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Aktenzeichen

File Number

Numéro du dossier

T 969 191-3.33

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- eine Kopie des Berichtigungsbeschlusses
- ein korrigiertes Vorblatt (Form 3030)
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*eine neue Kopie der Seite 28*

Anmeldung Nr. / Patent Nr.:

*83100645.7*

(soweit nicht aus der Anlage ersichtlich)

Please find enclosed

- a copy of the decision correcting errors
- a corrected covering page (Form 3030)
- a headnote / catchword (Form 3030)
- \_\_\_\_\_

Application No. / Patent No.:

(if not apparent from enclosure)

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- une copie de la décision rectifiant des erreurs
- une page de garde (Form 3030) corrigée
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- (A)  Publication in OJ  
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**D E C I S I O N**  
of 8 February 1995

**Case Number:** T 0969/91 - 3.3.3

**Application Number:** 83100645.7

**Publication Number:** 0084888

**IPC:** C08G 61/08

**Language of the proceedings:** EN

**Title of invention:**

A dicyclopentadiene thermoset polymer and a catalyst and a method for making it

**Patentee:**

HERCULES INCORPORATED

**Opponent:**

Nippon Zeon Co., Ltd.

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 54, 56, 83, 84

**Keyword:**

"Novelty - yes (no implicit disclosure of parameters)"

**Decisions cited:**

T 0124/87; T 0279/89; T 0666/89; T 0012/81

**Catchword:**

-



Case Number: T 0969/91 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 8 February 1995

**Appellant:**  
(Opponent)

Nippon Zeon Co., Ltd.  
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**Decision under appeal:**

Interlocutory decision of the Opposition Division  
of the European Patent Office announced orally on  
22 August 1991 and posted on 11 October 1991  
concerning maintenance of European patent  
No. 0 084 888 in amended form.

**Composition of the Board:**

**Chairman:** C. Gérardin  
**Members:** P. Kitzmantel  
M. Aúz Castro

## Summary of Facts and Submissions

I. European patent application No. 83 100 645.7 in the name of Hercules Inc., filed on 25 January 1983 and claiming the priority of 25 January 1982 from two earlier US applications, resulted in the grant of European patent No. 84 882 on 16 June 1987 on the basis of 28 claims, independent Claims 1 and 23 reading as follows:

"1. A method of making a thermoset homopolymer comprising: first, combining a plurality of reactant streams, one of which contains the activator of a metathesis-catalyst system, and a second which contains the catalyst of said metathesis-catalyst system, and at least one of which contains dicyclopentadiene to form a reaction mixture and then, immediately injecting the reaction mixture into a mold where polymerization occurs."

"23. A thermoset homopolymer comprising polymerized units of dicyclopentadiene having a flexural modulus of at least  $1,035 \times 10^6$  KPa (150,000 psi) at ambient temperature, a notched Izod impact strength according to ASTM D-256 of at least about 0,08 J/mm (1.5 ft. lb/in) notch, and a percent gel swell after immersion in toluene for two hours at 100°C of less than 200%."

Claims 2 to 22 and 24 to 28 were dependent on Claims 1 and 23, respectively.

II. Notice of Opposition was filed by Nippon Zeon Co., Ltd. on 15 March 1988 requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC and 100(b) EPC, invoking particularly lack of novelty and lack of inventive step having regard to, *inter alia*, following documents:

- (1) "Development in Application of RIM rigid urethanes", *Plastics*, K.K.Kogyo Research Association Japan, 1978, pp. 29-38 and 88 (partial English translation),
- (2) R.S. Kubiak, "Taking RIM beyond the urethanes", *Plastics Engineering*, March 1980, pp.55-61,
- (4) US-A-3 652 487,
- (8) G. Dall'Asta et al., "Homopolymerization of Dicyclopentadiene Induced by ZIEGLER-NATTA Catalysts and by other Transition Metal Systems", *Die Makromolekulare Chemie* 130 (1969) 153-165 (Nr.3179), and
- (12) EP-A-84 375 (to be taken into account under the provisions of Article 54(3) EPC for the contracting states BE, DE, FR, GB, IT and NL).

III. In its interlocutory decision announced orally on 22 August 1991 (written decision date-stamped 11 October 1991) the Opposition Division held that the process according to Claim 1, amended by incorporation of the feature of granted Claim 9, the amended passage reading

"... first, combining a plurality of reactant streams, one of which contains the activator of a metathesis-catalyst system combined with a moderator, and a second which ...",

was novel over documents (4) and (12), because neither disclosed the joint use of moderators and activators in one reactant stream. Furthermore, the identification of dicyclopentadiene (hereinafter DCPD) in document (4) required a double selection of parameters from the

generic formula (II), and, concerning document (12), the bulk polymerization of DCPD was not within its disclosure.

The product according to Claim 22 (identical to granted Claim 23 renumbered in consequence of the deletion of granted Claim 9) was held to be novel over document (8), because the latter did not explicitly disclose the physical parameters required by this claim, and because the available experimental evidence could not establish an implicit disclosure of these parameters.

In view of the fact that document (12) did not encompass the preparation of crosslinked DCPD polymers according to the conditions of the bulk polymerization of Example 7 therein, the novelty of the subject-matter of Claim 22 over this citation was also recognized.

Since none of the cited documents referred to the problem underlying the patent in suit, namely the provision of thermoset DCPD homopolymers having high impact strength and flexural modulus, and since the cited prior art lacked any suggestion for using the reaction injection moulding (hereinafter RIM) technique for the homopolymerization of dicyclopentadiene and for combining, in one of the reactant streams, the activator of a metathesis catalyst system with an appropriate moderator, the subject-matter of Claims 1 and 22 was considered to be inventive.

Said decision held also that the objection of insufficient disclosure was unfounded, since the description of the opposed patent contained at least one example for carrying out the invention.

IV. On 11 December 1991 the Appellant (Opponent) lodged an appeal against that decision and paid the appeal fee.

The Statement of Grounds of Appeal was submitted on 21 February 1992.

- V. Oral proceedings were held on 8 February 1995. In the course thereof the Respondent (Patentee) filed as the basis of its sole request the following amended Claim 1:

"1. A method of making a thermoset homopolymer comprising: first, combining a plurality of reactant streams, one of which contains the activator of a metathesis-catalyst system combined with a moderator which is an ester, ether, ketone or nitrile, and a second which contains the catalyst of said metathesis-catalyst system, and at least one of which contains dicyclopentadiene to form a reaction mixture and then, immediately injecting the reaction mixture into a mold where polymerization occurs."

The passage "which is an ester, ether, ketone or nitrile" was inserted following an invitation of the Board to clarify (Art. 84 EPC) the term "moderator", which had been introduced into Claim 1 during the first instance opposition procedure.

- VI. The arguments of the Appellant (Opponent) may be summarized as follows:

(i) The process according to Claim 1 was not novel over document (4), whose formula (II) embraced DCPD as a monomer, because (4) disclosed also the injection moulding of thermosetting materials and - since the molecular oxygen used in combination with the organoaluminium compound had the function of a "moderator" in the catalyst system - the joint use of an activator and a moderator.

Document (12), whose whole content comprised the bulk polymerization of DCPD, was also novelty destroying for

the subject-matter of Claim 1, because the compounds ethylene oxide and epichlorohydrin used therein as "polymerization activators" were ethers falling within the scope of the term "moderator" according to the patent in suit, and because the skilled person would, as a matter of course, combine these compounds in the same reaction stream with the alkylaluminium "cocatalysts" ("activators" in the patent in suit).

(ii) In order to demonstrate the lack of novelty of the polymers according to Claim 22, the Appellant submitted the results, on the one hand, of its reworking of Run 9 from Table 2 of document (8), showing that the insoluble fraction obtained met the Izod impact, flexural modulus and gel swell requirements of Claim 22, and, on the other hand, of the bulk polymerization of DCPD according to the conditions of Example 7 of document (12), showing that the DCPD polymers prepared thereby met also the terms of Claim 22 of the patent in suit. In this context the Appellant stressed that according to the whole contents approach regularly applied by the boards of appeal the disclosure of document (12) comprised not only the solution polymerization of DCPD, leading to smooth, viscous polymer cements, but also the bulk polymerization which could only lead to crosslinked polymers within the scope of the patent in suit.

(iii) Having regard to the issue of inventive step of the process according to Claim 1, the Appellant argued that it was obvious to apply the RIM technique, which was disclosed in documents (1) and (2) for the preparation of a variety of polymers, to the specific DCPD/catalyst/activator/moderator reactive system known from document (4) to be suitable also for the technique of injection moulding.



(iv) Similarly, an inventive step could not be recognized, in the opinion of the Appellant, in the provision of thermoset DCPD polymers according to Claim 22 of the patent in suit; as demonstrated by the Appellant's reworking of Run 9 of Table 2, crosslinked DCPD polymers have been known from document (8), and their improvement by using for their preparation the RIM method, known from document (4) to be applicable to the bulk polymerization of norbornene-type monomers, including DCPD, was an obvious measure.

(v) Although the objection of insufficiency of the disclosure was maintained in the grounds of appeal, in the oral proceedings, though invited by the chairman, the Appellant refrained from making any comments thereon.

VII. The arguments of the Respondent (Patentee) may be summarized as follows:

(i) As to the novelty of process Claim 1 over document (4), the analysis of formula (II) showed that it did not extend to DCPD, because the term "alicyclic" did not embrace "more complex bicyclic or polycyclic rings". Furthermore, the molecular oxygen combined in (4) with an organoaluminium compound increased the yield, and was therefore not a moderator but an activator. Moreover, document (4) aimed at the production of molded rubber products whose polymerization reaction lasted up to 2 hours and did not therefore make available the preparation of high impact strength thermoset plastics by RIM, involving reaction times of below 1 minute.

Concerning the novelty of Claim 1 over document (12), the Respondent pointed out that the compounds epichlorohydrin and ethylene oxide were used therein as activators and could not, therefore, be equated with

ethers employed in the patent in suit as moderators, which served to lower the rate of polymerization and to delay the onset of polymerization.

The Respondent contested that the Appellant's reworking of Run 9 from Table 2 of document (8) was novelty destroying for the product according to Claim 22 of the patent in suit, because these results were not reliable, since the manner of reworking was not sufficiently based on the disclosure in document (8).

Respondent's own duplication of Run 15 from Table 2 of document (8) showed a gel swell value of 718%, well above the maximum of 200% set in present Claim 22. With respect to document (12) the Respondent argued that its "whole content" did not comprise thermoset (crosslinked) polymers, but only smooth, viscous polymer cements and that even the bulk polymerization of example 7 led to a plastic polymer.

Thus, documents (8) and (12) did not affect the novelty of the subject-matter of product Claim 22.

(ii) Concerning the issue of inventive step of the process according to Claim 1 over document (4) in combination with documents (1) and (2), the Respondent stressed particularly that there was no suggestion in (4) to use a moderator.

(iii) As to the product according to Claim 22 neither document (4) or document (8), nor a combination thereof, could suggest crosslinked DCPD polymers having the claimed properties. On the one hand, (4) related essentially to mouldable, rubber-like products and would therefore hardly be considered by a skilled person; on the other hand, the insoluble precipitates described in (8), as shown by the Respondent's reworking of Run 15 of

Table 2, exhibited a much higher gel swell. Further, the results of Appellant's reworking of Run 9 were those of a partial product not within the actual disclosure of (8).

VIII. The Appellant requested that the decision under appeal be set aside and the patent be revoked.

The Respondent requested that the appeal be dismissed with the proviso that the patent be maintained on the basis of Claim 1 filed during oral proceedings and Claims 2 to 27 as well as the adapted description, both filed during oral proceedings of 22 August 1991 before the Opposition Division.

#### Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
  - 2.1 The incorporation into Claim 1 of the features that the activator is "combined with a moderator which is an ester, ether, ketone or nitrile" is based on granted Claim 9 (corresponding to original Claim 9), on page 3, lines 30 to 31 and page 4, lines 22 to 24 of the description as granted (corresponding to page 5, lines 4 to 6 and page 7, lines 25 to 28 of the description as originally filed).

In view thereof and since this amendment amounts to a restriction of the scope of Claim 1 as granted, the requirements of Article 123(2) and (3) EPC are met.

2.2 The incorporation into Claim 1 of the feature "which is an ester, ether, ketone or nitrile" establishes clarity and consistency with the description (Art. 84 EPC) of the word "moderator" (which was inserted into Claim 1 during the first instance opposition proceedings), which is a functional term that has a specific definition in the patent specification and in the original application.

3. *Novelty*

3.1 Claim 1

The main features of this method claim are:

- (a) thermoset (crosslinked)
- (b) dicyclopentadiene (DCPD) homopolymer
- (c) using a metathesis catalyst system
- (d) using at least two reactant streams
- (e) at least one of the streams contains DCPD
- (f) catalyst of metathesis catalyst system in one stream
- (g) activator of metathesis catalyst system in other stream
- (h) activator used in combination with moderator which is an ester, ether, ketone or nitrile
- (i) forming a reaction mixture by combining the streams
- (j) immediately injecting the reaction mixture into a mold
- (k) polymerization in the mold.

3.1.1 Document (4)

Relates to a process of polymerizing a preformed mixture comprising an unsaturated alicyclic hydrocarbon, in particular of the formula (II):

CH=CH [P being a fragment comprising 2  
  \  
  P / or 3 carbon atoms which may be  
          constituents of alicyclic rings],

under the action of a four component catalyst system consisting of (A) an organoaluminium compound, (B) molecular oxygen, (C) tungsten halides or oxyhalides, and (D) a compound of the formula R-Y-H, where Y is oxygen or sulphur and R is hydrogen or a hydrocarbon radical. Preferably, the catalyst components (A) and (B) on the one hand, and (C) and (D) on the other hand, are combined before their addition to the monomer containing reaction mixture (see Claims 1 and 2; column 6, lines 27 to 42). The products of the polymerization are either solid rubbery compositions (see e.g. Example III) or may be - if crosslinking agents are added - "snappy" crosslinked polymers (see Example VII; column 7, line 74 to column 8, line 20).

According to column 7, lines 67 to 73 the process described in document (4) "is employed in conjunction with any of the well-known methods for molding and casting articles from **thermosetting** plastic materials and/or curable polymeric compositions [emphasis added]." These methods include "injection molding".

There was some argument between the parties whether or not DCPD would come under the definition of formula (II). This question is, however, not decisive for the issue of novelty, because the process according to present Claim 1 differs in any case from that according to document (4) in that it requires the combination in one reactant stream of an activator with a moderator which is an ester, ether, ketone or nitrile; neither does document (4) envisage the use of such a compound in the catalyst system, nor of another moderator. As can be inferred, on the one hand, from Tables I to VII,

which show that four component catalyst systems lead to very high yields up to 100 weight percent, and, on the other hand, from the Comparative Example in (4), the oxygen influences only the yield of the polymer and not - as is the function of a moderator (see page 3, lines 30 to 31 and page 4, lines 22 to 23 of the patent in suit) - the rate of polymerization (including a delay of the polymerization reaction).

A further point to consider is that, though with respect to the process steps Claim 1 of the patent in suit states only that the reactant streams are combined to a reaction mixture which is then immediately injected into a mold "where polymerization occurs", interpretation under Article 69 (1) EPC in the light of the description (particularly page 2, line 42 to page 3, line 2 and Examples 26 to 33) reveals that this definition is directed to a RIM process, i.e. a reaction injection moulding process, where the mass injected into the mould sets up quickly, so that the moulding can soon be removed, e.g. after 2 minutes (page 2, lines 58 to 60; page 4, lines 51 to 53; Example 26: page 9, line 62). Since the reaction times (at ambient temperature) reported in document (4) range from 30 minutes (Example II) to 20 hours (Examples V and VI), it is clear that a RIM process as actually contemplated in the patent in suit is not at all envisaged in the citation. The term "injection molding" mentioned in (4) implies only that a deformable mass is pushed into a mould cavity, where it is hardened, e.g. under the action of heat, as is normally the case with curable (thermosetting) rubber compositions. The conditions of hardening (e.g. crosslinking system, temperature and time) are, however, in no way defined by this term.

Document (4) does therefore neither disclose the use of a moderator, nor the RIM process, and is thus not novelty destroying for the process according to Claim 1.

3.1.2 Document (12)

Relates to the preparation of polymers, for example homopolymers of DCPD, by ring-opening polymerization of norbornene-type monomers, in the presence of a catalyst system comprising organoammonium molybdates or tungstates and an alkylaluminium cocatalyst, in solution or in bulk, the latter including reaction injection moulding (see Claims 1 and 2; page 9, lines 4 to 9; page 12, lines 19 to 27; Example 5).

Accordingly, document (12) comprises all features of present Claim 1 except for the moderator to be used together with the activator and except for the property "thermoset" of the DCPD polymer. In respect of these features, the Appellant contended that the compounds epichlorohydrin and ethylene oxide, labelled "polymerization activators" in document (12), would in fact display the function of the moderator according to present Claim 1; it furthermore contended that it would be concluded by a skilled person from the sentence bridging pages 10 and 11 "The activator may be employed in a range from about 0 moles to about 3 moles per mole of alkylaluminum halide cocatalyst,..." that these "activator" compounds (allegedly "moderators" according to the patent in suit) were used in combination with the "cocatalysts" ("activators" according to the patent in suit).

The above conclusions of the Appellant are, however, not convincing for the following reasons. First, a compound added, according to the patent in suit, in

order to "moderate the rate of polymerization (page 3, lines 30 to 31) and to "delay the onset of polymerization (page 4, lines 22 to 23) cannot be equated, in regard to its function, with another compound added in order to "activate a cocatalyst", i.e. to enhance the overall catalytic activity; secondly, epichlorohydrin and ethylene oxide, although structurally belonging to the general class of "ethers", because of their high reactivity (which is untypical for ethers) would normally not be considered by a person skilled in the preparation of transition metal catalyst systems and do not fit into the series of solvent-type moderator compounds comprised by the patent in suit; thirdly, the sentence on page 11, lines 3 to 6 in document (12): "The activator may be added at any point in the charge procedure but is more preferably added last, or with the ... catalyst." does not support the Appellant's allegation that the skilled person would, as a matter of course, consider only the combined use of "polymerization activators" and "cocatalysts".

The novelty of the subject-matter of Claim 1 over document (12) must therefore be recognized.

3.2. Claim 22

Contains the following features:

- (a) DCPD homopolymer
- (b) thermoset
- (c) flexural modulus  $\geq 1,035 \times 10^6$  KPa (150,000 psi)
- (d) Izod impact strength  $\geq 0,08$  J/mm (1.5 ft.lb/in)
- (e) gel swell  $< 200$  %



3.2.1 Document (8)

3.2.1.1 Is a scientific article concerning the homopolymerization of DCPD in the presence of Ziegler-Natta and other transition metal catalyst systems. The aim of this work was the determination of the structure of the obtained soluble DCPD polymers, the results being summarized in Table 2 on page 160. The parties are in agreement that these soluble polymers are not crosslinked, in contrast to "thermoset" or "crosslinked" products which, according to the definition in the patent in suit, page 2, lines 22 to 24, refer to polymers which are insoluble in common solvents and resistant to flow at elevated temperatures.

A footnote "(b)" (column "Yield" of Table 2 of the citation) indicates, however, that in several experiments (Runs 3, 9, 11, 13 to 15), apart from the soluble polymer fraction, a partially crosslinked and insoluble polymer was formed.

This insoluble polymer fraction is the key point of the Appellant's novelty objections. In particular, it repeated Run 9 twice, isolated and tested the insoluble fraction, and concluded that it fell within the terms of present Claim 22.

3.2.1.2 The Appellant's repetitions of said Run 9 are not, however, true duplications, partly because it did not exactly follow the procedure according to document (8) and partly because (8) does not disclose all information necessary for an exact reworking.

In its first repetition (letter dated 1 June 1990, page 13, paragraph 3 to page 14, paragraph 2; Annex C) a DCPD solution in toluene is added to solid  $\text{MoCl}_5$ ,

provoking "a slight amount of smoking and a small exotherm"; to this slurry a solution of triethylaluminium in toluene is added. The reaction is stopped with an excess of ethanol, leaving a large amorphous mass attached to the stirring rod, which is then washed with ethanol and toluene, isolated and dried. Samples from this material are tested for gel swell (average from two measurements: 99%) and Izod impact strength (average from two measurements: 3.56 ft.lb/in).

As rightly observed by the Respondent, the addition of the DCPD solution to  $\text{MoCl}_5$  creates other reaction conditions than the reverse addition of  $\text{MoCl}_5$  to the DCPD solution according to (8) (pages 163 and 164: "3.1 Polymerization runs and properties of the polymers"). As demonstrated by the smoking and the exotherm observed, the high local concentration of the reactants causes a violent reaction which could not occur under the reaction conditions employed in (8), where the solvent was able to quickly dilute and prevent any high local concentration of  $\text{MoCl}_5$ ; considering the stickiness of the precipitate (large amorphous mass attached to the stirring rod) the Respondent's doubts concerning the efficiency of the catalyst killing and washing steps appear also to be justified.

- 3.2.1.3 In its second repetition of Run 9 (Experiment A in "Memorandum" filed with the Statement of Grounds of Appeal) the Appellant states "A solid mass was obtained by repeating Experiment 9 set forth in Document (8)". After washing and vacuum drying a sample was cut for measuring its flexural modulus value, which was 163 600 psi.

In order to be valid as novelty anticipation, there must not be any doubt that the product obtained and tested is identical to the one duplicated. However, the experimental data in document (8) do not indicate if and how the "insoluble fraction" (bridging sentence pages 163 and 164) was isolated and characterized, making a true duplication in that respect impossible. The assumptions made by the Appellant (catalyst deactivation with ethanol, removal of soluble fraction by toluene treatment, vacuum drying at 50 to 60°C), although reasonable, cannot set aside the fact that it is unknown whether the insoluble fraction of (8) was treated and isolated in the same way. The efficiency of the catalyst deactivation and washing treatment may, however, have an impact on the properties and thermal behaviour of the isolated precipitate, due to possible residual catalyst activity and varying contents of non-crosslinked species. Moreover, it rather appears that in (8) the insoluble fraction was, at most, separated and, without further treatment, discarded, since only the soluble fraction was analysed (page 160, footnote b)). There is thus no proof that the mass isolated in Appellant's comparative Run 9 corresponds indeed to the "insoluble fraction" identified in footnote b) of Table 2.

Consequently, the flexural modulus value measured for the product of the second repetition of Run 9 cannot be considered to correspond to the same property of the insoluble polymer fraction.

Moreover, the results of the first and second repetitions stem from different preparation variants and cannot be regarded as referring to the same product; it has thus not even been established by the Appellant that a single product met all three parameters of present Claim 22.

3.2.2 Document (12)

3.2.2.1 Appellant's argumentation with respect to this document is based on its interpretation, for the assessment of the relevant available disclosure, of the "whole content approach". It relies particularly on the statements

(i) on page 12, lines 19 to 27 of document (12), according to which the polymerization could be carried out in bulk, in the absence of a solvent,

(ii) on page 9, lines 5 to 9, according to which (12) contemplates the preparation of i.a. homopolymers of methyltetracyclododecene (MTD) and DCPD, and

(iii) Example 7, describing the bulk polymerization of MTD.

From this the Appellant concludes that the disclosure of document (12) implicitly comprised such a DCPD polymer which would result when polymerizing DCPD under the reaction conditions of Example 7; according to Experiment A submitted with Appellant's letter of 13 November 1989, such a DCPD polymer would have a flexural modulus of 223 755 psi, a notched Izod impact strength of 1.51 ft.lb/in and a gel swell of 168% (Experiment B of the same letter is less relevant, since tridodecylammonium tungstate is used therein in lieu of the tridodecylammonium molybdate used in Example 7 of (12)). These values are all within the terms of present Claim 22.

3.2.2.2 There can be no doubt that for the assessment of that subject-matter of a document which was "made available to the public" in the sense of Article 54(2) EPC the whole disclosure of that document has to be taken into account. This must be concluded from the wording of this article "The state of the art shall be held to comprise **everything...**" (emphasis added). Particularly,

the disclosure is not confined to the worked examples or to preferred embodiments, but encompasses everything one skilled in the art will be able to identify, in the context of the document, as a technical teaching.

To qualify as a "technical teaching" information, which is not explicit, must ensue as a logical consequence and without any doubt from the positive content of the document.

This is not the case for the substitution of DCPD for MTD in Example 7 of document (12). While the description of this document, and particularly the passages quoted by the Appellant, may justify the conclusion that DCPD homopolymers prepared by bulk polymerization in the absence of solvent are, as a general class, within its disclosure, the skilled person would not consider such DCPD homopolymers prepared by strictly applying to DCPD the reaction conditions for MTD of Example 7 to be within the disclosure of document (12). This is because one skilled in the art would not, in view of the heterogeneity of the large group of norbornene-type monomers encompassed by document (12) (page 7, line 35 to page 9, line 3), regard the specific polymerization conditions of one particular example as representative for all monomers. This is supported by the fact that, depending on the monomer, the solvent polymerization examples of (12) use different reaction conditions (cf. Examples 1/3 (MTD), 4/6 (methyl norbornene) and 5 (DCPD)); such differences are not surprising in particular in the case of DCPD and MTD in view of their different structures (tetracyclic monoolefin or tricyclic unconjugated diolefin) and the resulting different reactivities. As set out in document (8), last paragraph of page 162, even among other cyclodiolefins DCPD is an exception because of its

strong tendency to polymerize also in the absence of an organometallic cocatalyst. Document (8), page 163, 3rd paragraph stresses also "the complexity of behaviour of dicyclopentadiene in polymerization and its variability depending on even small differences in the nature of the catalyst."

Under these circumstances, there is thus no established factual correlation between DCPD and MTD concerning their bulk polymerization behaviour, and carrying out the polymerization of DCPD under the conditions of Example 7 does therefore not amount to a "technical teaching" that was "available to the public" within the meaning of Article 54 (2) EPC. As a consequence, the DCPD polymers whose properties have been alleged by the Appellant to fall within the terms of present Claim 22 (Experiment A submitted on 13 November 1989) are not part of the disclosure of document (12).

- 3.2.2.3 In support of its view of the whole contents approach the Appellant has relied on some decisions of the boards of appeal, particularly on T 124/87 (OJ EPO 1989, 491), T 279/89 of 3 July 1991 (not published in OJ EPO) and T 666/89 (OJ EPO 1993, 495).

Decision T 124/87 related to the issue of novelty of an ethylene copolymer defined by three features overlapping with those of the prior art. In particular, the copolymer was defined by (i) an alpha-olefin comonomer having 4 to 10 carbon atoms, (ii) a density of about 0.940 to 0.960 g/cm<sup>3</sup>, and a melt index of between 100 and 200, whereas the prior art copolymers were defined by (i) the use of alpha-olefin comonomers having 3 to 12 carbon atoms, (ii) a density of 0.945 to 0.970 g/cm<sup>3</sup>, and melt indices from 0.1 to 100 or over. This situation, where the relevant state of the art was formed by a combination of three ranges of properties

of the same copolymer, is unrelated to the present issue of combining the conditions of a specific process of polymerization, executed with a specific monomer, with an alternative monomer mentioned in a general statement in the description and without reference to said specific polymerization conditions.

The statement in point 3.4 of the reasons of T 124/87 that the disclosure of the prior art was "clearly not limited to the particular polymers whose preparation is described in the Examples, but extends to the general class of polymers described", is thus directed to facts which are completely different from those of document (12) and does not contain any clue for its interpretation.

Decision T 279/89 was concerned with the criteria for novelty by selection of the use, in a certain range of amounts, of 2,4'-methylene bis(phenylisocyanate) in compositions comprising 2,4'- and 4,4'-isomers, when the state of the art described the same compositions, but for a broader range of amounts of the 2,4'-isomer. Again these facts are unrelated to those presently at issue in respect of document (12). Insofar as this decision, in point 4.3 of the reasons, makes reference to T 124/87 the relevant questions have been commented on in the preceding paragraphs. With regard to decision T 26/85 (OJ EPO 1990, 22), point 4.2 of the reasons of T 279/89 sets out: "When that information" (whole content of document) "is sufficient to enable the skilled man to practice the technical teaching which is the subject-matter of the disclosure, taking into account also the general knowledge in the field to be expected of him, novelty can no longer be acknowledged. It follows, therefore, that a realistic approach in assessing the novelty of an invention under examination over the prior art in a case where

overlapping ranges (emphasis added) exist, would be to consider whether the person skilled in the art would in the light of the technical facts seriously contemplate applying the technical teachings of the prior art document in the range of overlap. If it can be fairly assumed that he would do so, it must be concluded that no novelty exists." Again this decision does not apply to present novelty issue, because it concerns the situation of overlapping ranges which does not exist in respect of document (12). Moreover, as discussed in point 3.2.2.2 above, one skilled in the art would not, for the reasons indicated, contemplate applying the special polymerization conditions of Example 7 of (12) to DCPD.

Finally, the Appellant relied on decision T 666/89 where it was set out in point 5, last paragraph of the reasons that "In applying this principle, the evaluation must therefore not be confined to a comparison of the claimed subject-matter with only the examples of a citation, but must extend to all the information contained in the earlier document." Following this principle, a combination of two ranges of preferred constituents was held to be within the disclosure of the prior art document (3a) of this case. This conclusion was i.a. justified in T 666/89, point 4, paragraph 6 by the statement "There is no disclosure or indication in document (3a) that particular rules have to be observed when combining the respective components ..., which rules would lead the skilled person not to follow the technical teaching of document (3a) with respect to those compositions which overlap ...". This conclusion is not applicable to the novelty question at issue with respect to document (12), since - although (12) does not militate explicitly against the use of the reaction conditions of Example 7 for the bulk polymerization of DCPD - one skilled in



the art would not, considering his general knowledge in the field, put MTD and DCPD on a par (see point 3.2.2.2 above).

Perhaps more relevant to the issue under consideration is T 12/81 (OJ EPO 1982, 296), where the threo form of a certain acetal was held not to be novel over a document disclosing, in a group of twenty compounds, the relevant starting compound for its preparation by hydrogenation, and also disclosing, among five alternative hydrogenation methods, the one which led to the threo isomer; it was argued in T 12/81 that in this situation the threo isomer was implicitly disclosed because the choice of the specific hydrogenation method from the group of five alternatives did not involve a new element, since all these methods led to the same addition to the starting compound of two hydrogen atoms (reasons point 14.3). In contrast to the facts of T 12/81, there is no information in document (12) that DCPD could be subjected to the specific polymerization conditions of Example 7; it follows that a DCPD polymer resulting from such conditions is not within its disclosure.

3.2.3 In view of the above reasoning the subject-matter of Claim 22 is novel over documents (8) and (12).

4. *Inventive step*

4.1 Claim 1

As set out in point 3.1.1 above, the subject-matter of present Claim 1 is distinguished from the disclosure in document (4) by (i) the choice of DCPD as norbornene-type alicyclic compound of formula (II), by (ii) combining the activator with a moderator, and by (iii) employing a RIM technique.

When starting from document (4) the problem underlying the subject-matter of Claim 1 was the definition of a process for the easy preparation and moulding of DCPD polymers having such physical properties which allow their use for automobiles, appliances and sports equipment (see page 1, lines 15 to 17; 42 to 43 of the patent in suit).

The solution to this problem is a process for the homopolymerization of DCPD compatible with conventional RIM equipment, involving the separation of the two components (catalyst and activator) of a metathesis polymerization catalyst system in two separate reactant streams - at least one of which contains DCPD - and wherein the otherwise very rapid rate of polymerization is controlled by the addition of a moderator to the activator containing stream.

As demonstrated by Example 33 of the patent in suit (page 12, Table VIII), a combination of tensile, flexural, impact and heat deflection properties can thereby be attained which permit the use of the DCPD polymer for the desired purposes (see also page 2, lines 12 to 15 of the opposed patent).

Document (4) does not comprise any pointer towards the solution of the existing problem; there is no suggestion in it of DCPD, of the subjection of two reactant streams to the RIM process and of the use of a moderator in conjunction with the activator of a metathesis catalyst system (cf. point 3.1.1 above).

Documents (1) and (2) relate to the application of RIM for the preparation of polymers other than polyurethanes, for which the RIM process was originally developed. In particular, document (2) sets out on page 55, bridging paragraph central column/right-hand

column: "Polymers that are formed from liquid monomers by an addition reaction .. are candidates for RIM. Because of the presence of mutually addition-reactable chemical groups in isocyanates, polyols, epoxies, polyesters, acrylics, phenolics, nylons, and others, innumerable hybrids of these resins are possible, some of which might be suitable for RIM." Since, even in this speculatively broad enumeration of possibilities, the exemplified chemical entities bear no resemblance to DCPD-type polymers, these documents cannot suggest the processing of DCPD according to the RIM technique.

Thus document (4), neither alone, nor in combination with documents (1) or (2) is able to render the subject-matter of Claim 1 obvious.

#### 4.2 Claim 22

(8) is the only document describing the formation of crosslinked (thermoset) DCPD polymer (footnote b) in Table 2 on page 160). It does, however, not disclose if and how the insoluble fraction comprising this polymer was isolated and characterized.

The skilled person, starting from document (8), was thus confronted with the problem of providing a thermoset DCPD polymer having such physical properties which allow their use for automobiles, appliances and sports equipment (see page 1, lines 15 to 17; 42 to 43 of the patent in suit).

The solution to this problem resides in the provision of a polymer having the characteristics according to Claim 22. As demonstrated by Example 33 of the opposed patent, the flexural modulus and notched Izod impact limits set in Claim 22 have actually been met by the invention. Example 33 does, however, not report a gel

swell value, nor does any other available evidence provide information on all three properties of a single test sample (Example 34 reports a gel swell value of 110% for a DCPD polymer sample, but is silent on the other two properties defined in Claim 22). In the absence of any counterevidence by the Appellant the Board sees however no reason to assume that the gel swell value is not met by the polymers prepared by Example 33; apart from the fact that the onus for proving the contrary would have been on the Appellant, a proportional behaviour of gel swell on the one hand, and notched Izod impact and flexural modulus on the other hand, i.e. an increase of the latter properties with increased crosslinking, appears reasonable.

The issue of obviousness turns thus on the question whether or not the state of the art contained any pointer to solve the existing problem by the provision of DCPD homopolymers having the properties according to present Claim 22.

As stated above, document (8), which concentrates on the structural properties of soluble, non-crosslinked DCPD polymers, is silent about any particulars of the insoluble polymer fraction and does not contain any suggestion of the technical utility of this fraction. Document (8) does not therefore comprise any incentive for a person skilled in the art to consider crosslinked DCPD polymers as a useful raw material for construction purposes, e.g. in the automotive industry. Document (8) by itself cannot therefore render obvious the subject-matter of present Claim 22.

Nor can document (4), alone or in combination with document (8), suggest the solution of the existing problem. First, (4) does not mention DCPD at all, but only similar alicyclic monomers; secondly, (4) relates

mainly to moulded rubber products (column 1, lines 26 to 33) and does not qualify in this respect as relevant prior art for stiff polymers having the properties of present Claim 22. Where document (4) relates to "snappy crosslinked polymers" (Example VII, column 10, lines 49 to 50), these are, unlike the self-crosslinked homopolymers according to the patent in suit, crosslinked by virtue of an added crosslinking agent (see column 4, lines 54 to 59; Examples VII to IX). Furthermore, the reference in column 7, lines 67 to 73 to "injection molding" of "thermosetting plastic materials and/or curable polymeric compositions" is not, as explained in point 3.1.1 above, a reference to RIM, and does not therefore imply - as a possible implicit consequence of the submission of DCPD to this procedure - the preparation of DCPD homopolymers having the claimed property profile.

Hence, for the expert aiming to solve the existing problem, documents (4) and (8) do not lend themselves to a combination. Neither was there any reason, when starting from (8), to expect that by the polymerization conditions of (4), including "injection molding", DCPD could be processed to homopolymers having the desired properties, nor could a skilled person starting from document (4) assume that the substitution of DCPD, as employed in (8), for the monomers used in (4) would lead, in the absence of crosslinking agents, to other than rubbery products.

Appellant's contention that it was not inventive to provide a thermoset DCPD polymer having physical parameters which are "typical of most thermoset plastics" and, with respect to flexural modulus and Izod impact, "no better than those obtained for most thermoplastics" (page 9 of "Memorandum" filed together with appeal brief) is not supported by any concrete

comparison with the prior art and is thus manifestly inappropriate to cast doubt on the requirements of Article 56 EPC being met ("The invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art.").

- 4.3 The subject-matter of independent Claims 1 and 22 involves therefore an inventive step. Owing to their appendancy to the independent claims, the subject-matter of dependent Claims 2 to 21 and 23 to 27 must also be considered inventive.

5. *Insufficiency of disclosure*

In the written appeal proceedings the Appellant maintained its objection under Article 100(b) EPC by alleging that the claimed process could not be carried out by a skilled person in the whole breadth of Claim 1.

As set out above in points 4.1 and 4.2, Example 33 demonstrates that DCPD homopolymers exhibiting the essential physical properties according to Claim 22 can be prepared by a RIM process according to Claim 1. Examples 26 to 32 show the same success for preferred embodiments and Example 36 shows that the desired low gel swell value (< 200%) is obtainable under laboratory conditions.

These examples prove that the desired results (solution of the existing problem) can be achieved with the chosen reactants, which are all within the claimed scope.

During the first instance opposition proceedings the Appellant had filed experimental evidence (Experimental

Report No. 3, Annex B of letter dated 1 June 1990) demonstrating that a variety of known metathesis catalyst systems were not suitable for the RIM process as defined in Claim 1. In the Board's judgment, this does not, under the circumstances prevailing, prove that the disclosure of the patent in suit was insufficient; on the contrary, the information contained in the description is exhaustive as regards the criteria of reactivity to be observed (preference of tungsten catalysts, use of solubilizers, Lewis base and chelating agent together with the catalyst; use of moderator together with activator, which is preferably an alkylaluminium compound; observation of catalyst/activator ratios: page 6, line 1 to page 8, line 32; Examples 1 to 34). The skilled person has thus sufficient information at hand to find out by trial and error experimentation the concrete catalyst system and the reaction conditions that will enable him to solve the existing problem.

The Appellant's objection of insufficiency of the disclosure is therefore unfounded.

6. Consequently, the objections brought forward by the Appellant do not prejudice the maintenance of the patent as amended in accordance with the appealed decision.

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 Claim 1 filed during oral proceedings and Claims 2 to 27 as well as the adapted description, both filed during oral proceedings of 22 August 1991 before the Opposition Division.

The Registrar:

  
E. Görgmaier

The Chairman:

  
C. Gérardin