 or 2; and A⁻ is a non-coordinating, compatible anion of a Bronsted acid salt.

Amongst those eight compounds in the list containing a bridged ligand, referred to in section 5.3.1, above, only two are free of a halogen (chloride) ligand, ie (tert-butylamido)dibenzyl(tetramethyl- η^5 -cyclopentadienyl)silane zirconium dibenzyl and (phenyl-phosphido)dimethyl(tetramethyl- η^5 -cyclopentadienyl)silane zirconium dibenzyl (column 5, lines 1, 2, 5 and 6).

5.3.3 Finally, whilst Examples 1 and 2 relate to catalysts on the basis of η^5 -[C₅(CH₃)₅] titanium compounds which are free of any -Z-Y- group, Example 3 of D1 discloses a catalyst of the above general structure, wherein the relevant groups and ligands would be in terms of the symbols as defined in Claim 10 of the patent in suit: R = methyl; x = 4; B = Si(CH₃)₂; (JR'_{z-1-y}) = tert-butyl-

amido; Q = methyl; A = pentafluorophenyl borate. A comparison with Claim 10 of the patent in suit indicates that the catalyst of Example 3 would fall within the definitions in that claim.

5.3.4 These considerations show that D1 relates to a broad range of conceivable complex compounds with or without a bridged Cp ligand, without putting a clear emphasis on one of these two possibilities. However, only those containing such a ligand can play a further role in this examination.

5.3.5 Apart from the examples, the compounds according to Claim 10 of the patent in suit differ, according to the Appellant, from the above preferred compounds in D1 identified in the previous paragraphs by a purposive selection of particular meanings of ligand Q out of the various denotations of ligand X in the document.

Thus, ligand Q in Claim 10 is a hydride, a C₁ to C₅₀ hydrocarbyl radical, a C₁ to C₅₀ substituted hydrocarbyl radical wherein one or more hydrogen atoms is replaced by an electron-withdrawing group, or a C₁ to C₅₀ hydrocarbyl substituted metalloid radical wherein the metalloid is selected from the Group IV-A (= Group 14), provided that Q is different from the Cp-ligand, whilst halogen, alkoxy and aryloxy are excluded.

5.3.6 The arguments of the Appellant (see section IV(c), above; Statement of Grounds of Appeal, section III, page 4 *et seq.*) that ligands X having these latter meanings represent poor leaving groups and are excluded from Q, and that compounds containing such ligands X are not active catalysts, on the one hand, for this

reason or, on the other, because they would split off catalyst poisons (hydrogen halide or alcohol) when reacted with the second component of the catalyst (D1: column 8, lines 36 to 49) have not been disputed, let alone refuted by the former Respondents.

This information could neither be taken nor derived from D1. On the contrary, the list of preferred compounds in column 4, line 25 *et seq.* contains numerous species containing halogen and/or hydrocarbyloxy ligands (sections 5.3.1 and 5.3.2, above).

Hence, the patent in suit contains further essential information not derivable from D1, and the claimed subject-matter is limited accordingly. Therefore, the Board accepts that a purposive selection was made.

However, Example 3 of D1 and the two species mentioned in the last paragraph of section 5.3.2, above, meet these requirements in the claims of the patent in suit.

5.3.7 As already stated above, D1 is a document of the state of the art in accordance with Article 54(3) EPC.

Therefore, it is necessary to identify those parts of the document which can be taken into account.

5.3.8 In "US1", the definitions of the symbols in the above formula $CpMX_n^+A^-$ differ in certain respects from those given in D1: Cp may optionally be covalently bonded to M through an unspecified substituent; M is a metal of Groups IIIB to VIB and VIII or a Lanthanide element; X denotes halo, alkyl, aryl, N-R₂, aroxy or alkoxy of up to 20 carbon atoms, or two or more X groups together form a metallocycle with M, R being alkyl or aryl of up

to 10 carbons. One of the optional substituents of Cp may be a group R'' according to one of the following structures:



wherein p is an integer from 1 to 4, Y is nitrogen or phosphor[ous] and each R'', independently, denotes alkyl, aryl, silyl or combinations thereof having up to 10 carbon or silicon atoms. M is preferable Ti or Zr (Claim 1 and page 5).

A single compound having a metallocyclic structure is disclosed in "US1": (N-t-butylamino)(dimethyl)-η⁵-2,3,4,5-tetramethylcyclopentadienyl)silane zirconium dichloride. "Such components" are said to be readily prepared by combining the corresponding metal chloride with a dilithium salt of the substituted cyclopentadienyl group such as a cyclopentadienyl-alkane, -silyl amine, or -phosphine compound. Then a further reference is made to an unpublished US patent application said to disclose "certain of these compounds". However, no mention is made of that application in D1 at all, nor are any particulars available about that application as to its availability to the public, or which would indicate that or which part of the further disclosure in D1 was based on that application ("US1": page 6, line 23 to page 7, line 9).

The US application contains two examples corresponding to Examples 1 and 2 of D1.

5.3.9 The comparison of these particulars shows that only those compounds of the formula $CpMX_n^+A^-$ containing one $\eta^5-(C_5R'_4R'')$ group can be taken into account for novelty which are within the scope of the following limits:

R' is hydrogen, halogen, alkyl, aryl or haloalkyl of up to 10 carbon atoms (the latter limit is not disclosed in D1);

R'' is an $-SiR'''_2-Y(R''')$ group, Y is $-N(R''')$ or $-P(R''')$, wherein $R''' (= R^*)$ is alkyl, aryl or silyl within a range not exceeding 10 carbon or silicon atoms (whilst this limit is not contained in D1) and $R'' (= R''')$ is an C_{1-10} alkyl or C_{6-10} aryl group (the C_6 limit not being disclosed);

X is halogen, alkyl, aryl, alkoxy or aryloxy of up to 20 carbon atoms;

M is an element of Groups 3 to 6 or 8 to 10 or a Lanthanide element, preferably Ti or Zr;

n is 1 or 2 (dependent on the valence of M); and

A^- is a non-coordinating, compatible anion of a Bronsted acid salt (D1: column 1, lines 31/32; column 3, line 1 to column 4, line 18; "US1": page 2, line 30/31; page 3, lines 1 to 10; page 5, lines 1 to 35).

This list clearly demonstrates that the disclosure of D1, as far as belonging to the state of the art in the sense of Article 54(3) EPC (ie in the light of "US1"), still encompasses a large range of conceivable combinations of the different constituents in the above formula, requiring purposive selections for each of these constituents to be made in order to arrive at an active catalyst within the terms of Claim 10.

Furthermore, the only species in "US1" containing a bridged Cp ligand (but which also had halogen ligands rendering the species unsuitable for the preparation of an active catalyst) was deleted from the subject-matter used to prepare the text of D1 and, hence, not published therein.

In fact, none of the relevant individual species referred to in the general disclosure of D1 (in particular, those referred to in the last paragraph of section 5.3.6, above) nor in Example 3 thereof have an antecedent in "US1". Consequently, neither those species nor Example 3 of D1 are state of the art with respect to the patent in suit.

5.3.10 Moreover, both D1 and "US1" define their ligand X in the same way, inclusive of five preferred radicals, three of which prevent, undisputed by the former Respondents, that active catalysts can be prepared from those complex components containing these radicals, and are, therefore, excluded from Claim 10 of the patent in suit.

Hence, as shown above, the patent in suit is based on further essential information, that specific constituents, in particular specific X ligands, have to be selected in order to obtain active catalysts for the polymerisation of olefins, and the subject-matter claimed is limited accordingly. However, no such information is derivable from D1, nor from "US1".

5.3.11 Consequently, the subject-matter of Claim 10 is novel, in the sense of Article 54(3) and (4) EPC over the disclosure of D1.

5.4 Only a small part of Document D2, Claim 1 of which does not even require its π -bonded moiety to be cyclopentadienyl, is supported by "US2". More particularly, the metal coordination complex used as a starting material for the preparation of the catalyst contains a ligand X which at each occurrence is hydride or a moiety selected from halo, alkyl, aryl, silyl, germyl, aryloxy, alkoxy, amide, siloxy and combinations thereof having up to 20 non-hydrogen atoms and neutral Lewis base ligands having up to 20 non-hydrogen atoms. In a preferred embodiment of D2, X is hydride, halo, alkyl, aryl, aryloxy or alkoxy of up to 10 carbons (page 7, lines 14 to 18 and 52). In "US2" support is found for halo, alkyl, aryl, $-NR_2$ (R being hydrogen, silyl, alkyl, aryl and combinations thereof having up to 10 carbons), phenoxy and alkoxy of up to 10 carbons (second half of page 3). It follows that the above considerations concerning a purposive selection are also valid for D2.

Moreover, the above metal coordination complex is activated by means of (b) an organoaluminium compound containing at least one oxygen atom bound to the aluminium atom or between two such atoms, ie an aluminoxane (D2: page 5, lines 27 to 31; "US2": Claim 8; page 4, lines 1 to 6). This means that D2 does not disclose an ionic catalyst containing an anion A^- as defined in Claim 10, but corresponds to a catalyst involving a "conventional" method of activation as referred to in the patent in suit as being less advantageous (page 10, lines 46 to 48).

Consequently, the subject-matter of Claim 10 is novel, in the sense of Article 54(3) and (4) EPC over the disclosure of D2.

5.5 D3 relates to a process for polymerising vinyl aromatic monomers, such as styrene, by means of a monocyclopentadienyl metal catalyst having the formula $[\text{Cp}_m\text{MX}_n\text{X}'_p]^+\text{A}^-$.

5.5.1 In the catalyst, Cp denotes an optionally substituted η^5 -cyclopentadienyl which may be bonded to M through a substituent; M is a metal of Groups 3 to 6 or 8 to 10 or a lanthanide; the ligands X are inert anionic ligands; at least one of these ligands is however R, the latter being hydride, hydrocarbyl or silyl, optionally substituted with one or more halogen atoms or alkoxy groups and having up to 20 C- and/or Si-atoms; X' is an inert, neutral donor ligand; m and p are independently 0 or 1; $n \geq 1$; the sum of $m + n$ is two less than the valence of M; A⁻ is a non-coordinating compatible anion of a Bronsted acid salt (D3: Claim 1; page 2, lines 19 to 30). Illustrative examples for groups X other than R, are halo, NR₂, PR₂, OR, SR, BR₂ (page 2, lines 45).

Ti, Zr, Hf, Cr, La are named to illustrate M; Ti and Zr being preferred. According to particular embodiments, the substituent further bonding Cp to the metal may be alkyl haloalkyl of up to 6 C-atoms or C₂₋₅ oxyalkylene or alkylene. However, in the numerous individual examples of compounds useful for the preparation of catalysts within the above definitions, not a single species contains a bridged cyclopentadienyl, as pointed out by the Appellant in the letter of 19 December 1997

(page 14, point 2.33). Moreover, the list contains a significant number of individual compounds without any cyclopentadienyl ligands and of those containing halogen or hydrocarbyloxy groups (D3: page 3, line 30 to page 4, line 18) None of the examples of D3 discloses a bridged complex compound either.

Hence, the considerations as to the disclosure of a citation and those concerning the necessity for a purposive selection in order to arrive at an active catalyst for the polymerisation of olefins (sections 5.2, 5.3.1 and 5.3.10, above) are also valid for D3. This document does not provide a clear and unambiguous disclosure of a monocyclopentadienyl titanium or zirconium compound, wherein this ligand is further bonded to the metal by a bridging substituent. In the letter of 22 September 1998, this fact was conceded by former Opponent 01 (page 10, point 6) who also put emphasis on the fact that D3 had been of particular for former "Set A" (wherein y could be 0).

5.5.2 These findings are not rendered invalid by "US3", wherein support is only found for a compound of the formula $CpMX_n^+A^-$. The symbols in the formula have the same meaning as in "US1", apart from the fact that the definition of X extends even further and includes silyl, PR_2 , OR, SR, and BR_2 having up to 20 C-, Si- or C- and Si-atoms, with the proviso that at least one X is alkyl, aryl, silyl or a combination thereof (Claim 1 and page 2, line 15 to page 3, line 30). Nor is this assessment rendered invalid by the fact that the optional bridging group is also further defined in a way similar to that in "US1" (section 5.3.2, above) and

refers within these definitions preferably to oxyalkylene (page 6, line 32).

5.5.3 Consequently, the subject-matter of Claim 10 is novel, in the sense of Article 54(3) and (4) EPC over the disclosure of D3.

6. The above considerations, in particular those relating to the necessity for a purposive selection of the groups and radicals of the catalyst in order to arrive at an active catalyst for the polymerisation of olefins, are also valid for the catalyst system as used in the process of Claim 18 of "Set B" and Claim 1 of "Set C". Therefore, their subject-matter is novel over any one of D1, D2 and D3 for the same reasons.

7. Claim 1 of "Set B" differs from the catalyst system of Claim 10 in that it is defined in terms of a product-by-process claim. The definitions of the relevant groups and radicals in the starting compounds A. and B., which form the activated catalyst, are, however, identical to those in Claim 10. Therefore, Claim 1 also meets the novelty requirement with respect to the cited prior art.

8. In summary and for the reasons given above, the Board has come to the conclusion that the main request meets the requirements of the EPC.

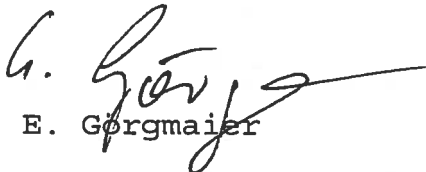
Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the Main request being the two sets of claims (Claims 1 to 26 for the Contracting States AT, CH, LI, DK, BE, DE, FR, GB, IT, NL, SE; Claims 1 to 11 for the Contracting State ES) filed as auxiliary request with the letter dated 16 May 2003 and after any necessary consequential amendment of the description.

The Registrar:


E. Gorgmaier

The Chairman:


R. Young