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DECISION
of 23 November 2005

Case Number:	T 0096/04 - 3.3.05
Application Number:	96308479.3
Publication Number:	0776691
IPC:	B01J 8/00
Language of the proceedings:	EN

Title of invention:
Process for introducing a solid catalyst into a gas-phase olefin polymerization reactor

Patentees:
Innovene Europe Limited
BP Chemicals S.N.C.

Opponent:
Basell Poliolefine Italia S.p.A.

Headword:
Catalyst introduction/BP

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty: yes"
"Inventive step: yes"

Decisions cited:
T 0651/91

Catchword:
-

Case Number: T 0096/04 - 3.3.05

DECISION
of the Technical Board of Appeal 3.3.05
of 23 November 2005

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(Patent proprietors)

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Decision under appeal:

Decision of the Opposition Division of the European Patent Office posted 26 September 2003 revoking European patent No. 0776691 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: M. Eberhard
Members: B. Czech
H. Preglau

Summary of Facts and Submissions

I. The appeal is from the decision of the opposition division revoking European patent No. 0 776 691.

II. The two independent claims 1 and 2 of the patent as granted read as follows:

"1. Process for introducing a solid catalyst into a gas-phase olefin polymerization reactor through which passes a gaseous reaction mixture containing at least one olefin to be polymerized, characterized in that it comprises:

- storing under an inert atmosphere the solid catalyst in the form of a dry powder in a hopper,
- withdrawing under an inert atmosphere from the hopper a measured amount of the catalyst in the form of a dry powder,
- introducing the measured amount of the catalyst in the form of a dry powder and a liquid hydrocarbon into a mixing chamber,
- mixing the said catalyst with the said liquid hydrocarbon in the mixing chamber so as to form in the said chamber a suspension of the entrained catalyst with the said liquid hydrocarbon, and
- introducing the said suspension into the gas-phase olefin polymerization reactor."

"2. Process for introducing a solid catalyst into a gas-phase olefin polymerization reactor through which passes a gaseous reaction mixture containing at least one olefin to be polymerized, characterized in that it comprises:

- storing under an inert atmosphere the solid catalyst in the form of a dry powder in a hopper,
- withdrawing under an inert atmosphere from the hopper a measured amount of the catalyst in the form of a powder,
- continuously introducing a liquid hydrocarbon into a mixing chamber so as to form a continuous stream of the liquid hydrocarbon passing through the chamber and flowing into the polymerization reactor,
- adding the measured amount of the catalyst in the form of a powder to the continuous stream of the liquid hydrocarbon in the mixing chamber so as to mix the said catalyst with the said liquid hydrocarbon and to form in the said chamber a suspension of the said catalyst with the said liquid hydrocarbon, and
- introducing the said suspension entrained by the continuous stream of the liquid hydrocarbon into the gas-phase olefin polymerization reactor.

III. The references cited in the course of the opposition proceedings include the following:

D1: GB-A-1 514 336;

D2: Encyclopedia of Polymer Science and Engineering, 1986, Volume 6, J. Wiley & Sons; pages 439 to 444;

D3: US-A-4 610 574; and

D4: LU-A-79 915.

IV. In the contested decision, the opposition division concluded that the process of claim 1 as granted and of amended claim 1 of an auxiliary request filed during the oral proceedings on 19 March 2003 was novel over the disclosures of the prior art cited by the opponent. It also held *inter alia* that the process of claim 1 as granted was not obvious in view of combinations of D1 and D2, of D3 and D4 and of D1 and D3, but that it lacked an inventive step in view of a combination of D1 with the description of the prior art as given in D3.

V. In their statement of grounds of appeal, the appellants (proprietors of the patent), referring to D1, D3 and D4, contested the argumentation of the opposition division and considered the subject-matter of claim 1 as granted to involve an inventive step with respect to a combination of D1 and the prior art cited in D3. They also filed an amended claim 1 as auxiliary request.

VI. In its reply, the respondent (opponent) *inter alia* maintained that the subject-matter of claim 1 as granted did not involve an inventive step in view of D1 and the background art referred to in D3.

VII. Oral proceedings were held on 23 November 2005. At these oral proceedings the parties also discussed the following prior art document, cited in the patent in suit

D7: FR-A-2 705 252,

and the appellants filed a further amended set of claims as second auxiliary request.

VIII. The appellants requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or, in the alternative, on the basis of the auxiliary request as filed during the oral proceedings before the opposition division (first auxiliary request) or of the auxiliary request as filed during the oral proceedings before the board (second auxiliary request).

The respondent requested that the appeal be dismissed.

IX. The essential arguments of the parties can be summarised as follows:

The appellants argued that polymerisation in the gas phase was an essential feature of the claimed process. D1 related to suspension polymerisation and not to gas phase polymerisation of olefins. There was no teaching or suggestion in D1 that the catalyst injection procedures described therein were applicable to gas phase processes.

The appellants referred to the problems mentioned in the patent in suit with respect to the method of D7, which could occur separately or simultaneously and depended on the size and composition of the catalyst used. The claimed process was advantageous since it was more universal whilst being able to be carried out in one and the same reactor. There was no clear teaching in D1 of gas phase polymerisation, which was very different from suspension polymerisation. Since D1 did not relate to gas-phase polymerisation, it addressed different problems. Starting from D7 as the closest prior art, the claimed process was thus not rendered obvious by D1.

Moreover, the appellants argued that there was no clear and direct reference in the prior art discussion in D3 of a process wherein a suspension of a catalyst in a hydrocarbon solvent may be suitable for use in a polymerisation process operating in the gas phase. In particular, the prior art discussion in D3 did not mention feeding the quench liquid and catalyst particles into the reactor together, i.e. in form of a suspension. The problems addressed by the invention were related to gas phase reactors and processes. Since D1 and D3 addressed different problems, the skilled person confronted with the problems associated with the injection of catalyst into a gas phase reactor would not be motivated to combine the teaching of D1 and the prior art discussion in D3. Considering D1 as the closest prior art, the only feature of claim 1 not disclosed in this document was that the polymerisation is carried out in the gas phase. Since gas-phase and slurry polymerisation were both very specific processes, there was a "big leap" to make from one to the other. Moreover, a combination of D1 with D3 had to fail since the invention according to D3 taught away from a process as claimed.

The respondent again raised a novelty objection on the basis of document D1 at the oral proceedings. Referring to the "Case Law of the Board of Appeal of the EPO", 4th edition, section I.C.4., the first two sentences (page 72), it argued that an "olefin polymerisation" as referred to in D1 had to be carried out either in the gas or in the liquid phase. Gas phase polymerisation was known, although not widely used, before the filing date of D1, as shown e.g. by D2. Therefore, although D1 did not expressly mention gas phase polymerisation, it nevertheless disclosed the latter by virtue of the general reference to "olefin polymerisation". The process as claimed in the patent in suit was merely an arbitrary selection among the two possibilities (gas or liquid phase polymerisation) covered by this general expression and was thus made "accessible to the public" by D1. Moreover, the only difference, if any, between the process according to claim 1 of the patent in suit and the process expressly disclosed in D1 was the fictitious use of the catalyst dosing method known from D1 in a gas phase polymerisation. In view of the "Guidelines for Examination at the EPO", section C-IV, 7.6, which section was not restricted to claims directed to a physical entity, the reference, in claim 1, to the particular use of the known dosing method in combination with gas phase polymerisation did thus not impart novelty to the claimed subject-matter.

Considering D7 as closest prior art, the respondent referred to the technical problem as set forth in section [0003] of the patent in suit which consisted in overcoming the four drawbacks mentioned there. To solve this problem, the skilled person would look into documents addressing the feeding of catalyst and addressing these drawbacks. D1 was concerned with the continuous dosing of catalyst and addressed the same four drawbacks. Since D1 dealt with the same problems, the skilled person was prompted to look into it. As a solution to these problems, D1 disclosed all those features of claim 1 of the patent in suit which were missing in D7, and in particular the feature of mixing the catalyst with a liquid hydrocarbon. Since there was no disincentive to do so, the skilled person would have combined the teachings of D7 and D1 with a reasonable expectation of success, thereby arriving at the process of the patent in suit. Considering that D1 also mentioned many known types of catalysts, the possibility to use catalysts different in composition and size in a method according to the patent in suit was an extra effect which, as far as it occurred at all, could not contribute to make the claimed process inventive. Although D7 disclosed a more modern powder dosing apparatus, it still mentioned the same problems as D1 as far as the use of gas as catalyst suspension medium was concerned.

The respondent maintained that D1 could also be considered as the closest prior art, since all the problems mentioned in the patent in suit with reference to D7 would also stand when starting from D1, independently of where the catalyst suspension was fed to. Assuming that D1 was not novelty-destroying, the only missing feature was that the polymerisation was to be carried out in the gas phase. Starting from D1 the claimed invention would thus consist in fitting the method of D1 to the specific case of gas-phase polymerisation. The introductory part of the description of document D3 included references to earlier prior art. The respondent was of the opinion that this part of the description showed that it was known at the filing date of the patent in suit to directly introduce a suspension, i.e. a slurry of catalyst in liquid hydrocarbon into a gas-phase polymerisation reactor. Knowing this possibility from D3, it would have been obvious for the skilled person to prepare a liquid catalyst suspension according to the method indicated in D1 and to then perform the introduction of this suspension into a gas-phase polymerisation reactor. The skilled person would have combined the teachings of D1 and D3 since there was nothing in D1 or D3 that could be considered as a disincentive or hindrance to apply the method of D1 to a gas phase polymerisation. In particular, no changes were required in the design of the actual dosing method and apparatus described in D1.

At the oral proceedings, the respondent expressly confirmed that the objections raised against claim 1 also applied to claim 2 of the patent in suit and that conclusions concerning novelty and inventive step reached with respect to claim 1 would, for the same reasons, also apply to claim 2.

Reasons for the Decision

Novelty (main request)

1. Document D1 relates to a method and an apparatus for the continuous dosed introduction of a catalyst into an olefin polymerisation reactor (see title and page 1, lines 10 to 13). As indicated in the contested decision, the method disclosed in D1 comprises all the features of the first four steps listed in the characterising part of claim 1. This remained undisputed during the appeal proceedings and can e.g. be gathered from claims 1 and 3, Figure 1 and the corresponding description on page 3, lines 6 to 29 of D1.

1.1 As pointed out by the respondent, D1 does not expressly mention gas-phase polymerisation but refers more generally to the "introduction of catalysts into olefin polymerisation reactors" at several instances, see the title, the indication of the technical field concerned (page 1, lines 10 to 13) and the object of the invention (page 2, lines 64 to 72).

1.1.1 However, the actual definition of the invention as given in D1 on page 2, lines 73 to 82 and in claim 1 expressly refers to the suspension polymerisation of olefins, i.e. to a particular mode of polymerisation carried out in the liquid phase, and to a pressurised reactor.

1.1.2 The board observes that no other known olefin polymerisation techniques are mentioned in D1 in connection with the definition or description of the invention. The reference to low-pressure suspension or solution polymerisation on page 1, lines 14 to 38, especially lines 21 to 27 is part of the discussion of earlier prior art involving various ways of feeding the catalyst to the reactor.

1.1.3 Under these particular circumstances, the board is not convinced that the disclosure of D1 more generally extends to other olefin polymerisation methods than suspension polymerisation in a pressurised reactor.

1.2 Even assuming, purely for the sake of argument, that the disclosure of D1 went beyond such suspension polymerisations and extended more generally to the dosing of catalyst in connection with other polymerisation modes, the arguments submitted by the respondent would still not suffice to establish the disclosure of a method specifically involving gas-phase olefin polymerisation.

1.2.1 As illustrated e.g. by D2 for the case of polyethylenes, olefin polymerisation may be carried out in different manners in the liquid phase, namely in a liquid suspension or in a solution under varying conditions (see D2, pages 439 to 440, the first and last paragraphs of the section entitled "Low Pressure, Gas-phase Polyolefin Processes"). D1 also implicitly refers to prior art solution polymerisation methods (page 1, line lines 21 to 27) in addition to the envisaged suspension polymerisation methods. The sub-category of liquid-phase processes thus embraces different ways of carrying out the polymerisation.

1.2.2 As pointed out by the respondent, olefin polymerisations may be carried out in the liquid phase or in the gas phase. More particularly, D2 refers to gas-phase polymerisation in a fluidised bed or stirred bed (see paragraph bridging pages 439 and 440). In view of what is said in D2 (see page 439, the first sentence of the third paragraph), it appears that gas-phase polymerisation of olefins had already been the subject of several patent applications and was already being commercially operated before the filing date of D1.

1.2.3 Even assuming additionally, for the sake of argument, that the quoted passages of D2 meant that gas-phase olefin polymerisation was generally known at the filing date of D1, the board nevertheless holds that, in accordance with the "Guidelines for examination at the EPO", section C-IV, 7.4, this would not imply that the generic expression "olefin polymerisation" as comprised in D1 can be considered to take away the novelty of the more specific feature "gas-phase polymerisation" falling within the terms of the former. In this connection, it is not of relevance whether the generic disclosure of the prior art document D1 embraces only two (here: gas- or liquid-phase polymerisation) or more alternatives, see e.g. decision T 651/91 of 18 February 1993, not published, Reasons, point 4.3).

1.3 The respondent also argued that the only features of claim 1 of the patent in suit not disclosed in D1 (namely the fifth step listed in the characterising part of claim 1) represented a mere indication of a fictitious use of the dosing method according to the first four steps listed in the characterising part of claim 1. Therefore, this fifth step could not establish novelty in view of the following sentence taken from the "Guidelines for Examination at the EPO" (see edition of June 2005, C-IV, 7.6, emphasis added by the board): The examiner "*should remember that, **particularly** for claims directed to a physical entity, non-distinctive characteristics of a particular intended use should be disregarded (see III, 4.8)*".

1.3.1 Claim 1 of the patent in suit is directed to a method (activity) and not to a physical entity (apparatus or product). In the board's view, it is questionable whether the quoted sentence is applicable to the present case merely because of the use, in the cited sentence, of the term "particularly", as alleged by the respondent.

1.3.2 In any case, claim 1 is expressly directed to a "process for introducing a solid catalyst into a gas-phase olefin polymerisation reactor", comprising the step of "introducing the said suspension into the gas-phase olefin polymerisation reactor". The introduction of the catalyst into a gas-phase polymerisation reactor is thus not just expressed as some kind of intended or fictitious use but is presented as an essential feature of the claimed method, which obviously requires the presence of a suitable reactor wherein gas-phase polymerisation is carried out and which receives the catalyst suspension. In this connection, reference is made to the Guidelines for Examination in the EPO (edition of June 2005), C-III, 4.8, last paragraph, which particular section is also referred to in the section quoted by the respondent. A gas-phase olefin polymerisation reactor is, however, not disclosed in D1.

1.4 In accordance with the finding of the opposition division, the board concludes that the step of introducing the catalyst suspension into a gas-phase olefin polymerisation reactor is not clearly and unambiguously derivable from D1. The subject-matter of claim 1 is thus novel in view of D1.

1.5 The subject-matter of claim 1 is also novel with respect to the disclosure of the other prior art documents cited. Since this was not disputed by the respondent, a detailed reasoning needs not be given.

Inventive step (main request)

2. *Closest prior art*

2.1 Document D7 is referred to as prior art in the granted patent in suit (see section [0003] and example 1) and is acknowledged to relate to a method for introducing a dry catalyst powder into a gas-phase olefin polymerisation reactor in the absence of liquid by using a carrier gas. In the patent in suit, the claimed process is stated to make it possible to reduce or even completely avoid the problems associated with the process of D7 (see column 1, lines 19 to 37 and lines 56 to 58). Hence, it emanates from the introductory part of the patent in suit that the applicants considered the method of D7 as a starting point in making the invention.

2.2 More particularly, D7 discloses the storing of a catalyst in powder form in a storage hopper maintained under an inert gas atmosphere. A dosed amount of the catalyst is withdrawn from the storage hopper in a controlled manner by means of a rotating valve having a cavity of a known size. The valve transports the catalyst to a chamber wherein it is mixed and entrained with and suspended in a stream of inert gas, in particular nitrogen. The suspension of catalyst is then fed to the reactor. Reference is made in particular to claim 1; Figures 1 and 2; page 2, lines 8 to 16 and lines 21 to 23; page 3, line 28 to page 4, line 4; page 4, lines 20 to 25, page 5, lines 16 to 18; page 6, lines 3 to 6 and 11 to 17; page 8, line 10 to page 9, line 19; page 9, line 32 to page 10, line 2; and page 10 lines 7 to 23. The process according to claim 1 of the patent in suit thus differs from the one according to D7 in that the catalyst suspension is formed using a liquid, and not a gas, as the carrier fluid. No further difference has been identified by the appellants.

2.3 D7, like the patent in suit, relates to the introduction of a catalyst powder suspended in a carrier fluid into a gas-phase olefin polymerisation reactor. Considering moreover that the process of D7 includes the same sequence of process steps as the claimed process, the sole difference being the use of a different carrier fluid for the catalyst, the board considers this document to represent the closest prior art.

3. *Technical problem*

3.1 In connection with the description of the method of D7, the following problems are identified in the patent in suit (see section [0003]):

(i) the introduction of large volumes of gas into the reactor together with the catalyst,

(ii) an insufficiently homogenous dispersion of the catalyst in the reactor,

(iii) an excessive entrainment of the catalyst out of the fluidised bed, and

(iv) the appearance of hot spots both in and above the fluidised bed.

Said problems may arise separately or simultaneously, depending on the composition or size of the catalyst.

3.2 According to the patent in suit (see section [0005]), the claimed process makes it possible to very substantially reduce or even to completely avoid the problems associated with the prior art methods. The claimed process is stated to be more universal, since it makes it possible to use catalysts differing in composition and size in the same reactor. It is plausible, in the absence of evidence to the contrary, that these advantages over the process of D7 can indeed be achieved with a process according to claim 1 of the contested patent. Concerning the respondent's allegation that the ability to use different catalysts would not necessarily occur in all cases, the respondent has not provided convincing arguments or evidence. The fact that D1 refers to many different types of catalysts (page 3, lines 6 to 10) does not render the statement in the patent in suit concerning the universal applicability of the claimed process less credible.

3.3 Hence, the board has no reason to depart from the technical problem as presented in the contested patent, which consists in providing a more universal process for feeding catalyst powder to a gas-phase olefin polymerisation reactor, wherein the problems associated with the method according to D7 are reduced or avoided.

3.4 Therefore, what remains to be seen is whether the claimed solution to this problem is suggested by the cited prior art.

4. D7 itself is entirely silent about the use of liquids in connection with the introduction of the catalyst powder into the reactor. Therefore, taken alone, it cannot suggest the claimed process.

5. As already indicated under points 1 to 1.4 above, D1 contains no clear and unambiguous reference to gas-phase polymerisation. On the contrary, its teaching is focussed on one particular liquid-phase olefin polymerisation method, namely suspension polymerisation in a pressurised reactor.

5.1 In view of the constructional differences between reactors for gas-phase polymerisation and those for liquid-phase polymerisation, and also the differences in terms of their operation (e.g. prevailing flow conditions and heat transfer aspects) it is rather questionable whether a skilled person seeking to solve the stated technical problem, would consider document D1 at all. But even assuming, for the sake of argument, that the skilled person would do so, it would not, for the following reasons, find in D1 an incentive to replace the catalyst dosing method (using gas) considered essential in D7 by the dosing method of D1 (using liquid).

5.2 In the introductory part of D1 different known liquid phase polymerisation methods are discussed wherein a solid catalyst is transferred into the reactor. As pointed out by the respondent, D1 also addresses the various drawbacks of these methods.

5.2.1 The catalyst may e.g. be suspended in a liquid medium in a storage tank provided with agitators, which suspension is then transported into the reactor as required (see page 1, lines 14 to 38). This method has several disadvantages (see page 1, line 39 to page 2, line 5). It requires a stirring device for achieving the uniform distribution of the catalyst in the suspension medium which is necessary for avoiding fluctuating catalyst concentrations and hence temperature fluctuations in the reaction tank. This uniform distribution is difficult to achieve and the required intensive agitation leads to the abrasion of catalyst granules resulting in an undesirably fine granulometry of the polymer particles obtained. Moreover, some catalysts are very unstable and lose activity rapidly when stored in suspension media.

5.2.2 According to some other known methods, the catalyst may also be stored under an inert protective gas in order to avoid such a loss of catalyst activity in a liquid suspension medium. In this case the dry catalyst powder may be dosed into the polymerisation vessel using cell wheel locks or screws (see page 2, lines 12 to 29). However, difficulties are encountered with such dosing devices when performing the polymerisation process at high pressure. The catalyst may also be blown with compressed gas through a capillary tube into the pressurised reactor (see page 2, lines 30 to 37). With pre-reduced catalysts the olefin to be polymerised cannot be used as pressure gas for locking in the catalyst. However, the use of an extraneous gas for locking in the catalyst is stated to lead to an undesirable lowering of the partial pressure of the monomer to be polymerised in the polymerisation tank (see page 2, lines 50 to 58).

5.3 D7 was published in 1994, i.e. many years after D1 (1978). The dosing method and device disclosed in D7 differ substantially from those mentioned as prior art in D1 which make use of a gas as suspension medium for the catalyst. It cannot be derived from D1 that the specific problems mentioned in point 5.2.2 above would also occur to a significant degree when carrying out the more recent process disclosed in D7, i.e. the dosing of a catalyst suspended in a gas using the particular means described in D7 into a gas-phase polymerisation.

5.3.1 More particularly, according to D7, the degree of dispersion of the solid catalyst particles achieved in the gas phase polymerisation reactor is considered as very good (see page 2, lines 5 to 7). Considering the different conditions prevailing respectively in gas- and liquid-phase polymerisation reactors, the skilled person carrying out the process of D7 and realising the problem of an insufficiently homogeneous dispersion of the catalyst in the gas phase reactor and/or the formation of hot-spots in the case of some particular catalysts used would not be prompted by the content of the older document D1 to modify the process of D7 merely because D1 contains some statements concerning the non-uniform distribution of catalyst in a liquid suspension fed to a liquid phase polymerisation tank and resulting temperature fluctuations in the reaction tank. Nor would the skilled person relate the problem of attrition of catalyst particles occurring in stirred liquid suspensions and the subsequent excess of fine polymer particles formed in a liquid phase polymerisation to the different problem of excessive entrainment of catalyst particles out of a gas-phase reactor.

5.3.2 D7 also addresses and suggests an improvement to the problem of the amount of gas introduced into a gas-phase reactor together with the catalyst (see page 1, last paragraph, page 2, first paragraph, and page 5, lines 3 to 6). The statements in D1 concerning specific problems occurring with older and different catalyst dosing techniques using gas as the transport medium (see point 5.2.2 above) would thus not give the skilled person an incentive to modify some essential, dosing-related features of the more recent gas phase process disclosed in D7.

5.4 Summarising, even assuming that the skilled person confronted with the stated technical problem would actually look into D1 at all despite the differences between gas phase and liquid phase polymerisation reactors, the board is not convinced that the skilled person, considering the said differences, could reasonably expect that the stated technical problem would be successfully solved by replacing the catalyst feeding technique of a gas-phase polymerisation process as disclosed in D7 by the catalyst feeding technique of D1.

6. The respondent's other line of argument, according to which the claimed process was not inventive in view of a combination of D1 with D3 is also not convincing for the following reasons.

6.1 As already indicated under points 1 to 1.4 above, D1 does not refer to other specific polymerisation processes than suspension polymerisation in a pressurised reactor. On the other hand, claim 1 of the patent in suit is directed to a process comprising introducing a measured amount of catalyst "into a gas-phase olefin polymerisation reactor through which passes a gaseous reaction mixture containing at least one olefin", i.e. to a gas-phase polymerisation process involving a particular dosing method. For this reason, the board does not accept that D1 represents the closest prior art for the purpose of assessing inventive step.

6.2 Assuming, purely for the sake of argument, that D1 could nevertheless be considered as the closest prior art, the technical problem as formulated by the respondent at the oral proceedings, i.e. "adapting the method of dosed introduction of catalyst into its use in a gas phase process" cannot be retained. As indicated by the board at the oral proceedings, any reference to a gas phase process in the formulation of the technical problem to be solved with respect to D1 constitutes a pointer to the claimed solution or anticipates the claimed solution, and thus necessarily leads to an *ex post facto* view of inventive step being taken, see e.g. "Case Law of the Boards of Appeal of the EPO", 4th edition 2001, I.D.4.2. The technical problem can, however, in any case be considered to consist in the provision of a further process comprising introducing a solid catalyst into an olefine polymerisation reactor.

6.3 Gas phase polymerisation of ethylene was known before the filing date of D1 (see D2, the paragraph bridging pages 439 and 440). However, since D1 is concerned with suspension polymerisation, it does not by itself suggest the replacement of the polymerisation reactor by a gas phase polymerisation reactor.

6.4 Document D3 relates to a catalyst feeding system for polymerization processes (column 1, lines 11 to 12). From the discussion of the prior art in the introductory part of the description, as well as from several other indications in this document, it can be inferred that it essentially relates to feeding catalyst into olefine polymerisation systems (see column 1, lines 17 to 63, column 1, line 66 to column 2, line 12, column 5, line 47, and column 5, line 57 to column 6, line 2.

6.4.1 The teaching of D3 is to mix a dry catalyst with a hydrocarbon fluid in a mixing tank to form a catalyst **mud** prior to its introduction into the polymerisation system via a metering valve. D3 does not clearly and expressly indicate the particular polymerisation reactors that may be used in carrying out this teaching. In column 5, lines 38 to 45 of D3 it is only stated that the hydrocarbon used to wash or draw the catalyst mud into an (intermediate) dilution vessel or directly into the reactor vessel is the same as used in the reactor for temperature control. In the following sentence, D3 generally states that "in gas-phase systems, this is considered quench liquid or in a slurry process a catalyst and polymer particulate suspending medium".

6.4.2 The catalyst mud to be used according to D3 is stated to be denser and more homogeneous than the catalyst slurries produced by the previously known methods. It is formed by expanding the catalyst by about 15 to 60% in volume. D3 itself thus makes a difference between a mud and a slurry. According to D3, feeding the catalyst to the reactor in the denser form of a mud has advantages over the previously known methods involving feeding of the catalyst in form of a slurry. In particular, the catalyst mud "can be fed in exact amounts into the polymerisation system", it tends to be fed "in a more predictable manner", and mixing of the catalyst with the liquid hydrocarbon is performed without undesirable pulverisation of the catalyst, see column 2, lines 1 to 6, lines 9 to 12, and lines 23 to 36, column 3, lines 20 to 24, and column 5, lines 31 to 38.

6.4.3 The board does not exclude that in some technical fields or according to some lexical definitions a mud may also be considered as a suspension, as submitted by the respondent. However, D3 itself emphasises that the catalyst mud to be used is denser than the slurries produced according to the prior art methods, and the mud is also stated to "settle in the lower portion" of the liquid-filled tank 12 used for mixing the hydrocarbon and the catalyst (column 3, lines 22 to 24). Therefore, the skilled person familiar with the technical field in question would not assimilate the mud described in D3 to a slurry in the sense of the prior art discussion in D3 itself, or to a suspension in the sense of D1 or of claim 1 of the contested patent.

6.4.4 D1 requires the formation of a liquid catalyst suspension to be fed to the reactor (see e.g. page 2, line 90 and page 3, line 74). Considering that D3 prescribes, in contrast therewith, the preparation of a catalyst mud to be transported to the reactor, and points out the advantages of this technique over the use of a catalyst slurry, the skilled person confronted with the stated technical problem would rather be led away from using a liquid catalyst suspension.

6.5 In the introductory part of the description (column 1, lines 16 to 33), under the heading "Setting of the invention", D3 mentions some earlier prior art.

6.5.1 It first mentions "vapour phase or slurry phase olefin polymerizations", wherein the catalyst is introduced at timed intervals into a reactor vessel. According to the following sentence of this section "in the reactor vessel the catalyst and a quench liquid, such as a light hydrocarbon, are introduced directly into and onto the stirred and/or fluidized bed for forming the desired polymers". As pointed out by the appellants, this sentence does not expressly indicate that the quench liquid and the catalyst are introduced together as a mixture. Since the addition of quench liquid and the addition of catalyst have different purposes and an opposite effect on the reaction rate, the board accepts that this sentence cannot be understood as excluding the possibility that they are fed to the reactor separately.

6.5.2 The third sentence of the said passage, starts in line 25 with the wording "In one type of polymerisation system...". The third and fourth sentences refer to the formation of a catalyst slurry by mixing the catalyst and a hydrocarbon at high rate of speed in a mixing tank, which slurry is then introduced in a dilution vessel before being fed into the reactor vessel. Considering the very general ("in one type") beginning of the third sentence and the absence of an express indication of the type of a specific type of polymerisation reactor, the reader of the third and fourth sentences would not necessarily understand that they refer to the vapour phase polymerisation methods addressed in the previous sentences of this paragraph. Hence the reader can only speculate about the type of the polymerisation reactor concerned in the third and fourth sentences.

6.5.3 The statements concerning gas-phase polymerisation and quench liquid which are contained in column 5, lines 42 to 45 of the description of D3 relate to the disclosure of the actual invention according to D3 and not to the prior art and cannot, therefore, be used to provide the information missing or being unclear in the sentences describing the prior art.

6.5.4 In view of the lack of precision addressed under points 6.5.1 und 6.5.2 above, the board concludes that the description of the earlier prior art in D3, column 1, lines 16 to 43 does not constitute a clear and unambiguous disclosure of a gas-phase olefin polymerisation wherein the catalyst is fed to the reactor in form of a mixture with a liquid hydrocarbon. In the absence of *ex post facto* considerations, and considering also that the actual invention according to D3 requires the use of a catalyst mud, the quoted passage of D3 cannot be considered to provide an incentive for replacing the suspension polymerisation of D1 by a gas phase polymerisation whilst still feeding the catalyst in form of a suspension and not as a mud.

6.6 Summarising, the respondent's arguments based on the documents D1 and D3 or D7 and D1 could not convince the board that the claimed process lacks an inventive step. The remaining prior art documents cited in the opposition and appeal proceedings do not contain further information which would point towards the claimed process.

7. Independent claim 2 essentially differs from claim 1 in that it additionally requires a continuous stream of liquid hydrocarbon through the mixing chamber and into the polymerisation reactor. Since the process of claim 1 is inventive even without the said additional limiting features, the same conclusion must apply to the more specific process of claim 2. The patentability of dependent claims 3 to 10 is supported by that of claims 1 and 2.

8. Since the appellants' main request is allowed, there is no need to deal with their two auxiliary requests.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained as granted.

The Registrar: The Chairman:

A. Wallrodt M. Eberhard