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Datasheet for the decision of 15 March 2017

Case Number: T 0261/13 - 3.3.03

Application Number: 03754705.6

Publication Number: 1551881

IPC: C08F2/14, C08F6/00, C08F6/24

Language of the proceedings: EN

Title of invention:
PROCESS AND APPARATUS FOR SEPARATING DILUENT FROM POLYMER SOLIDS

Patent Proprietor:
CHEVRON PHILLIPS CHEMICAL COMPANY LP

Opponents:
Ineos Sales (UK) Limited
Total Research & Technology Feluy

Relevant legal provisions:
RPBA Art. 13(1)
EPC Art. 54, 56

Keyword:
Late-filed auxiliary requests - admitted (yes)
Novelty - unambiguous disclosure (no)
Inventive step (no) - obvious modification - all requests

Decisions cited:
G 0004/88, T 0939/92

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Case Number: T 0261/13 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 15 March 2017

Appellant: (Patent Proprietor)	CHEVRON PHILLIPS CHEMICAL COMPANY LP 10001 Six Pines Drive The Woodlands, TX 77380 (US)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted on 16 January 2013 revoking European patent No. 1551881 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman D. Semino
Members: F. Rousseau
R. Cramer

Summary of Facts and Submissions

I. The appeal by the patent proprietor lies against the decision of the opposition division posted on 16 January 2013 to revoke European patent No. 1 551 881.

II. The contested decision was based on a main request, auxiliary requests 1, 2D and 2E all filed during the oral proceedings on 6 December 2012, as well further auxiliary requests submitted with letters of 8 October 2012 and 12 November 2012.

III. The decision under appeal can be summarized as follows. Claims 2 of the main request and auxiliary requests 1 and 2D contained the feature "*wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C)*" which had been taken from the description and introduced in the claims on the day of the oral proceedings. As the introduction of that feature could provide an advantage to the patent proprietor, neither the main request, nor auxiliary requests 1 and 2D were admitted into the proceedings. Auxiliary request 2E met the requirements of Rule 80 EPC, as well as those of Articles 84, 123(2), 123(3), 83 and 54 EPC. As regards inventive step the closest prior art was D12 (WO-A-99/60028) which also disclosed a method for continuously separating polymer solids from a liquid medium in slurry polymerisation processes in which two flash tanks were used. The problem solved over D12 was merely to provide an alternative apparatus. That alternative apparatus, however, did not involve an inventive step, because the only distinguishing feature of the claimed subject-matter over D12, which was the transfer of the polymer solids from the intermediate pressure zone without passing

through a flash zone, was suggested by an embodiment of D12 in which 100% of the liquids was removed within the first flash tank. None of the other auxiliary requests met the requirements of Article 123(2) EPC.

IV. An appeal against that decision was lodged by the patent proprietor (appellant). The statement of grounds of appeal included a main request and auxiliary requests 1A to 1C, 2 and 2A to 2C, 3 and 3A, 4 and 4A, 5 and 5A.

V. In a communication of the Board in preparation of oral proceedings the Board indicated *inter alia* that the insertion of the feature "*wherein the intermediate pressure zone is at a temperature of from 100 °F to 250 °F (37.8 °C to 121.1 °C)*" into claim 2 of the main request was necessary in order to overcome the objection invoked by opponents 1 and 2 (respondents 1 and 2) that granted claim 2 extended beyond the content of the application as filed, but that no unwarranted advantage could be given to the patent proprietor by allowing that amendment to claim 2. It was therefore indicated that the Board had no reason to exercise the discretion conferred to it by Article 12(4) RPBA to hold the main request inadmissible (points 9 to 13 in the communication). It was also indicated that the claimed process appeared to be sufficiently disclosed when all diluent or substantially all diluent was removed in the intermediate pressure zone, but that it did not appear to be the case when for example only slightly more than half of the diluent was vaporized in the intermediate pressure zone as the claimed process did not allow the existence of an additional flash zone before the purge zone (point 24).

VI. The appellant submitted with letter of 3 March 2017 a new main request and new auxiliary requests 1, 2, 2A, 3, 4 or 5. Those were indicated to correspond to former auxiliary requests 1B, 1C, 2B, 2C, 3A, 4A and 5A, respectively. The other claim requests were withdrawn. The claims which are relevant to the present decision are:

Main request

"1. A process for slurry polymerization of olefins and for separating polymer solids from diluent, the process comprising:

polymerizing in a reaction zone at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising the liquid diluent and polymer solids;
withdrawing a portion of the slurry from the reaction zone;
heating the withdrawn portion of the slurry;
passing the withdrawn portion of the slurry to an intermediate pressure zone in which a majority of the diluent is separated from the polymer solids, wherein the intermediate pressure zone is at an absolute pressure in the range of from 100 psi to 1500 psi (690-10300kPa);
withdrawing the polymer solids from the intermediate pressure zone;
transferring the polymer solids to a purge zone without passing through a flash zone;
monitoring the level of the polymer solids in the intermediate pressure zone; and
adjusting the withdrawal of the polymer solids from the intermediate pressure zone in response to the monitored level.

2. A process according to claim 1 wherein the separated diluent is condensed without compression after the intermediate pressure zone, and wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C).

4. A process according to claim 1 wherein the polymer solids are substantially free of unentrained diluent after the intermediate pressure zone.

5. A process according to claim 1 wherein the polymer solids are substantially free of entrained diluent after the purge zone."

Auxiliary request 1

Claims 1 and 3 of auxiliary request 1 have the same wording as claims 1 and 4 of the main request, respectively.

Auxiliary requests 2 and 2A

Claims 1 of auxiliary requests 2 and 2A are identical. They contain the same wording as claim 1 of the main request, supplemented at the end by the following text:

"wherein the polymer solids are substantially free of unentrained diluent after the intermediate pressure zone; and
wherein the step for controlling the rate of the withdrawing the (sic) polymer solids from the intermediate pressure zone comprises:
establishing a first signal representative of the actual level of the polymer solids in the intermediate pressure zone;

establishing a second signal representative of a desired level of the polymer solids in the intermediate pressure zone;
comparing the first signal and the second signal and establishing a third signal responsive to the difference between the first signal and the second signal; and
manipulating the solids outlet control valve in response to the third signal."

Auxiliary request 3

Compared to claims 1 of auxiliary requests 2 and 2A, claim 1 of auxiliary request 3 contains the additional feature "wherein the separated diluent is condensed without compression after the intermediate pressure zone, and wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C);" inserted between the features "*....adjusting the withdrawal of the polymer solids from the intermediate pressure zone in response to the monitored level;*" and "*wherein the polymer solids are substantially free of unentrained diluent after the intermediate pressure zone...*".

Auxiliary request 4

Compared to claim 1 of auxiliary request 3, claim 1 of auxiliary request 4 contains the additional wording "and wherein the control valve is manipulated by a control system which is configured to manipulate the control valve such that the polymer solids residence time is maintained in the range of 10 seconds to 120 minutes".

Auxiliary request 5

Compared to claim 1 of auxiliary request 4, claim 1 of auxiliary request 5 contains the the word "continuously" inserted as shown below in bold:
"... *the pressure in the range of from 100 psi to 1500 psi (690-10300kPa);*
continuously *withdrawing the polymer solids from the intermediate pressure zone ...*".

VII. As far as relevant to the present decision, the submissions of the appellant can be summarized as follows:

(a) The claims of the main request and auxiliary requests 3, 4 and 5 had been already submitted with the statement of grounds of appeal and for the reasons indicated by the Board in its communication sent in preparation for the oral proceedings, the insertion of the feature "*wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C)*" did not justify their non admittance to the appeal proceedings.

(b) The absence of a flash zone between the intermediate pressure zone and the purge zone did not allow to conclude that sufficiency of disclosure was lacking, because a purge gas could be fed to the bottom of the purge column and exit the top of the purge column along with any purged diluent, as was taught in the application as filed.

(c) Concerning novelty, one could not understand from the polymerisation process disclosed in D12 that every drop of diluent could be vaporized in the first flash tank used for separating the diluent

from the polymer solids. That vaporization of all diluent could be achieved in the first flask tank could be understood only on the basis of a mere linguistic analysis of the description of D12. This, however, was technically impossible considering the embodiments and the technology described therein. Using the conditions employed in the first tank of D12, some diluent necessarily remained in the pores of the polymers (the so-called "entrained diluent"), whose vaporization was more difficult to achieve and necessarily had to occur under lower pressure in the second flash tank. The presence of a second flash tank in D12 had a technical necessity, meaning that D12 could not teach that vaporization of the diluent did not take place in the second flash tank. Accordingly, D12 could not disclose that the polymer solids were transferred from the first tank to the purge zone without having passed through a further flash zone. Accordingly, D12 did not anticipate the claimed subject-matter.

(d) As regards inventive step D12 constituted the closest prior art. The problem solved by the claimed process over that prior art was the provision of a simplified process for slurry polymerization of olefins and for separating solids from diluent which used a simplified apparatus and reduced costs.

(e) The whole point of D12 was the development of a two stage flash process in order to reduce the need for compression of vaporized diluent prior to recycling to the reactor in comparison to known processes, because compression amounted to a significant portion of the expenses involved in producing

polymers. In D12 compression of the vaporized diluent was still needed, but only after the second flash tank and for a more limited amount of vaporized diluent. The indication at page 28, lines 5-6 that the use of a continuous flash heater would vaporize up to 100% of the diluent and the further indication in the same paragraph in lines 9-10 that "*diluent recovery though the first flash tank would reduce utility and capital cost*" were to be read in that context. They did not suggest to eliminate the second stage low pressure flash. They only meant that a two-stages flash in which less diluent needed to be flashed in the second, low pressure flash tank, resulted in less costs associated with condensation by compression of removed diluent and further treatment such as drying. Moreover, D28 taught at page 28, lines 12-15 that the flash line heater would increase the temperature of the polymer in the downstream dryer system facilitating removal of entrained diluent in the second flash tank. Accordingly, those passages did not suggest to dispense with the second stage flash, but rather to incorporate a continuous flash line heater in order to improve the efficiency of the two stage flashes. Therefore, finding obvious to dispense with the second stage flash could only arise following an ex post facto analysis of the patent in suit.

(f) The inventive finding underlying the claimed process was at least based on the recognition that a level sensor could be used to control residence time of the polymer solids in the intermediate flash zone, allowing flashing and separation of more diluent, including more entrained diluent as shown in column 11, lines 1-5 of the contested

patent. This enabled the diluent, including unentrained and entrained diluent, to be removed by the combination of an intermediate pressure zone and a purge zone, which allowed to eliminate a low pressure flash tank and obtain the advantages of reduced costs and maintenance associated with the simpler arrangement of the claimed invention.

(g) Further, eliminating the second flash from D12 was far from trivial. The second stage flash in D12 played an essential role in removing entrained diluent and there was no hydrocarbon recovery downstream of the second stage flash in D12. Furthermore, to simply dispense with the second flash tank would adversely affect other aspects of the system and process described in D12, for example because in D12 polymer fines entrained in the cyclone 13 with the diluent vaporized in the first flash tank were returned to the bulk of the polymer flow in the second flash tank.

(h) Hence, the elimination of the second flash vaporization step in the process of D12 was a non-obvious and therefore inventive measure.

(i) The arguments in support of an inventive step applied for even stronger reasons to the auxiliary requests.

VIII. As far as relevant to the present decision, the submissions of the respondents can be summarized as follows:

(a) The main request, as well as auxiliary requests 3, 4 and 5 should not be admitted into the proceedings, because they all contained the feature

"*wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C)*" introduced on the day of the oral proceedings before the opposition division. The decision of the opposition division not to admit the requests which contained that feature into the proceedings was reasonable, *inter alia* because this could trigger new discussions. It had also to be taken into account that many requests had been already submitted and there was no justification not to have submitted that amendment earlier. Accordingly, the decision of the opposition division to refuse that amendment was correct and the present requests which contained the same feature should not be admitted into the appeal proceedings.

(b) The decision of the opposition division that the invention was sufficiency disclosed was based on a very specific request defining that the polymer solids were substantially free of unentrained diluent after the intermediate pressure zone. However, some of the processes according to the present requests were not limited to that embodiment. It was not disputed by the parties that a reduction of pressure would usually result in a flash of any diluent present. In the absence of information on how for those other embodiments separation of the diluent without a low pressure flash could be operated, sufficiency of disclosure could not be acknowledged.

(c) Concerning novelty, D12 disclosed a process for slurry polymerisation of olefins in a loop reactor, wherein a portion of the slurry was withdrawn from the reaction zone, heated and passed to an

intermediate pressure zone at an an absolute pressure in the range of 140-315 psi (claim 21 and page 12, lines 13-17). That document also disclosed that the polymer solids were subsequently transferred to a purge zone as could be taken from Figure 1 showing the unnumbered vessel located just after the dryer (28). Moreover, "level measurement and control", i.e. monitoring the level and adjusting the withdrawal were disclosed for example at page 15, lines 8-17. D12 furthermore disclosed at page 28, lines 16-19 and in the last paragraph of page 29 that 100% of the diluent could be vaporised in the first flash tank, meaning that in the apparatus shown in Figure 1 the polymer solids leaving flash tank 11 were transferred to the purge zone without any flashing occurring between these two zones, because there was no diluent left to be vaporised, vaporization of all diluent having already taken place in tank 11. Accordingly, the process claimed was anticipated by D12.

(d) If novelty of the claimed process were acknowledged over D12, that document could be considered as the starting point for assessing inventive step. The problem solved over the process of D12 could be merely the provision of an alternative. D12 also disclosed the same level sensor, level monitoring and control in the intermediate pressure flash zone as used in the patent suit and also explicitly taught to remove the maximum amount of liquid diluent in the first flash zone, even disclosing that the liquid medium could be completely recovered in the first flash tank. In that case the second flash tank was technically redundant because there was no further liquid medium to flash and thus it would be clear that the second flash tank

could be removed without impacting the process. Accordingly, the step of transferring the polymer solids from the intermediate pressure zone in which all liquid diluent had been already evaporated to a purge zone without passing through a flash zone was obvious and therefore non inventive. The additional features contained in the auxiliary requests, namely condensation step without compression, residence time and continuous withdrawal were also obvious measures found in D12. Hence, the subject-matter of the auxiliary requests was not inventive either.

IX. The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the claims of the main request, or alternatively on the basis of the claims of any of auxiliary requests 1, 2, 2A, 3, 4 or 5, all submitted with letter of 3 March 2017.

X. The respondents requested that the appeal be dismissed. Respondent 1 further requested that the main request and auxiliary requests 3, 4 and 5 not be admitted into the proceedings.

Reasons for the Decision

Transfer of an opposition

1. On 24 October 2013 a request for a transfer of the opposition from Ineos Commercial Services UK Limited to Ineos Sales (UK) Limited was filed by respondent 1. The request contained a declaration of transfer showing *inter alia* that Ineos Commercial Services UK Limited had sold to Ineos Sales (UK) Limited its entire

polyolefins technology business, i.e. the assets in the interest of which the opposition against the patent in suit directed to a process for preparing polyolefins was filed. The Board is therefore satisfied that the conditions for a transfer of the opponent's status as set out in the decision of the Enlarged Board of Appeal G 4/88 (OJ EPO 1989, 480) are met. The request for transfer of the opposition made by respondent 1 which was not contested by the appellant is therefore granted.

Admittance of the main request and auxiliary requests 3, 4 and 5.

2. With the statement setting out the grounds of appeal the appellant filed a main request and auxiliary requests 1A to 1C, 2, 2A to 2C, 3, 3A, 4, 4A, 5 and 5A. Those were replaced by a main request and auxiliary requests 1, 2, 2A, 3, 4 or 5, all submitted with the letter of 3 March 2017, which formally represents an amendment to the appellant's case whose admittance into the proceedings is at the Board's discretion pursuant to Article 13(1) RPBA. However, it is undisputed that the sets of claims according to the main request and auxiliary requests 3, 4 and 5 whose admittance is objected to by the respondents correspond to the sets of claims according to auxiliary requests 1B, 3A, 4A and 5A submitted with the statement setting out the grounds of appeal, albeit renumbered following the withdrawal of the other claim requests. Accordingly the discretionary power given in Article 12(4) RPBA is to be exercised rather than the one in Article 13 RPBA.

It is undisputed that the insertion of the feature "*wherein the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C)*"

now contained in the main request and auxiliary requests 3, 4 and 5 is an appropriate amendment to overcome the ground of opposition under Article 100(c) EPC, as it is in the application as filed associated with the feature "*wherein the separated diluent is condensed without compression after the intermediate pressure zone*" also contained in the claims of the requests whose admittance is contested. Moreover, the appellant in his written submissions has not argued that this range of temperature represents a feature designed to overcome the other grounds of opposition. The Board agrees that the addition of the feature provides a clear solution to the above mentioned objection and has no impact on the other patentability objections, thereby putting the respondents at a disadvantage, so that it sees no reason not to admit these requests. The opposition division, in not allowing the then pending main request into the proceedings, which main request contained claims 1 and 2 identical to claims 1 and 2 of the present main request, did not exercise its discretion in a reasonable manner. This is not only because its reasoning was based on a procedural situation (claim 2 could be made the subject-matter of an independent claim) which had not arisen at the moment that the discretion was exercised, but also because no arguments by the patent proprietor based on said inserted feature had been submitted to challenge the objections based on the other grounds of opposition.

Keeping in mind the possibility for the Board pursuant to Article 13(1) RPBA also to disregard any subsequent submissions to be made in the course of oral proceedings in respect of this feature, which would put the respondents at a disadvantage e.g. when discussing inventive step, the Board finds it appropriate to

exercise its discretion by admitting the main request and auxiliary requests 3, 4 and 5 into the proceedings (Articles 12(4) and 13(1) RPBA).

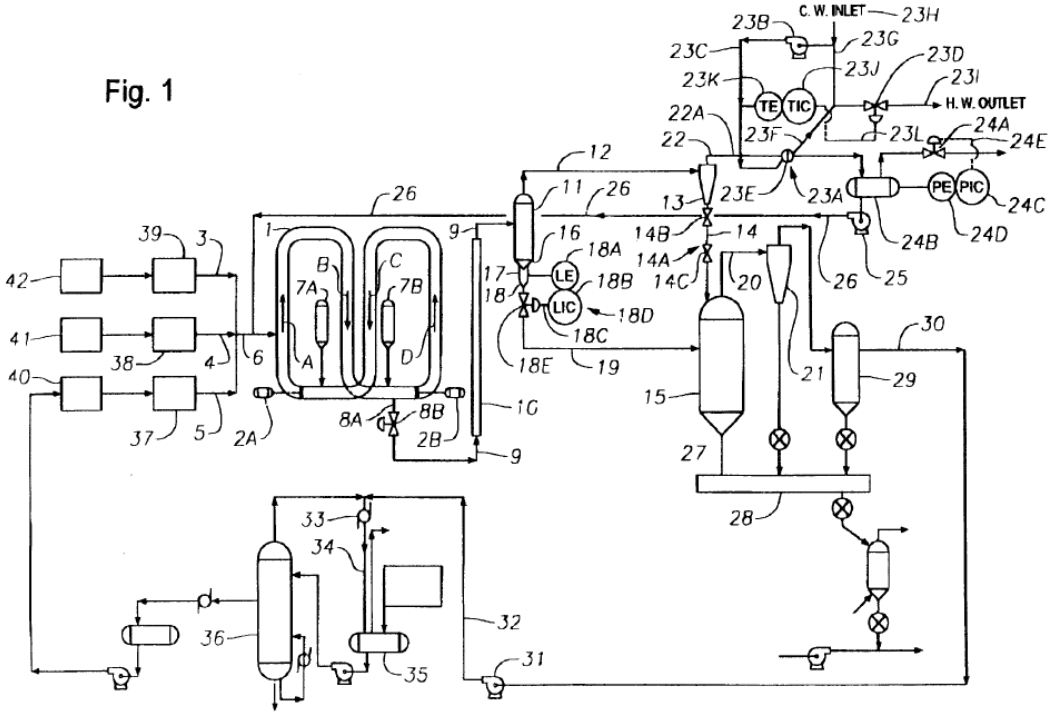
Main request

Novelty

3. Novelty of the claimed subject-matter is challenged having regard to D12, whose disclosure is analysed as follows:

3.1 D12 is concerned with an apparatus and a method for continuously separating in a process for slurry polymerisation of olefins the polymer solids from the liquid medium which comprises an inert diluent and unreacted monomers (page 3, lines 3-13; page 10, lines 15-21, paragraph bridging pages 10 and 11 and examples). The process for producing the polymer is generally defined in claim 21 and explained in more detail in the description by reference to Figure 1 shown below representing an apparatus employed for that process. The process and the apparatus of Figure 1 are described from page 12, line 26 to page 18, line 4. Other examples of apparatus suitable for the process described in claim 21 of D12 are not provided.

Fig. 1



3.2 The olefin polymerization is carried out in a loop reactor 1 from which the polymerization slurry is removed by continuous or discontinuous discharge, the slurry passing through a conduit 9 into the first flash tank 11. The conduit 9 is provided with a line heater 10 which may be a flash line heater, the polymerization effluent in said first transfer conduit being heated to a temperature below the fusion temperature of the polymer (claim 21) in order to supply a quantity of heat which is at least equal to that quantity of heat which equals the heat of vaporization of that quantity of inert diluent which is to be flash vaporized in the first flash tank (page 11, lines 19-26). The pressure in said first flash tank and the temperature of said heated polymerization effluent are selected such as to produce a vapour from about 50% to about 100% of the liquid medium (claim 21), which undisputedly leads to a majority of the diluent being separated from the polymer solid. Said pressure is typically in the range of from about 140 psi to about 315 psi, more preferably

from about 200 psi to about 270 psi and most preferably from about 225 psi to about 250 psi (page 12, lines 15-17), i.e. within the range defined in claim 1 of the main request.

The vaporized liquid medium comprising diluent and unreacted monomers exits the first flash tank 11 and is passed after separation from entrained catalyst and polymer solids in a cyclone 13 via conduit 22 to a heat exchanger system 23A wherein the vapour is condensed by indirect heat exchange such as to eliminate the need for compression (paragraph bridging pages 13 and 14; page 16, lines 1-7).

The concentrated polymer solids/slurry in the bottom of the first flash tank 11 continuously slides into the seal chamber 17 and from there is continuously discharged into the lower pressure second flash tank 15 (paragraph bridging pages 14 and 15). The level of the polymer solids in the first flash tank is monitored and the withdrawal of the polymer solids from the first flash tank is adjusted in response to the monitored level, this being accomplished using in particular a nuclear level indicating system 18D, a level element 18A, a level indicating controller 18B and a control valve 18E (page 15, lines 8-17). The polymer solids when passing to the second flash tank 15 are exposed to a pressure reduction leading to substantially all of any remaining inert diluent and unreacted monomer in the concentrated polymerization effluent to be vaporized and taken overhead via conduit 20 to a second cyclone 21 (page 15, lines 31-33). The vapour exiting the second cyclone 21 is passed to a compressor 31 and the compressed vapours are passed to a condenser 33 (page 17, lines 28-32).

The polymer solids are discharged from said second flash tank and passed to a conventional dryer 28. It is undisputed that Figure 1 shows that the polymer is then transferred from dryer 28 to a purge zone.

3.3 The sole point of contention between the parties concerning novelty over D12 is whether that document discloses that the polymer solids are transferred from the intermediate pressure zone to a purge zone without passing through a flash zone, which step constitutes the sole feature potentially distinguishing the claimed process from the disclosure of D12.

The objection of the respondents that claim 1 lacks novelty over D12 is based on a combined reading of (i) the process shown in its Figure 1 and also in more detail in the description, as explained in above sections 3.1 and 3.2, and (ii) the possibility mentioned at page 28, lines 5-19 to vaporise up to 100% of the diluent in the first flash tank, or the indication in the last paragraph of page 29 that complete vaporization could be accomplished in the first flash tank. When complete vaporization of the diluent takes place in the first flash tank, the polymer solids leaving flash tank 11 of the polymerisation/separation unit shown in Figure 1 would be transferred to the purge zone without passing through a flash zone, because in the absence of remaining diluent no flashing could take place anymore.

Doubts have been expressed by the appellant as to whether the skilled person would understand from D12 that a complete vaporization of the liquid diluent in the first flash tank is at all possible under the conditions used therein, because some diluent necessarily remains in the pores of the polymer solids

under the conditions employed in the first flash tank and its removal is described to occur in the second flash tank under lower pressure conditions as indicated on page 11, lines 27-30 of D12. This argument of the appellant is to be considered in the light of claim 21 which gives the broadest definition of the process for producing the polymer and sets out that the first flash tank produces a vapour from "about 50% to about 100%" of the liquid medium. The same information is repeated at page 3, lines 23-25, page 4, lines 14-15 and lines 27-28, as well as at page 7, lines 23-24. Furthermore, the passages at page 3, line 30, page 4, lines 24, 31 and 32 which follow the passages mentioned above disclosing a removal of about 50% to about 100% of the liquid medium, define the product leaving the first flash tank as concentrated polymer solids/slurry, i.e. a product which still contains some liquid medium. This is consistent with an upper limit for the amount of liquid medium removed which is not defined in claim 21 to be 100% but merely about 100%. Hence, the above cited passages of D12 do not disclose a removal of 100% of the liquid medium, let alone of the inert liquid diluent, in the first flash tank.

The only passages of D12 which appear to disclose an 100% removal of the diluent are the passages cited by the respondents (see above). The passage at page 28, lines 5-9 appears to relate to an envisaged development of the invention according to D12 and not necessarily to D12 itself, as that passage contains the expression "*A development which would increase efficiency of the two-stages flash system is the continuous flash line heater. The heater would vaporize up to 100% of the diluent discharged from the reactor with the polymer*". However, a flash line heater is also represented in Figure 1 and in the second passage at page 29, lines

26-29 disclosing a complete vaporization in the first tank, which could also indicate that the use of a flash line heater to remove exactly 100% of the diluent is to the contrary an embodiment of the invention of D12.

Accordingly, having regard to the whole disclosure of D12 doubts arise as to whether that document discloses without any ambiguity a process in which all liquid diluent discharged from the reactor, i.e. exactly 100% of it, is removed in the first flash tank.

Even if one accepted that the passage at page 28, lines 5-9 and at page 29, lines 26-29 of D12 constitute a disclosure that a complete vaporization of the diluent discharged from the reactor can take place in the first flash tank, and therefore that the polymer solids cannot pass through a zone wherein flash vaporization occurs, this information alone would not result in a direct and unambiguous disclosure that the polymer solids are transferred to a purge zone. The only disclosure of a purge zone in D12 is in Figure 1 where a purge column is depicted (see above section 3.2, last paragraph). In addition to said purge column, Figure 1 also shows, downstream from the first flash tank, a second flash tank 15, a second cyclone 21, a compressor 31, a condenser 33, as well as a dryer 28. These components of the apparatus have the function of drying the polymer solids or recycling diluent which has not been removed after the first flash vaporization step. Accordingly, it can be doubted that the skilled person would necessarily associate the apparatus depicted in Figure 1, comprising many components specifically designed to remove the liquid diluent which was not vaporized in the first flash zone or to recycle the liquid diluent which exits the second flash zone, with the specific situation mentioned in D12 in which all

diluent discharged from the reactor has been already removed in the first flash zone. Accordingly, in the absence of any passage of D12 describing the use of a purge zone other than in Figure 1, which obviously does not correspond to the situation where all liquid diluent discharged from the reactor is vaporized in the first flash zone, the skilled person could not find any indication in D12 that evaporation of all diluent in the first flash tank would necessarily be associated with the use of a purge zone.

Accordingly, D12 does not constitute a direct and unambiguous disclosure of a process wherein the polymer solids leaving an intermediate pressure zone are transferred to a purge zone without passing through a flash zone. Consequently, the objection that the subject-matter of claim 1 lacks novelty over D12 fails to convince.

Sufficiency of disclosure

4. The process of claim 1 is defined to separate the polymer solids from the diluent used for the slurry polymerisation. The process of claim 1 does not contain any limitation with respect to the amount of diluent in the slurry polymerisation, which amounts are usually large, as illustrated by D12 indicating that the solid content in the polymerisation slurry is most desirably from 55 to 65 wt % (page 9, lines 17-19). According to its definition in the main request, the process of claim 1 includes the step in the intermediate pressure zone in which a majority of the diluent is separated from the polymer solids, which definition covers situations in which slightly more than half of the diluent was vaporized in the intermediate pressure zone and situations "*wherein the polymer solids are*

substantially free of unentrained diluent after the intermediate pressure zone" as defined e.g. in claim 4 of the main request. It is, however, questionable whether a slurry comprising large amounts of diluents can be separated from the diluent based on the technical information provided in the patent in suit and the knowledge of the skilled person, when only slightly more than half of it is vaporized in the intermediate pressure zone and no flash zone is present (or in other words no flash vaporization takes place) between the intermediate pressure zone and the purge zone. Whereas sufficiency of disclosure is questionable in so far as the latter situation is concerned, sufficiency of disclosure is not disputed when claim 1 concerns a process in which "*the polymer solids are substantially free of unentrained diluent after the intermediate pressure zone*", this process being comprised within the subject-matter of claim 1 (as shown clearly by dependent claim 4).

5. Consequently, as the process according to said limitation is found not to be inventive as shown below, even if accepting the meaning attributed by the patent proprietor to the expression "*unentrained diluent*", it is not necessary for the purpose of the present decision to establish whether other processes encompassed by claim 1 are sufficiently disclosed and in the affirmative if they could be seen to involve an inventive step.

Inventive step

6. As indicated in the previous section, the reasons for the decision in respect of inventive step are given having regard to the sub-embodiment of claim 1 according to which a process in which "*the polymer*

solids are substantially free of unentrained diluent after the intermediate pressure zone", while accepting the meaning of the expressions "*unentrained diluent*" and "*entrained diluent*" given by the appellant and which are in line with the use of those expressions for example in paragraphs [0012], [0013] and [0018] and claims 6 and 10 of the patent in suit. Accordingly, the wording "*entrained diluent*" designates the part of diluent which cannot be separated from the polymer under the conditions used in the intermediate pressure zone and remains in the pores of the polymer or the polymer fluff when the polymer leaves the intermediate pressure zone, the "unentrained diluent" designating the rest of the diluent transferred to the first flashing zone but which can be separated from the polymer under the conditions used in the intermediate pressure zone. In what follows, when claim 1 of the main request is mentioned, it is intended to refer to the sub-embodiment defined in the present paragraph (i.e. containing the additional limitation of claim 4).

Closest prior art

7. In line with the contested decision, it is not disputed that D12 constitutes the closest prior art and therefore the starting point for assessing inventive step. The Board has no reason to take a different view. The relevant process is that summarised in above sections 3.1 and 3.2 by reference to claim 21, Figure 1 and its description from page 12, line 26 to page 18, line 4, i.e a process in which about 100% of the liquid medium is removed in the first flash tank (i.e. almost all of it) and substantially all of any remaining inert diluent and unreacted monomer is vaporized in the second flash tank (claim 21, page 15, lines 31-33) . The appellant did not dispute that about 100% of the

liquid medium could be removed in the first flash tank of D12 using the technique described therein, but only that it would not be possible to remove all of it, i.e. exactly 100% of it.

Problem successfully solved and solution

8. Having regard to the disclosure of D12, as described in above sections 3.1 and 3.2, the appellant formulated the technical problem to be solved by the subject-matter of the main request as to provide a simplified process for slurry polymerization of olefins and for separating solids from diluent which uses a simplified apparatus and reduces costs, whereas the respondents argued that the problem to be solved could only be formulated as the provision of a further process for slurry polymerization of olefins and for separating solids from diluent.

8.1 In D12 substantially all of the inert diluent and unreacted monomer will be vaporized after the second flashing zone, i.e. under lower pressure conditions than those used in the first flash tank or the intermediate pressure tank using the terminology of the patent in suit. According to the sub-embodiment of claim 1 of the main request the polymer solids are substantially free of "unentrained diluent" after the intermediate pressure zone, which means substantially free of the diluent which can be separated from the polymer under the conditions used in the intermediate pressure zone. Hence, according to claim 1 of the main request the polymer after the intermediate pressure zone possibly contains a small amount of "unentrained diluent", as well as the "entrained diluent", i.e. the diluent which one cannot separate from the polymer under the conditions used in the intermediate pressure

zone. Therefore, it cannot be concluded that the polymer solids leaving the intermediate pressure zone in the process defined in claim 1 of the main request, which polymer solids contain "entrained diluent" and possibly residual amount of "unentrained diluent", contain less diluent than the polymer solids leaving the second flash tank of D12 in which the conditions are such as to also remove the "entrained diluent". Considering that the polymer solids leaving the intermediate pressure zone are transferred with the process of claim 1 of the main request to the purge zone without passing through a flash zone, it is concluded that the polymer solids entering the purge zone may contain more diluent in the process of present claim 1 than in the process according to D12. This analysis is consistent with the wording of claim 5 of the main request defining that the polymer solids are substantially free of entrained diluent after the purge zone and the description of the invention in paragraphs [0012] and [0013] of the contested patent according to which "*The polymer solids and any remaining diluent (including entrained diluent) are then withdrawn from the intermediate pressure zone and passed to a downstream purge zone*"), and "*Additionally, the process may include holding the polymer solids in the intermediate pressure zone for a characteristic average residence time sufficient to remove substantially all the unentrained diluent, withdrawing the polymer solids from the zone, and transferring the polymer solids to a purge zone to remove substantially all the entrained diluent*".

8.2 Having in mind that the claimed process requires, as a result of said process, separation of the polymer solids from the diluent, despite the fact that entrained diluent will be transferred to the purge

zone, possibly in an amount which is higher than in the process of D12, it cannot be held that the present process necessarily reduces cost or is simpler, because it will require *inter alia* purging of more entrained diluent and possibly recycling thereof as in D12, the costs of which have not been shown to be lower than those resulting from the use of the second flash tank in D12. Finally, to the benefit of the appellant, the Board does not accept the use of a simplified apparatus for the formulation of the problem, as it is considered to provide a pointer to the solution, which might result in an *ex post facto* analysis of the claimed solution (see Case Law of the Boards of Appeal, 8th Edition, 2016, I.D.4.3.1), but the argument in relation to a simplification of the apparatus has nevertheless be taken into account when assessing the obviousness of the solution.

8.3 Thus, in view of the above, the problem underlying the patent in suit is to be seen as providing a further process for slurry polymerization of olefins and for separating solids from diluent. As a solution to that problem the patent in suit proposes the process as defined in claim 1 (sub-embodiment), *inter alia* characterized in that the polymer solids (substantially free of unentrained diluent) after the intermediate pressure zone are transferred to a purge zone without passing through a flash zone. This in fact is the sole feature distinguishing the process of claim 1 of the main request from the process disclosed in D12.

Obviousness

9. It remains to be decided whether or not the proposed solution to the above problem is obvious in view of the state of the art.

9.1 As indicated in above section 3.3, D12 suggests at page 28, lines 5-19 that up to 100% of the diluent could be vaporized in the first flash tank, in line with the indication in the last paragraph of page 29 that complete vaporization could be accomplished in the first flash tank. This is meant to be achievable by the use of a continuous flash line heater as indicated at page 28, from line 5 to line 19 of D12. D12 further describes as shown in section 3.3 above that a continuous flash line heater before the first flash zone could provide enough heat to the polymerisation effluent in order to vaporize up to 100% of the diluent discharged from the reactor (emphasis added by the Board; D12, page 28, lines 6-7).

9.2 Even if one accepts to the benefit of the appellant that the skilled person would understand from D12 that a complete vaporization of the liquid diluent (i.e. exactly 100% of it comprising also all entrained diluent) in the first flash tank is impossible under the conditions used therein, because some diluent necessarily remains in the pores of the polymer solids under the conditions employed in the first flash tank (i.e. the entrained diluent), he would nevertheless understand that a continuous flash line heater can be used to supply sufficient heat to minimize said amount of entrained diluent. Hence, whereas D12 teaches that under conditions used in the first flash tank leading to far less than 100% removal of the liquid medium, the second flash tank has to be used to evaporate still

large amounts of liquid diluent, D12 also teaches that a removal of almost 100% of the liquid diluent discharged from the reactor in the first flash tank, using a continuous flash line heater and the appropriate amount of heat, will result in a minimum amount of entrained diluent transferred to the second flash tank and therefore to almost no diluent evaporating in said second tank.

9.3 Furthermore, it is undisputed and even indicated in paragraph [0005] of the patent in suit that the skilled person is aware that in many polymer production processes polymer solids after the flash chamber are subjected to further processing to further remove residual and entrained diluent, examples of such processing including purge zones. It is in that context referred to paragraph [0006] of the patent describing that one known method for removing additional amounts of diluent after the flash chamber involves passing the polymer solids through a purge zone, wherein a non-combustible gas is used to remove the diluent.

9.4 Under those circumstances, knowing that the second flash tank in D12 would be of little use if almost 100% of the liquid diluent discharged from the reactor were evaporated in the first flash tank, the skilled person would find it obvious, when he merely seeks to provide a further process, to dispense with the second flash tank and to remove any remaining entrained diluent with another appropriate conventional means such as a purge zone.

9.5 The appellant argued that incorporation of the continuous flash line heater is taught in D12 in order to improve the efficiency of the two stages flashes, and therefore finding it obvious to dispense with the

second stage flash could only arise on the basis of an *ex post facto* analysis. It is stressed, however, that the answer to the question as to what a person skilled in the art would have done depends on the result he wished to obtain (T 0939/92, OJ EPO 1996, 309; Reasons for the decision, point 2.5.3). In the present case, the skilled person is deemed to be merely seeking to provide a further process for slurry polymerization of olefins and for separating solids from diluent, i.e. irrespective of the efficiency of the separation or drawbacks associated with the solution proposed. Accordingly, having regard to the embodiment suggested in D12 which would allow to remove almost 100% of the liquid diluent discharged from the reactor, i.e. the one using the continuous line-heater, the skilled person not necessarily desiring to provide the highest achievable separation level and accepting that he could not keep all advantages resulting from the second flash tank would consider as a useful and obvious measure to dispense with the second flash tank and for example to merely use a purge zone after the intermediate pressure flash tank, which results in a simplified apparatus. In other words, simply accepting known disadvantages linked to a simplified apparatus or the absence of a second flash tank when almost 100% of the diluent discharged from the reactor was removed with the first flash tank, meaning that the amount of entrained diluent transferred to the purge zone might be slightly increased and should be recovered if necessary in another manner than in D12, cannot confer any inventive character to the method of claim 1.

9.6 The argument that an inventive finding underlying the claimed process was the recognition that a level sensor could be used to control residence time of the polymer solids in the intermediate flash zone is not

persuasive, because the use of such level sensor is also described in Figure 1 and on page 15, lines 8-17 of D12, as indicated in above section 3.2. Finally, D12 describes at page 28, lines 20-22 that diluent vapour and unreacted/under reacted catalyst/polymer fines go overhead from the first flash tank to the cyclone. Figure 1 also shows that the fines separated by cyclone 13 are passed at the bottom of the cyclone via a conduit 14 to the second flash tank. Similarly, Figure 1 shows that the fines separated by cyclone 21 are passed to the drying zone 28, indicating that those are passed to the final polymeric product. Hence, the skilled person wishing to dispense with the second flash tank would find in D12 itself the suggestion that the polymer fines separated in cyclone 13 do not necessarily need to be sent to the second flash tank, but can be also sent to a subsequent zone and collected with the final product. In addition, the fines remaining in the overhead stream from the cyclone can be returned after condensation of the diluent to the reactor, the condenser and accumulator receiving the diluent being designed to accommodate a level of fines without accumulation or plugging (see D12, page 29, lines 1 to 23). Accordingly, the skilled person would not only dispense with the second flash tank, but would also find on the basis of common general knowledge or D12 itself obvious measures for adapting the process of D12 for not adversely affecting the other aspects of the system and process described in D12.

9.7 Thus, the skilled person starting from the disclosure of D12 and faced with the problem identified in above point 8.3 would arrive in an obvious manner at the process defined in claim 1 of the main request. Accordingly, this request does not meet the requirements of Article 56 EPC.

Auxiliary request 1

10. The subject-matter of claims 1 and 3 of auxiliary request 1 corresponds to that of claims 1 and 4 of the main request and therefore lacks an inventive step for the same reasons.

Auxiliary requests 2 and 2A

11. Compared to claim 4 of the main request, claims 1 of auxiliary requests 2 and 2A contained the feature "*wherein the step for controlling the rate of the withdrawing the polymer solids from the intermediate pressure zone comprises:*
establishing a first signal representative of the actual level of the polymer solids in the intermediate pressure zone;
establishing a second signal representative of a desired level of the polymer solids in the intermediate pressure zone;
comparing the first signal and the second signal and establishing a third signal responsive to the difference between the first signal and the second signal; and
manipulating the solids outlet control valve in response to the third signal", which feature merely expresses the particle level measurement and control disclosed on page 15, lines 8-17 and represented in Figure 1 of D12 (see section 3.2 above). Accordingly, this feature does not provide an additional distinguishing feature over the prior art and cannot affect the assessment of inventive step made with respect to claim 1 of the main request.

Auxiliary request 3

12. Claim 1 of auxiliary request 3 specifies in comparison to claim 1 of auxiliary request 2 that the separated diluent is condensed without compression after the intermediate pressure zone, and that the intermediate pressure zone is at a temperature of from 100°F to 250°F (37.8°C to 121.1°C). However, the purpose of D12 is to avoid a compression step to liquefy the diluent prior to recycling to the loop reactor, a condensation step being used instead (see page 28, lines 16-17 and page 29, lines 6-12). Accordingly, condensation of the separated diluent without compression after the intermediate pressure zone does not constitute a distinguishing feature over the closest prior art and its insertion into claim 1 has no effect on the assessment of inventive step made with respect to auxiliary request 2. As to the temperature for the intermediate pressure zone defined in claim 1 of auxiliary request 3, this temperature is not described for the specific embodiment of D12 forming the closest prior art (i.e. a process in which about 100% of the liquid medium is removed in the first flash tank; see above point 7). However, the temperature range defined in claim 1 of auxiliary request 3 encompasses the temperatures used in the intermediate pressure zone of examples 1, 2 and 4 of D12 (pages 22 to 24), namely 180°F and 175°C. A further indication of the temperature employed in the intermediate pressure zone of D12 is also provided with the mention of the temperature of the heat exchanging fluid used for condensing without compression of the diluent, which is in the range of 65° F to 150° F, most preferably 85°F to 130°F (page 12, lines 18-22) and is necessarily below that used in the intermediate pressure zone. Accordingly, the temperature of the intermediate

pressure zone defined in claim 1 of auxiliary request 3, which is not alleged to solve another technical problem than that defined in above point 8.3, is also obvious to the skilled person in light of D12. The subject-matter of claim 1 of auxiliary request 3 is therefore also not inventive.

Auxiliary request 4

13. Claim 1 of auxiliary request 3 already defines the manipulation of the control valve. Accordingly, the definition of claim 1 of auxiliary request 4 differs from that of claim 1 of auxiliary request 3 only in that the polymer solids residence time in the intermediate pressure zone (see also paragraph [0042] of the specification) is maintained in the range of 10 seconds to 120 minutes. However, the polymer solids residence time in the intermediate pressure zone which is necessary to obtain polymer solids substantially free of unentrained diluent, as required by claim 1, is imposed by the level of solid olefin polymer particles, the temperature and pressure conditions in the intermediate pressure zone, which time can be determined by the skilled person on the basis of routine experimentation work. Hence, the additional feature contained in claim 1 of auxiliary request 4 cannot contribute to an inventive step either.

Auxiliary request 5

14. The sole additional feature defined in claim 1 of auxiliary request 5, according to which the polymer solids are continuously withdrawn from the intermediate pressure zone, does not represent a distinguishing feature over the closest prior art as indicated in above section 3.2 (see D12, paragraph bridging pages 14

and 15). Accordingly, this feature also does not affect the assessment of inventive step made with respect to claim 1 of auxiliary request 4. Accordingly, the subject-matter of claim 1 of auxiliary request 5 also lacks an inventive step.

Conclusion

15. As claim 1 according to all requests on file does not involve an inventive step, the appeal is to be dismissed and there is no need for the Board to decide on any further issue.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana D. Semino

Decision electronically authenticated