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Datasheet for the decision of 6 June 2013

Case Number: T 0225/10 - 3.3.03

Application Number: 98113059.4

Publication Number: 891990

IPC: C08F 10/00, C08F 2/14, B01J 19/18, B01J 19/24, B01J 4/00

Language of the proceedings: EN

Title of invention:
High solids slurry polymerization

Patent Proprietor:
CHEVRON PHILLIPS CHEMICAL COMPANY LP

Opponents:
Ineos Commercial Services UK Limited
Total Research & Technology Feluy

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 114(2), 123(2)
RPBA Art. 12(4), 13(3)

Keyword:
"Requests unconditionally withdrawn - resubmitted at oral proceedings- admitted -(no)"
"Amendments- Added subject-matter -(yes) 7th auxiliary request"
"Maintenance of the patent in amended form - (yes) - eighth auxiliary request"

Decisions cited:
T 0644/97, T 0608/07

Catchword:
-

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Case Number: T 0225/10 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 6 June 2013

Appellant: (Patent Proprietor)	CHEVRON PHILLIPS CHEMICAL COMPANY LP 10001 Six Pines Drive The Woodlands, TX 77380 (US)
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Respondent I: (Opponent 1)	Ineos Commercial Services UK Limited Hawkslease Chapel Lane Lyndhurst Hampshire SO43 7FG (GB)
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Respondent II: (Opponent 3)	Total Research & Technology Feluy Zone Industrielle C B-7181 Seneffe (BE)
Representative:	Gyi, Jeffrey Ivan De Clercq & Partners cvba Edgard Gevaertdreef 10 a B-9830 Sint-Martens-Latem (BE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 9 December 2009 revoking European patent No. 891990 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman: B. ter Laan
Members: M. C. Gordon
C.-P. Brandt

Summary of Facts and Submissions

I. The appeal by the patent proprietor lies from the decision of the opposition division announced on 14 October 2009 and posted on 9 December 2009 revoking European patent number 0 891 990 (granted on European patent application number 98 113 059.4).

II. The patent application as filed contained 29 claims, of which claims 1, 18, 20 and 29 were independent. Claims 1, 18 and 29 were directed to processes, claim 20 to an apparatus. Claims 1, 2, 3, 5, 8, 9 and 10 read as follows:

"1. A polymerization process comprising:
polymerizing, in a loop reaction zone, at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising liquid diluent and solid olefin polymer particles;
maintaining a concentration of said solid olefin polymer particles in said slurry in said zone of greater than 40 weight percent based on the weight of said polymer particles and the weight of said liquid diluent; and
continuously withdrawing a slurry having an increase in solids concentration as compared with said slurry in said zone, the thus withdrawn slurry comprising withdrawn liquid diluent and withdrawn solid polymer particles as an intermediate product of said process.

2. The process of claim 1, wherein said olefin monomer comprises ethylene, in particular wherein said olefin monomer comprises ethylene and 0.01-5 weight percent hexene based on the total weight of said ethylene and

said hexene, and wherein said liquid diluent is isobutane.

3. The process of claim 1 or 2, wherein said concentration of said solid olefin polymer particles in said slurry in said zone is greater than 50 weight percent based on the weight of said polymer particles and the weight of said liquid diluent.

5. The process of any of claims 1 to 3, wherein a pressure differential of greater than 21.3 per mm (0.07 per foot) of reactor flow path length is maintained in a propulsion zone, in particular wherein said differential is within the range of 21.3 to 45.7 mm/mm per mm (0.07 to 0.15 ft/ft per foot) of said reactor flow path length.

8. The process of any of the preceding claims, wherein said intermediate product of said process is continuously passed through a heating zone wherein said intermediate product is heated to produce a heated intermediate product and thereafter said heated intermediate product is exposed to a pressure drop in a high pressure flash zone, said heated intermediate product being heated to an extent such that a major portion of said withdrawn liquid diluent is vaporized and thus separated from said withdrawn solid polymer particles, the thus separated withdrawn liquid diluent thereafter being condensed for recycle, without any compression, by heat exchange with a fluid having a temperature within the range of 4 to 54°C (40 to 130 degrees F).

9. The process of any of the preceding claims, wherein said slurry is continuously withdrawn from an area near the last point in said loop reaction zone where flow turns upward before a catalyst introduction zone.

10. The process of any of claims 1 to 8, wherein said slurry is continuously withdrawn from at least one area adjacent the end of a lower zone of horizontal flow."

III. The patent was granted also with a set of 29 claims, whereby claims 1, 18, 20 and 29 were independent claims. As in the original application, claims 1, 18 and 29 were directed to processes and claim 20 was directed to an apparatus.

IV. Three oppositions against the patent were filed as follows:
Opponent 1 on 14 June 2005 invoking the grounds of opposition pursuant to Art. 100(a) EPC (lack of novelty, lack of inventive step) and Art. 100(b) EPC.
Opponent 2 on 14 June 2005 invoking the grounds of opposition pursuant to Art. 100(a), 100(b) and 100(c) EPC. This opposition was withdrawn by letter dated 12 December 2005.
Opponent 3 on 15 June 2005 invoking the grounds of opposition pursuant to Art 100(a) EPC (lack of novelty, lack of inventive step), and Art 100(b) EPC.

Inter alia the following documents were cited in support of the oppositions:

D2: Milieu-Effektrapport Solvay N.V.- Antwerpen "Produktie-Eenheid van Hoge Dichtheid Polyethyleen 100 kTon/jaar" (Environmental impact report Solvay N.V.-

Antwerp provided in original and as English language translation)
D11: US-A-3 248 179

V. The decision of the opposition division was based on a main request and an auxiliary request. Both requests contained process claims relating to the polymerisation of at least one olefin monomer and claims relating to a loop reactor apparatus. The opposition division held that the subject-matter of apparatus claim 20 and process claim 29 of the main request lacked novelty and that the subject-matter of process claims 1 and 18 and apparatus claim 20 of the auxiliary request lacked an inventive step.

VI. A notice of appeal against the decision was filed by the patent proprietor on 4 February 2010 with simultaneous payment of the prescribed fee. The statement of grounds of appeal, filed on 8 April 2010, was accompanied by a declaration by Mr. S.E. Kufeld and three sets of claims forming a main request and first and second auxiliary requests. Common to all requests was a restriction of the process claims to homo- or copolymerisation of ethylene with specified comonomers.

VII. The Respondents I (Opponent O1) and II (Opponent O3) replied with letters dated 17 August 2010 and 24 August 2010 respectively. Respondent I submitted *inter alia* a new translation of D2, designated D30.

VIII. By a letter dated 12 December 2011 the appellant submitted 7 sets of claims forming a main request and first to sixth auxiliary requests. The independent process claims contained the same restriction with

respect to the monomers as the claims submitted with the statement of grounds of appeal.

IX. On 22 January 2013 the Board issued a summons to attend oral proceedings. In a communication dated 21 March 2013 the Board set out its preliminary view of the case.

X. By letter of 3 May 2013 the appellant submitted seven sets of claims forming a main and first to sixth auxiliary requests, replacing the requests on file until then. Common to all requests with the exception of the fifth auxiliary request was the removal of the restriction referred to in sections VI and VIII above in respect of the permissible monomers from the process claims.

The fifth auxiliary request contained 14 claims of which claims 1, 4 and 7 read as follows (additions compared to the claims as originally filed in **bold**, deletions in ~~strikethrough~~ by the Board):

1. A polymerization process comprising:
~~polymerizing,~~ in a loop reaction zone, **homopolymerising ethylene or copolymerising ethylene and 1-butene, 1-pentene, 1-hexene , 1-octene or 1-decene** ~~at least one olefin monomer~~ in a liquid diluent to produce a fluid slurry comprising liquid diluent and solid olefin polymer particles;
maintaining a concentration of said solid olefin polymer particles in said slurry in said zone of greater than ~~40~~ **50** weight percent based on the weight of said polymer particles and the weight of said liquid diluent; and

continuously withdrawing a slurry having an increase in solids concentration as compared with said slurry in said zone, the thus withdrawn slurry comprising withdrawn liquid diluent and withdrawn solid polymer particles as an intermediate product of said process, **wherein said slurry is continuously withdrawn from an area near the last point in said loop reaction zone where flow turns upward before a catalyst introduction zone, and**
wherein said intermediate product of said process is continuously passed through a heating zone wherein said intermediate product is heated to produce a heated intermediate product and thereafter said heated intermediate product is exposed to a pressure drop in a high pressure flash zone, said heated intermediate product being heated to an extent such that a major portion of said withdrawn liquid diluent is vaporized and thus separated from said withdrawn solid polymer particles, the thus separated withdrawn liquid diluent thereafter being condensed for recycle, without any compression, by heat exchange with a fluid having a temperature within the range of 4 to 54°C (40 to 130 degrees F).

4. The process of ~~any of claims 1 to 3~~ **claim 1 or claim 2,** wherein a pressure differential of ~~at least 0.124 MPa gauge (18 psig)~~ **greater than 0.07 mm per mm (0.07 foot per foot) of reactor flow path length** is maintained in a propulsion zone ~~to circulate said slurry through said reaction zone~~ **, in particular wherein said differential is within the range of 0.07 to 0.15 mm per mm (0.07 to 0.15 foot per foot) of said reactor flow path length.**

~~10.~~ **7.** The process of any of claims 1 to ~~8~~ **6,** wherein said slurry is continuously withdrawn from at least one area adjacent the end of a lower zone of horizontal flow."

Claims 8-14 were dependent, directly or indirectly, on claim 7.

XI. Respondent I made a further written submission by letter also dated 3 May 2013.

XII. Oral proceedings were held before the Board on 6 June 2013.

In the course of the oral proceedings, after discussion of the admissibility of the requests filed on 3 May 2013, the appellant withdrew the main request and the first to fourth and sixth auxiliary requests as filed with the letter of 3 May 2013 and requested that the sets of claims as filed with the letter dated 12 December 2011 (main, first to sixth auxiliary request) be reinstated as the main request and first to sixth auxiliary requests. The set of claims filed as the fifth auxiliary request with the submission of 3 May 2013 was renumbered as seventh auxiliary request. A further request, designated eighth auxiliary request and consisting of claims 1-6 of the seventh auxiliary request (i.e. fifth auxiliary request as filed with letter of 3 May 2013) was also submitted.

XIII. The arguments of the appellant can be summarized as follows:

Admissibility of the main and first to sixth auxiliary requests

The main and first to sixth auxiliary requests had been filed significantly in advance of the oral proceedings (December 2011) so that the other parties had had ample opportunity to consider these. It was not of significance that these claims had subsequently been replaced by new claims (May 2013). The readmission of the December 2011 requests to the procedure could not take the respondents by surprise. The respondents could have expected that, in the case that the requests of May 2013 were not admitted to the proceedings, the appellant would revert to earlier filed requests. They were an honest response to the respondents' arguments. The requirement of *prima facie* allowability was not applicable to the requests resubmitted during the oral proceedings.

Seventh auxiliary request

Art. 123(2) EPC

a) Claim 1 of the seventh auxiliary request was derived from the features of originally filed claims 1, 3 and 8 and the passage commencing at page 7 line 9 of the description of the original application.
With respect to the term "zone", the skilled person would understand, in particular from original claim 1 and the discussion on page 7 of the original application that "zone" defined that volume within the

reactor where reaction took place, and that it was within this volume, i.e. this "zone" that the specified concentration - which was the only concentration mentioned in the claim - had to be maintained. The term "zone" was also employed elsewhere in the application as filed, e.g. with respect to other stages of the process e.g. a "heating zone", "high pressure flash zone". There was no distinction between the "loop reactor" and the "loop reaction zone". Hence maintaining a concentration in a "loop reactor zone" was the same as maintaining the concentration in a "loop reactor".

With respect to the specified (co)monomers in claim 1, those were indicated by the passage at page 7, lines 5-15 of the original application in relation to a "loop reactor". Since there was no distinction between "loop reactor" and "loop reaction zone", the introduction in claim 1 did not extend the subject-matter of the claim beyond what was originally disclosed. This was consistent with original claim 2.

b) Regarding the replacement of "and" (originally filed description) by "or" (operative claim) in the phrase "homopolymerising ethylene **and** copolymerising ..." the originally filed description explained that the invention was suitable for both homopolymerisation and copolymerisation of ethylene. However this statement would not be understood as relating to processes which simultaneously involved both types of polymerisation. In the operative claim the term "or" had its usual meaning so that the claimed process was a process in which either homopolymerisation or copolymerisation of

ethylene was carried out, as had been originally disclosed.

c) The subject matter of claim 7 corresponded to originally filed claim 10, the resulting arrangement also being disclosed starting at page 8 of the application as filed which related to various alternative arrangements of the take-off from the reactor. There was no indication in the application as filed that these alternatives could not be employed in combination. The amendments served to address objections raised by the respondents so that they were allowable pursuant to R. 80 EPC.

Eighth auxiliary request

Art. 84 and 123(2) EPC

The correction of the pressure units in claim 4 had been found by the opposition division to be an allowable correction of an obvious error. The basis for the correction was the clearly incorrect set of units. As followed from claim 5 and page 15 of the application as filed the pressure is reported as foot pressure drop per foot of reactor length, i.e. length/length which units cancelled out. Consequently no unit could be specified for the pressure drop. The correct conversion was consequently the same number irrespective of the units, which is what operative claim 4 specified.

Art. 83 EPC

It was known how to determine the concentration of a slurry as demonstrated by the fact that corresponding information was reported in a number of documents. The argument that different measurement methods would yield different results was speculative. In any case it was normal in the art that differing methods would give differing results. Any ambiguity or uncertainty would only result in a deficiency with respect to Art. 83 EPC if it were shown that the nature of the ambiguity was such as to deprive the skilled person of the promise of the invention (with reference to T 608/07 of 27 April 2009). No evidence had been advanced to support such a position. Any variations or uncertainty in the measurement, e.g. arising from the fact that the value was necessarily an average, were matters falling within the ambit of Art. 84 EPC, not Art. 83 EPC. It was disputed that the variation would be as high as argued by the respondents (of the order of 4%).

Art. 54 EPC

No document disclosed the subject-matter claimed.

Art. 56 EPC

The combination of features claimed was not arbitrary but provided a genuine technical advantage. None of the documents cited addressed the same technical problem as the patent in suit or provided any guidance towards the claimed combination of features as its solution. Therefore, the claimed subject-matter was inventive.

XIV. The arguments of the respondents can be summarised as follows:

Admissibility of the main and first to sixth auxiliary requests

The sets of claims forming the main and first to sixth auxiliary requests (i.e. the sets of claims originally submitted with the letter of 12 December 2011) had been unconditionally abandoned with the letter of 3 May 2013 and replaced by newly filed sets of claims.

The respondents in their preparation for the oral proceedings had no reason to expect to have to address said requests and were not in a position deal with said sets of claims. Consequently the sets of claims originally filed on 12 December 2011, subsequently withdrawn and then sought to be reintroduced on the occasion of the oral proceedings should not be admitted to the procedure.

Seventh auxiliary request

Art. 123(2) EPC

a) The term "loop reaction zone" (original claim 1) was broader than "loop reactor" (page 7). Processes were known employing two loop reactors in series, jointly forming a "loop reaction zone" and the appellant was on record as referring to such an arrangement as a "zone". Hence the combination of the subject matter of originally filed claim 1 with the disclosure of monomers from originally filed page 7 contravened the requirements of Art. 123(2) EPC. Original claim 2 could

not provide a basis for the subject-matter of operative claim 1 since original claim 2 was restricted to a combination of ethylene with a specific comonomer in specified proportions with a specific diluent. Also original claim 2 did not assist in establishing the relationship between "loop reactor" and "loop reaction zone".

b) A further defect arose from the change of "and" of original page 7 ("the homopolymerisation of ethylene **and** the copolymerization") to "or" in operative claim 1. This amendment added matter. In the case of a loop reactor system consisting of two loop reactors it would be possible to operate one reactor to effect homopolymerisation and the other to effect copolymerisation, or to operate both reactors to carry out the same type of reaction (homo- or co-polymerisation). Thus the technical meanings of "and" and "or" in the context of the claims differed, and the replacement of "and" by "or" gave rise to an objection pursuant to Art. 123(2) EPC.

c) Regarding claim 7, in the application as filed and also in the patent as granted the features of operative claim 7 had been present in claim 10 which was dependent solely on claim 1. The subject-matter of original claim 9 - relating to an alternative arrangement of the take off mechanism - was now incorporated into claim 1. Hence the embodiments of original claims 9 and 10, which according to the structure of the originally filed claims and the disclosure of the description were distinct, separate alternatives, were now simultaneously present in claim 1. Such subject-matter extended beyond the

content of the application as filed. Furthermore, the effect of this amendment, even if allowable pursuant to Art. 123(2) EPC, did not serve to address a ground of opposition and hence should not be allowed pursuant to R. 80 EPC.

Eighth auxiliary request

Art. 123(2) EPC/Art. 84 EPC

The amendment of the pressure units in claim 4 compared to the application as filed and the patent as granted gave rise to objections under the provisions of either or both of Art. 84 and 123(2) EPC. The feature relating to the pressure units had been the subject of multiple amendments throughout the procedure. The amendment now proposed did not constitute an obvious correction of the original disclosure. Furthermore the basis for the pressure units was not given. There were many different methods for measuring and reporting pressure (height of water, height of Hg, height of slurry etc.). The absence of any indication rendered the claim as amended unclear contrary to the requirements of Art. 84 EPC.

Art. 83 EPC

The patent contained no information or guidance as to the method to be employed for measuring the solids content of the slurry. The measurement was not trivial and required making certain assumptions which critically influenced the value determined. The accuracy of any such measurement value was furthermore subject to significant variation, e.g. of the order of 4%.

The consequence was that it was impossible for the skilled person to ascertain when a system was operating in accordance with the features of the claim. In particular in the case of a reactor system consisting of two loops there was a further uncertainty, in particular in the case where the loops had different volumes since it was not known where to carry out the measurement, which factor would also affect the outcome.

Art. 54 EPC

It was conceded that there was no document which disclosed the subject-matter of the eighth auxiliary request.

Art. 56 EPC

D2/D30 or D11 could serve as the closest prior art. D2/D30 disclosed a loop polymerisation process with continuous take off. The concentration as required by operative claim 1 was not disclosed, but there was no obstacle to increasing the concentration to the specified level. The feature that the withdrawn slurry had a higher concentration than the slurry in the reactor and the feature relating to the location of the take off point were also obvious, as taught by a number of documents. Similarly the downstream processing steps were known from the prior art.

The process disclosed in D11 had many features in common with the process claimed. The product was continuously withdrawn from the reactor at a bend, meaning there would be an increase in slurry solids compared to the remainder of the reactor. The slurry

concentration in the reactor specified according to the operative claims merely had the effect of reducing the amount of diluent in the outflow. The effect was predictable and could not support an inventive step. The specified value of the slurry solids concentration was arbitrary and was also disclosed in some prior art documents. Similarly the further features relating to the location of the take off point, the location of the catalyst entry point and their relationship as well as the nature of the downstream treatment steps were obvious and could not contribute to an inventive step.

XV. The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained on the basis of one of the sets of claims according to the main request or first to sixth auxiliary requests as submitted with the letter dated 12 December 2011, or on the basis of the claims according to the seventh auxiliary request filed as fifth auxiliary request with the letter dated 3 May 2013, or on the basis of the eighth auxiliary request (claims 1 to 6) as submitted during the oral proceedings on 6 June 2013.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of the main request, first to sixth auxiliary requests*

2.1 The main request and first to sixth auxiliary requests had been submitted with the appellant's second letter in the appeal proceedings (dated 12 December 2011). Common to all these sets of claims was a restriction in respect of the monomers to be (co)polymerised in the claimed process.

2.2 In its letter dated 03 May 2013 the appellant stated in section 1.1, second and third sentences with respect to the provisional opinion of the Board "In the light of that Provisional Opinion the Proprietor/Appellant has decided to amend the requests as described below. The changes made to the requests are a direct result of the comments made in the Provisional Opinion [...]". In section 2.2 of the letter it was stated: "Attached herewith are claim sets for each of the main request and the first to sixth auxiliary requests, **which replace all requests previously on file**" (Board's emphasis).

The wording of the letter of 3 May 2013 is in this respect explicit and unequivocal. Therefore the requests filed on 12 December 2011 were no longer valid and are to be seen as having been explicitly unconditionally withdrawn by the letter of 3 May 2013, the final written submission before the oral proceedings.

The case presented immediately prior to the oral proceedings, which the other parties were consequently expecting to have to address was therefore that based on the claims of 3 May 2013. Of these seven sets of claims (main, first to sixth auxiliary request) only the fifth auxiliary request retained the definition of the (co)monomers in process claim 1 as had been present in the claims sets of 12 December 2011.

2.3 In view of the unconditional withdrawal of the claims sets of 12 December 2011, the step taken by the appellant at the oral proceedings of changing its case by withdrawing the sets of claims submitted on 3 May 2013 and seeking to reintroduce those withdrawn sets of claims of 12 December 2011 could not have been foreseen and consequently took the other parties - and indeed the Board - by surprise. The respondents submitted in this connection that they had not been expecting to have to deal with the requests of 12 December 2011, which they regarded as unconditionally withdrawn, and consequently were not in a position to do so.

2.4 With respect to the argument of the appellant that the respondents should have expected, in the case that the sets of claims of 3 May 2013 were not admitted to the procedure, that the appellant would revert to the set of claims of 12 December 2011, the Board observes that there was no indication to this effect in the letter of 3 May 2013.

2.5 Furthermore the Board in its communication raised objections against all of the main and first to sixth

auxiliary requests as filed with the letter of 12 December 2011. The response of the appellant to the objections, with explicit reference to the provisional opinion of the Board (see above) was to withdraw the corresponding requests, without presenting any counterarguments. Consequently the Board had no reason to modify its assessment of the allowability of the sets of claims corresponding to the requests filed by letter of 12 December 2011, withdrawn by letter of 3 May 2013 and filed again at the oral proceedings. The (re)filing of the requests at the oral proceedings constituted a change of case at a very advanced stage of the proceedings.

2.6 According to the Rules of Procedure of the Boards of Appeal, Art. 13(3) amendments sought to be made to a party's case after oral proceedings have been arranged shall not be admitted if they raise issues with the Board or the other parties cannot reasonably be expected to deal with without adjournment of the oral proceedings.

Under the present circumstances the Board decided, pursuant to Art. 13(3) RPBA, not to (re)admit the sets of claims of 12 December 2011 to the procedure.

Accordingly in exercise of the discretion permitted pursuant to Art. 114(2) EPC and Art. 12(4) RPBA the main and first to sixth auxiliary requests presented at the oral proceedings are not admitted to the procedure.

3. *Seventh auxiliary request*

3.1 *Art. 123(2) EPC*

3.1.1 Claim 1 is based on the disclosure of originally filed claims 1, 3 (concentration of greater than 50 weight percent), 9 (location of withdrawal of the slurry), and 8 (treatment of the intermediate product). The specified monomers are disclosed at page 7 lines 5-13 of the original application, which passage discloses that:

"The present invention is applicable to any olefin polymerization in a loop reactor utilizing a diluent so as to produce a product slurry of polymer and diluent. Suitable olefin monomers are 1-olefins having up to 8 carbon atoms per molecule and no branching nearer the double bond than the 4-position. The invention is particularly suitable for the homopolymerization of ethylene and the copolymerization of ethylene and a higher 1-olefin such as butene, 1-pentene, 1-hexene, 1-octene or 1-decene."

3.1.2 Claim 1 as originally filed is directed to polymerisation in a "loop reaction zone". The operative claim retains the wording of the originally filed claim, i.e. "loop reaction zone". The terminologies employed in the claim and the passage on page 7 of the description cited above ("loop reactor") thus differ and it has to be ascertained whether the difference has any significance for Article 123(2) EPC.

3.1.3 A further instance where the (co)polymerization of ethylene is mentioned is claim 2 of the application as

filed, which is dependent on claim 1 and specifies that the olefin monomer comprises ethylene and in particular that the monomer comprises ethylene and 0.01-5 weight percent hexene, i.e. one of the monomers specified at page 7. Original claim 2 further specifies that the diluent is isobutane which is also disclosed at page 7. In the light of the relationship between originally filed claims 1 and 2 it is apparent that the application as filed related to the homo- or copolymerisation of ethylene.

3.1.4 Whilst the scope of originally filed claim 2 in respect of the permissible (co)monomers was significantly smaller than that of the disclosure of page 7, the existence of claim 2 indicates that the process of original claim 1 - in a loop reaction zone - was directed to polymerisation and copolymerisation of such monomers, which is consistent with the disclosure of page 7.

This information elucidates the relationship between the passage of page 7 and the originally filed claims and demonstrates that far from being distinct and disconnected subject-matters they in fact form a coherent whole, i.e. (co)polymerisation of such monomers in a loop reaction zone.

3.1.5 Regarding the use of "homopolymerizing ethylene **OR** copolymerizing ethylene and.... " in operative claim 1, whereas according to the passage on page 7 "The invention is particularly suitable for the homopolymerization of ethylene **AND** the copolymerization of ethylene and ...", the Board can see no contradiction since the description indicates that the

invention is applicable to both types of polymerisation, i.e. to two embodiments which are not necessarily, but might be carried out simultaneously. The wording of the claim reflects this by defining two alternatives for the process, namely homo- and copolymerisation, so that there is no contradiction or inconsistency in defining these two embodiments as alternative subject-matters for which protection is sought in the claim.

3.1.6 Accordingly it is concluded that the subject-matter of claim 1 does not contravene the requirements of Art. 123(2) EPC.

3.2 Claims 2, 3, 5 and 6 are derived from originally filed claims 2, 4, 6 and 7 and also do not give rise to objections pursuant to Art. 123(2) EPC.

3.3 With respect to operative claim 4, according to claim 5 of the application as originally filed the pressure differential (also referred to as "pressure drop" in the application as filed and the granted patent) is given as "21.3 per mm (0.07 per foot) [...] in particular [...] 21.3 to 45.7 mm/mm per mm (0.07 to 0.15 ft/ft per foot)[...]". In the patent as granted the corresponding S.I unit value was given as "0.23 per mm (0.07 per foot), in particular 0.23 to 0.49 mm mm/mm per mm (0.07 to 0.15 ft/ft per foot)".

In operative claim 4 the values are specified, for both the S.I. units and the original units as the same numeric value, namely 0.07 mm per mm (0.07 foot per foot), in particular 0.07 to 0.15 mm (0.07 to 0.15 foot per foot).

The discussion at page 15, line 5 of the originally filed application discloses that the specified pressure drop was for a nominal 24 inch diameter reactor and further stated that the units of pressure - ft/ft cancelled out.

The first aspect to be considered is that the "conversion" as contained in the application as originally filed and which was present in amended form in the patent as granted was incorrect since the pressure differential is dimensionless with the consequence that no conversion was required or indeed possible. The amendment to reinstate the correct value, being in the nature of the correction of an obvious error (since the original non-metric units remained in the patent) is permissible under R. 139 EPC. Regarding the matter of the size of the pipe for which the pressure differential applies, original claim 5 contained no restriction in this respect. Consequently, even though the corresponding passage of the originally filed description did specify that the pressure drop was for a pipe of 24 inch diameter, the absence of this restriction from the originally filed claim means that an objection pursuant to Art. 123(2) EPC does not arise.

The conclusion is that the specification of the pressure differential in operative claim 4 does not give rise to objections pursuant Art. 123(2) EPC.

3.4 Claim 7 specifies that the slurry is continuously withdrawn from at least one area adjacent the end of a lower zone of horizontal flow. This feature was present in originally filed claim 10 which was dependent on claims 1 to 8.

3.4.1 Operative claim 1, on which claim 7 is dependent however specifies that the slurry is continuously withdrawn from an area near the last point in the loop reaction zone where flow turns upwards before a catalyst introduction zone, which was the subject-matter of originally filed claim 9. In the originally filed application claims 9 and 10 were each dependent on claim 1. However claim 10 was not dependent on claim 9. Consequently the structure of the claims of the application as originally filed does not result in a disclosure of the subject-matter of claim 7.

3.4.2 The description also does not provide a disclosure of the subject-matter of claim 7. The passage invoked by the appellant (commencing at page 8) discusses the construction and operation of the apparatus with reference to the figure, as is explicitly stated in line 5 of page 8. Consequently this passage does not constitute a general disclosure. The first paragraph of page 9, which is on the contrary in the nature of a general discussion, corresponds to the subject-matter of original claim 9, i.e. now incorporated into claim 1. The final sentence of this paragraph states that the take-off appendage can be located on any segment or any elbow. There is no link in the text between this passage on page 9 and the preceding passage on page 8.

Consequently neither the structure of the claims nor that of the description results in a disclosure of the subject-matter of operative claim 7, which therefore does not meet the requirements of Art. 123(2) EPC. This same conclusion applies to claims 8-14, all of which are dependent on claim 7.

3.4.3 The seventh auxiliary request is therefore refused.

4. *Eighth auxiliary request*

4.1 Art. 123(2) EPC

4.2 Due to the deletion of claims 7-14 the defects noted for the seventh auxiliary request have been addressed.

4.3 Art. 84 EPC

The patent in suit specified in claim 5 the pressure differential. The only modification with respect to the granted claim is a correction of an obvious error (see section 3.3, above) in the numerical value and units of this dimension. The subject-matter of the claim in this respect has not been modified.
Consequently an objection of lack of clarity cannot be raised against of claim 4.

4.4 Art. 83 EPC

4.4.1 The objections raised by the respondents with respect to Art. 83 EPC concerned the determination of the slurry concentration, in particular the precision of the measurement and the reproducibility of the values obtained.

However the question of knowing precisely the boundaries of the claimed subject-matter is governed by Art. 84 EPC, not Art. 83 EPC. The technical features of the solids concentration of the slurry had been present, albeit with a different value, in the claims of the patent as granted. The respondents did not demonstrate

that the magnitude or nature of any uncertainty with respect to the value of the solids concentration had changed as a result of the amendment from 40 to 50 weight percent. Consequently there are no grounds for the Board to conclude that that the amendment in terms of the solids content of the slurry had given rise to an unclarity or ambiguity beyond any which had already been present in the claims of the patent as granted. As a result, objections pursuant to Art. 84 EPC are not available in respect of the feature of the solids concentration.

4.4.2 The respondents have not demonstrated that it is not possible to determine the slurry concentration, or that any uncertainties with respect to this feature were such as to deprive the skilled person of the promise of the invention (T 608/07 as cited by the appellant). Nor has it been argued that there would be any technical difficulty in attaining the specified slurry concentration. On the contrary, in their submissions with respect to inventive step the respondents argued that it would be a matter of routine for the skilled person to increase the slurry concentration to the range now claimed.

Consequently there is no evidence for a defect pursuant to Art. 83 EPC in respect of the feature of the solids content of the slurry.

4.4.3 No other objections under this Article have been raised. Consequently the requirements of Art. 83 EPC are satisfied.

4.5 Art. 54 EPC

The respondents explicitly stated that none of the cited documents anticipated the subject-matter of the claims of the eighth auxiliary request. The Board is aware of no reason to diverge from the position of the respondents.

Accordingly the requirements of Art. 54 EPC are satisfied.

4.6 Art. 56 EPC.

Closest prior art.

4.6.1 The closest prior art is generally that technical teaching which corresponds to a purpose or technical effect similar to that of the invention and requiring the minimum of structural and functional modifications (See the publication "Case Law of the Boards of Appeal of the European Patent Office, 6th Edition, 2010" section I.D.3.1).

4.6.2 The patent relates to high solids slurry polymerisation of olefin monomers in a liquid diluent. According to the patent in suit such polymerisations are carried out on a continuous basis in pipe loop reactors. Conventionally removal of the product is effected by settling legs, which operate on a batch principle. Settling legs however present a number problems: First they impose a "batch" technique on a process which is in essence continuous, the discharges of accumulated polymer from a settling leg leading to interference of the flow in the upstream part of the reactor and the

recovery system downstream. Settling legs are furthermore maintenance intensive. Secondly, it is difficult to increase the size of settling legs meaning that it is problematic to increase the size of reactors employing this technology. Settling legs have nevertheless continued to be employed especially in the case of polymerisations in a slurry in a liquid diluent, which polymerisations are generally limited to concentrations of 37 to 40 weight percent solids because they were believed to be required to increase the solids concentration of the slurry finally recovered as product slurry (paragraphs [0002]-[0005]).

4.6.3 The problem addressed by the patent was thus to provide a process for the production of olefin polymers in a slurry in a liquid diluent using continuous product slurry take off, or, in other words, to avoid the use of settling legs (paragraph [0009]). With regard to slurry concentration, example 3 demonstrates that it is possible to operate the claimed process at an average reactor solids content of 53 wt.-%.

4.6.4 The respondents proposed two documents as candidates for constituting the closest prior art, namely D2/D30 and D11.

(a) D2/D30 is an environmental impact report relating to a high density polyethylene production unit. According to section 1.5.2.b and figure 1.5/5 the reactor consists of large-diameter tubes connected by elbow bends forming a closed ring, i.e. a loop reactor.

D2/D30 discloses in section 1.5.2.1.b, in the original language: "De polymeersuspensie wordt door een axiale pomp in de reaktor rondgepompt. Een kleine hoeveelheid van het rondgepompt debiet wordt continu afgetapt uit de reaktor en naar de polymeerafdeling gezonden".

Which passage has been translated in D2 as: "The polymer suspension was circulated in the reactor by means of an axial pump. A small **quantity** of the circulated flow is continuously discharged from the reactor and **fed** to the polymer **department**".

According to the later translation, D30, this passage is translated as follows: "In the reactor an axial pump circulates the polymer suspension. A small **amount** of the circulated flow is continuously discharged from the reactor and **sent** to the polymer **section**".

In spite of the discrepancies in the translations it would appear that the indicated paragraph is referring to sampling of the polymer and dispatch of these - discrete - samples to some kind of laboratory facility for quality control purposes rather than referring to a continuous, uninterrupted flow of material to a downstream apparatus for further processing. In any case D2 is silent on the location and nature of the take off from the reactor. All that is said, in paragraph 1.5.2.1.c, is that the pressure of the suspension of polymer and diluent leaving the reactor is relieved adiabatically in a flash tank. This wording provides no information relating to

the location of the slurry take off and does not constitute a disclosure of continuous removal of the polymer slurry. Furthermore there is no disclosure of the downstream process steps as defined by the operative claims. Due to the nature of the document as an environmental impact report, it is not apparent from D2 which technical problem is to be addressed by the reaction apparatus described, let alone which technical features were employed to solve such problem.

(b) D11 relates to a method and apparatus for the production of solid polymers of olefins. According to claim 1 D11 is directed to a reactor comprising in combination a loop conduit, propelling means, a monomer intake to the loop conduit, vanes within the conduit and outlet means from the conduit. According to Figure 1, the reaction effluent, i.e. polymer slurry, is withdrawn at an upper location of the reactor where the flow moves from horizontal to vertically downward. The technical problem which D11 sets out to address is to provide an improved method and apparatus for producing high molecular weight solid particle from polymer and to avoid fouling of reaction surfaces in the polymerisation (D11, col. 3 lines 15-21). To this end the reactor configuration contains extended vertical sections with short horizontal sections (col. 6 lines 22-29), ensuring that the reactor contents are maintained in a highly turbulent state and to ensure that there is a highly homogeneous distribution within the reactor so that there is no concentration gradient from the top to the bottom of the horizontal pipe

(D11, col. 5 lines 35-46). The polymer is withdrawn from the reactor periodically or continuously, as desired, by an opening - reference 26 - which opening can be at any convenient location (D11, col. 6 lines 8-9). The polymer is then subjected to - undefined - further processing. According to the examples of D11 ethylene homopolymer and ethylene-butene copolymer were prepared in a continuous process whereby the solids content of the reactor is reported as being 22 and 15.3 weight percent respectively.

D11 therefore takes a different approach to the patent in suit in that concentration gradients within the reaction system are explicitly to be avoided, whereas according to the patent in suit concentration gradients are central to the process.

4.6.5 From the foregoing analysis it emerges that neither of the documents proposed by the respondents as closest prior art addresses the same problem with respect to loop reaction polymerisation processes as set out in the patent in suit. In D2/D30 there is no indication of any problem at all. D11 is focused on avoiding the occurrence of fouling within the reactor and no significance is attached to the manner of withdrawal of the slurry from the reactor in respect of which aspect D11 provides no details.

Obviousness

4.7 Starting from a state of the art the problem of which is not closely oriented to the claimed subject-matter,

leading to the absence of an identifiable, convergent aim, means that there is no basis for proposing any relevant measure or modification of the "closest state of the art" to achieve such an aim. The consequence is that any attempt by the skilled person to establish a chain of considerations leading in an obvious way to the claimed subject-matter gets stuck at the start (following T 644/97 of 22 April 1999).

4.8 It follows from the above that there is no basis in the arguments advanced by the respondents for concluding that the subject-matter claimed does not involve an inventive step. The requirements of Art. 56 EPC are fulfilled.

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 in amended form on the basis of the eighth auxiliary request (claims 1-6) as submitted during the oral proceedings on 6 June 2013 and after any necessary consequential amendment of the description.

The Registrar | The Chairman

E. Goergmaier | B. ter Laan