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Datasheet for the decision of 17 November 2021

Case Number: T 2283/18 - 3.3.03

Application Number: 11715685.1

Publication Number: 2563825

IPC: C08F210/16, C08F2/00, C08F2/34

Language of the proceedings: EN

Title of invention:
POLYMERIZATION PROCESS

Patent Proprietor:
Ineos Sales (UK) Limited

Opponent:
The Dow Chemical Company

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step (no) (all requests)

Decisions cited:
T 0939/92

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Beschwerdekammern

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Case Number: T 2283/18 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 17 November 2021

Appellant: (Opponent)	The Dow Chemical Company 2030 Dow Center Midland, MI 48674 (US)
Representative:	Boult Wade Tennant LLP Salisbury Square House 8 Salisbury Square London EC4Y 8AP (GB)
Respondent: (Patent Proprietor)	Ineos Sales (UK) Limited Hawkslease Chapel Lane Lyndhurst Hampshire SO43 7FG (GB)
Representative:	De Kezel, Eric Mathisen & Macara LLP Communications House South Street Staines-upon-Thames Middlesex, TW18 4PR (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 2 July 2018 concerning maintenance of the European Patent No. 2563825 in amended form.**

Composition of the Board:

Chairman	D. Semino
Members:	F. Rousseau
	A. Bacchin

Summary of Facts and Submissions

I. The appeal lies from the interlocutory decision of the opposition division posted on 2 July 2018 according to which European patent No. 2 563 825 as amended according to the claims of auxiliary request 2A filed with letter of 18 May 2018 and a description adapted thereto met the requirements of the EPC. The contested decision was also based on the patent as granted as the main request and a first auxiliary request filed with letter of 29 March 2018.

II. Independent claim 1 of auxiliary request 2A read as follows (for ease of understanding the Board has indicated by comparison to the text of claim 1 as granted additions in underlined, and deletions in strikethrough):

"1. Process for the transition between an ethylene co-polymerization process carried out in a polymerization reactor in the presence of a catalyst and of ethylene E and an olefin co-monomer A to produce an ethylene copolymer PEA into an ethylene co-polymerization process carried out in the same polymerization reactor in the presence of a catalyst and of ethylene E and an olefin co-monomer B to produce an ethylene copolymer PEB characterised in that

- co-monomer A and co-monomer B are different;
- co-monomer A and co-monomer B are both simultaneously present in the reactor during at least 50% ~~part~~ of the duration of the transition from PEA to PEB; and
- the transition is performed continuously,

and further wherein the melt index (MI) of the copolymer PEA and copolymer PEB fulfil the following equation:
$0.55 \times MI(PEA) < MI(PEB) < 1.45 \times MI(PEA)$
wherein the melt index is measured using the standard ISO 1133 at a temperature of 190 °C under load of 5 Kg."

III. The decision was taken having regard to the following documentary evidence amongst others:

D1: EP 2 172 495 A1
D2: Optimal Grade Transitions in a Gas Phase Polyethylene Reactor, K. B. McAuley et al, AIChE Journal, October 1992, Vol. 38, No. 10, pages 1564-1576
D3: Advanced control methods improve polymers' business cycle, O. Karagoz et al, Hydrocarbon Processing, April 2004, pages 45-49.

IV. According to the reasons for the contested decision which are pertinent in the appeal proceedings:

(a) For a particular system of reactor, monomers and catalyst, the skilled person was able to influence and control the melt index of the copolymer by varying the temperature of the reactor and the composition of the gas phase, reference being made to D2. For these reasons, not only the process in accordance with the granted claims, but as well that defined in auxiliary request 2A was sufficiently disclosed.

(b) Regarding inventive step, D1 constituted the closest prior art. The relationship concerning the melt indices could form part of the definition of the problem to be solved, but not of the solution.

Accordingly, the problem solved over the closest prior art could be formulated as to how to provide a transition between a copolymer comprising comonomer A of a given melt index and a copolymer comprising comonomer B of a similar melt index, whereby the melt indices fulfilled the requirement set out in claim 1. The simultaneous presence of comonomers A and B in the reactor represented a obvious option among two equally valid alternatives, as this choice had not been shown to bring about any advantage. The process of claim 1 of the main request lacked therefore an inventive step.

(c) Claim 1 of the first auxiliary request contained as an additional distinguishing feature over the closest prior art the activity of the catalyst system during the transition. This feature which had not been shown to result in any technical effect constituted only one of several arbitrary alternatives that would be considered by the skilled person. An inventive step was therefore also denied for claim 1 of the first auxiliary request.

(d) Concerning auxiliary request 2A, it was however at the very least counter-intuitive and in any case not suggested in the available prior art to carry out a transition between two different comonomers in a manner that required those two comonomers to be both present in the reactor during a substantial part of the duration of the transition. Whether the transition could be performed quicker and with less off-specification product was irrelevant, since the feature itself was not suggested in the prior art.

Therefore, the process in accordance with auxiliary request 2A was inventive.

V. The opponent (appellant) lodged an appeal against the above decision. The statement of grounds of appeal was submitted with letter of 12 November 2018.

VI. With their reply to the statement of grounds of appeal (letter of 22 Mach 2019), the patent proprietor (respondent) requested that the appeal be dismissed, i.e. the opposed patent be maintained on the basis of auxiliary request 2A in opposition, which was resubmitted and relabelled as the Main Request. Two sets of amended claims labelled First Auxiliary Request and Second Auxiliary Request were also submitted with said letter.

Claims 1 of the First Auxiliary request and Second Auxiliary Request corresponded to claim 1 as granted and claim 1 of the Main Request, respectively, in which the expression "and wherein the transition from PEA to PEB comprises a period during which both fresh co-monomer A and fresh comonomer B are fed simultaneously in the reactor;" had been inserted in both cases before the expression "and - the transition is performed continuously".

VII. With a further letter dated 9 July 2019 the appellant requested that the First Auxiliary Request be not admitted into the proceedings.

VIII. Oral proceedings before the Board were held by videoconference on 17 November 2021. During the course of oral proceedings, the request not to admit the First Auxiliary Request into the proceedings was withdrawn

and the order of the respondent's two auxiliary requests was inverted.

IX. The appellant's submissions, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. The appellant essentially argued that the subject-matter of the process defined in the respondent's claim requests was not inventive over the example of D1 constituting the closest prior art. The transitioning process disclosed in D1 was also continuous and the features distinguishing the process in accordance with the patent in suit from that described in D1 were arbitrary and therefore obvious to the skilled person.

X. The respondent's submissions, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. The respondent essentially submitted that the requirements for a continuous transition were defined in paragraph [0019] of the opposed patent and that the example of D1 representing the closest prior art did not disclose whether the transition operated in that example was continuous or not. The duration for the simultaneous presence of co-monomers A and B in the reactor and the melt index limitations for initial and final polymers brought about advantages in particular with respect to a minimisation of off-specification material. Those measures were not suggested by the prior art. The transitioning process claimed was therefore inventive.

XI. The appellant requests that the decision of the opposition division be set aside and that the European patent be revoked.

XII. The respondent requests that the appeal be dismissed or, in the alternative, that the opposed patent be maintained on the basis of the Second Auxiliary Request or of the First Auxiliary Request in this order, both submitted with the reply to the statement of grounds of appeal.

Reasons for the Decision

Main Request - Inventive step

1. The patent in suit relates to the sequential production of two ethylene copolymers in the same reactor, more specifically to a process for the continuous transition between the production of two ethylene copolymers containing a different comonomer (paragraphs [0001] to [0004]). It is stressed in paragraph [0003] that new products cannot be made instantaneously and require a quantifiable period of transiency in becoming adjusted to the new, desired conditions. It is an object of the patent in suit to provide a process for the transition between two ethylene copolymers containing a different comonomer which allows to reduce the amount of transient (off grade) material produced during the transition (paragraph [0014]).

Closest prior art

2. The appellant considers that the closest prior art can be represented by the process disclosed in the sole example of D1. The choice of that process as starting point for assessing inventive step was not disputed by the respondent. The Board has no reason to take a

different view, since D1, in particular its example, concerns a method for transitioning (emphasis added by the Board) from the production of a first polymer to the production of a second polymer in same reaction vessel during a polymerisation campaign (first part of claim 1).

As far as the polymerization process of example of D1 (paragraphs [0089] to [[0098]) is concerned, it is carried out in the same gas phase fluidised bed reactor using a Ziegler Natta catalyst and consists of various stages in the following order:

- the initial production of an ethylene/1-butene copolymer "at a temperature of approximately 108°C", followed by
- a first transition to produce an ethylene/1-hexene copolymer also produced "at a temperature of approximately 108°C", a slight drift downwards in temperature being noted,
- a second transition with an increase in temperature to approximately 110°C without a change in comonomer to produce a different grade ethylene/1-hexene copolymer,
- a third transition to produce a further different grade ethylene/1-hexene copolymer with a further temperature increase to 113°C,
- a temperature reduction back to approximately 108°C using the same 1-hexene comonomer,
- a change in comonomer returning back to 1-butene and temperature conditions initially used to produce the same product as in the initial production stage.

Distinguishing features

3. The parties agree that the process of operative claim 1 differs from the first transition between the

production of an ethylene/1-butene copolymer and the production of an ethylene/1-hexene copolymer described in example 1 of D1 or from the last transition described in that example (return to the production of an ethylene/1-butene copolymer) in that

- both co-monomers are simultaneously present in the reactor during at least 50% of the duration of the transition and
- the melt indices (MI) of the two copolymers obtained after and before the transition fulfil the equation defined in operative claim 1,

since no information is given in D1 concerning their simultaneous presence in the reactor or their melt indices.

4. Contrary to the opposition division and the appellant who considered that these were the sole features distinguishing the subject-matter of operative claim 1 from the process of the example of D1, the respondent argued that a continuous transition between the production of the two copolymers represented an additional distinguishing feature of the claimed process. As submitted by the respondent in section 2.5 of their rejoinder, the requirements for a continuous transition in the opposed patent were defined in paragraph [0019] of the specification.

4.1 The normal rule of claim construction is that the terms used in a claim should be given their broadest technically sensible meaning in the context of the claim in which they appear, and in order to ensure legal certainty, independently from any alleged intention derivable from the description that the claim should be read in a more restrictive way (Case Law of

the Boards of Appeal of the EPO, 9th Edition, 2019, II.A.6.3.4).

The definition in claim 1 that "the transition is performed continuously", i.e. in the context of a transition between the preparation of ethylene copolymers PEA and PEB (wherein comonomers A and B are different), merely means that the polymerization reaction is not interrupted.

There is no reason to construe claim 1 in a different way, having regard to an apparent more restrictive definition of that wording given in paragraph [0019] of the specification, as is done by the respondent in the 4th and 5th paragraphs of section 2.5 of the rejoinder. These restricted definitions, as confirmed by claims 2, 4, 6 or 7 of the present Main Request, merely refer to various embodiments of operative claim 1.

4.2 It remains therefore to be addressed whether the polymerization reaction is interrupted or not in the example of D1. First of all, the wording "*transitioning from the production of a first polymer to production of a second polymer*" which is part of the definition of the general method defined in claim 1 of D1 and which is also to be found in paragraphs [0014] and [0015] of that document already expresses the idea of moving gradually from the production of a first polymer to the production of a second polymer. This already excludes the idea of discontinuing the polymerisation reaction between the productions of the first and second polymer.

4.3 Furthermore, [0011] of D1 defines the meaning of the wording "*polymerisation campaign*" used in claim 1 and paragraph [0015] which, in operation of a commercial

polymerisation, is the production of "*a sequence of different polymers by variation of reaction conditions, such as temperature or comonomer used with time*". The following passages of D1:

"*over the course of a campaign the catalyst "type" and the principal olefin are likely to be "fixed" but it may be desirable to produce a number of polymers using different comonomers and a number of different polymer using a common comonomer, but with varying polymer properties, such as melt index and density*" (paragraph [0017]) and

"*in general, transitions in which the comonomer is not changed are also significantly less complicated that those in which the comonomer is changed, and thus it is often desirable, within an overall polymerisation campaign, to produce a number of polymers using the same comonomer in one sequence, before transitioning to polymers produced using a different comonomer, and producing a number of these in sequence*" (paragraph [0040])

indicate possible changes between two polymerisation sequences, the level of difficulty accompanying these changes and as a consequence of these difficulties preferred orders for polymerization sequences.

The only sensible reason for such an order of polymerization sequences is that it minimises the changes required for the control of the polymerization during a continuous transition, confirming thereby the continuous character, in the method of claim 1 of D1, of the transitioning from a first polymerization process to a second polymerization process.

4.4 On that basis the sole example of D1 must be understood to concern a sequence of polymerization reactions in which the transitions are continuous. Moreover, any interruption of the polymerization in the reactor between the various polymerization sequences described in the example would require extraordinary measures well known to the skilled person, such as deactivation of the catalyst or purging the reactor, which are not disclosed in that example. The absence of such information while details concerning usual parameters of the polymerization reaction such as temperature are given does not render credible the existence of such non-described extraordinary measures.

4.5 Finally, the respondent's argument that processes having discontinuous transitions between the continuous production of different grades are known is not supported by any evidence, let alone in respect of the operation of a commercial polymerization process, as is addressed in D1. The sole evidence on file concerning transition between sequences of polymerization reactions in a commercial polymerization process are D2 and D3 which rather concern a continuous transition, e.g. D2 (section "The Optimal Grade Transition Problem", pages 1566 and 1567) and D3 (page 45, section "Preparing for the upturn").

5. Consequently, the process in accordance with operative claim 1 solely differs from that described in example 1 of D1 by the two features identified in above point 3.

Problem successfully solved

6. The respondent did not formulate the problem solved over the closest prior art by the process of claim 1 as a whole, but separately addressed partial problems

alleged to be solved by each of the distinguishing features. This is consistent with the appellant's view that the relationship between the melt indices and the simultaneous presence in the reactor of comonomers A and B during at least 50% of the duration of the transition did not mutually influence each other.

6.1 The respondent submitted that the deliberate presence of both comonomers during a significant part of the transition enables the control of the terpolymer produced during the transition, which would provide a further control technique for the transition.

As argued by the appellant, operative claim 1 does not contain any limitation regarding variations of absolute or relative amounts of comonomers A and B during the transitioning, let alone limitations in respect of other variables of the polymerization process during that phase. It is, however, indisputed that the quality of a polymer depends on numerous process parameters, such as temperature, gas composition, including monomers and hydrogen, which also applies for the transition stage for which claim 1 does not contain any limitation, let alone as a function of the transition time. On that basis, it cannot be concluded that the sole measure defined in operative claim 1 concerning the deliberate presence of both comonomers during a significant part of the transition necessarily results in particular properties of the transitioning product or in any particular control or adjustment of the quality or usefulness of any off-grade material produced during the transition.

For the same reason, the respondent's argument that the presence of both comonomers during a significant part of the transition enables more of the product produced

during the transition to be saleable at higher prices for the respective on-spec materials fails to convince.

6.2 Moreover, as submitted by the appellant, the definition in claim 1 of the melt indices of the copolymers PEA and PEB at the beginning and the end of the transition does not result in any definition, even implicit, of the nature of the polymers produced during the whole transition, whose duration is also not specified in operative claim 1. Therefore, contrary to the respondent's submissions, it cannot be concluded either, that the relationship defined in claim 1 in respect of the melt indices of PEA and PEB necessarily results in a lower amount of "off-spec" materials.

6.3 For the same reasons, the respondent's argument that the selection of initial and final products with similar melt indices helps to ensure the compatibility of the products which are present at the same time in the reactor (i.e. during the transition period) even though those are produced with different comonomers, does not convince, since operative claim 1 does not comprise any limitation from which would result a definition, even implicit, of the nature of the polymers produced during the transition.

6.4 Finally, the respondent's arguments relating to the advantages of the claimed continuous transitioning process over a process in which the reaction is stopped, e.g. gain of time and reduction of pollution, are not pertinent, as the transitioning process of the closest prior art is also continuous (see above points 4 to 4.5).

6.5 On this basis, the subject-matter of claim 1 has not been shown to provide a successful solution to the

partial problems addressed by the respondent. In agreement with the appellant's position, the Board therefore concludes that the problem successfully solved over the closest prior art by the subject-matter of claim 1 can only be formulated as the mere provision of a further process for transitioning from the production of a first ethylene copolymer to the production of a second ethylene copolymer comprising a different comonomer.

Obviousness of the solution

7. It remains to be decided whether the skilled person desiring to solve the problem identified above, would, in view of the closest prior art, possibly in combination with other prior art or with common general knowledge, have modified the disclosure of the closest prior art in such a way as to arrive at the claimed process. In that respect, in the absence of any synergistic effect arising from the measures distinguishing the claimed invention from the closest prior art, the obviousness of each of said measures, taken alone, has to be assessed separately.

7.1 In is undisputed that a continuous transition, like in D1, from the production of a first ethylene copolymer PEA to the production of a second ethylene copolymer PEB (in the case of the first transition of the example of D1, the transition of an ethylene/1-butene copolymer to an ethylene/1-hexene copolymer and the converse in the last transition of that example) requires not only to stop feeding co-monomer A into the reactor at some point of the transition, but also to start feeding co-monomer B into said reactor at some further point of the transition (which is not necessarily the same as the first one).

When operating with a continuous transition from a monomer composition consisting of ethylene and co-monomer A (before the transition) to a monomer composition consisting of ethylene and co-monomer B (after the transition), it is immediate for the skilled person that only two options are available, namely:

(i) reducing the amount of co-monomer A contained in the monomers mixture to zero, i.e. until the only monomer contained in the reactor is ethylene, before feeding co-monomer B or

(ii) feeding co-monomer B to the reactor while the monomer mixture still contains co-monomer A.

7.2 According to the case law of the boards of appeal, the answer to the question what a skilled person would have done in the light of the state of the art depends in large measure on the technical result set out to be achieved (see T 0939/92, OJ EPO, 1996, 309, reasons Nrs 2.4.2 and 2.5.3). Here, with a view to merely provide a further process for transitioning from the production of a first ethylene copolymer to the production of a second ethylene copolymer comprising a different comonomer, the skilled person would consider any measure at his or her disposal, in particular feeding the second co-monomer B to the reactor while the monomer mixture still contains co-monomer A. Moreover, having regard to the obvious desire to reduce the duration of the transition and the amount of off-spec material, the skilled person would, in fact, rather be inclined to select above mentioned option (ii) which leads to the simultaneous presence of co-monomers A and B in the reactor during the transition.

7.3 It also results from the analysis of the problem successfully solved over the closest prior art that the duration of the simultaneous presence of comonomers A and B in the reactor for at least 50% of the transition is arbitrary in the sense that it does not result in the achievement of any particular technical effect. Thus, the act of choosing an arbitrary relative duration for which both comonomers A and B are simultaneously present in the reactor does not require any inventive skill. Therefore the Board finds that this is an obvious measure for the skilled person.

7.4 Similarly, it is undisputed that the melt index is known to the skilled person as a relevant parameter when preparing a copolymer of ethylene. The selection of the range for the relative melt index of PEA and PEB defined in operative claim 1 is moreover deemed to be arbitrary, as it does not result in any technical effect. Accordingly, selecting melt indices of the copolymer PEA and copolymer PEB as to fulfil the equation defined in operative claim 1 is an obvious measure to the skilled person. It was also undisputed in that respect that the skilled person in view of the common general knowledge, reference being for example made to the duration of the polymerization, the temperature of the gas phase or an adjustment of the hydrogen concentration, would have no difficulty, if necessary with a reasonable amount of experimental work, to prepare PEA and PEB whose melt indices meet the equation defined in operative claim 1.

7.5 Consequently, starting from the transitioning process of the example of D1 and faced with the problem of providing a further process for transitioning from the production of a first ethylene copolymer to the production of a second ethylene copolymer comprising a

different comonomer, the skilled person would have arrived in an obvious way at a process falling within the ambit of operative claim 1.

7.6 The main request is therefore not allowable, as the subject-matter of its claim 1 does not involve an inventive step, contrary to the requirements of Article 56 EPC.

Second Auxiliary Request

8. In view of the inversion of the order of the auxiliary requests requested by the respondent during the oral proceedings before the Board, without albeit changing their labelling (point VIII, above), the next request to be examined by the Board is the Second Auxiliary Request submitted with the reply to the statement of grounds of appeal.

Its claim 1 differs from claim 1 of the Main Request in that it has been specified that "*the transition from PEA to PEB comprises a period during which both fresh co-monomer A and fresh comonomer B are fed simultaneously in the reactor*".

8.1 In the context of the patent in suit the term "fresh" can only refer to the injection during the transition of a co-monomer which was not present in the reactor before the start of the transition, i.e. a fresh co-monomer A is a monomer A fed to the reactor during to the transition, whereas a fresh co-monomer B merely defines the feeding of co-monomer B into the reactor, as the latter had not been injected before the transition began. Accordingly, the feeding of fresh comonomer B is already a feature of claim 1 of the Main request. On that basis, claim 1 of the First Auxiliary

Request contains as sole additional feature compared to claim 1 of the Main Request the injection of co-monomer A for an unspecified period during the injection of co-monomer B.

8.2 Claim 1 does not contain in particular any restriction concerning the duration of the co-feeding of co-monomers A and B or the amount of "fresh" co-monomer A injected during transition. Accordingly, the additional feature contained in claim 1 cannot be held alone to result in any technical effect or advantage relating to the amount or quality of the product prepared during the transition. For this reason, the additional feature contained in claim 1 of the present request does not lead to a different formulation of the technical problem solved over the closest prior art.

8.3 As to the obviousness of this additional measure, the respondent submitted that the injection of a co-monomer A during the transition was for a skilled person counter-intuitive, as it would increase the time required for the transitioning. Injection of co-monomer A for an unspecified period during the injection of co-monomer B is, however, considered by the Board as on obvious means for the skilled person to achieve the simultaneous presence of comonomers A and B in the reactor for at least 50% of the transition, this latter measure being in view of its arbitrariness already obvious to the skilled person, as indicated in relation to the Main Request.

8.4 Consequently, the additional feature introduced in the Second Auxiliary Request cannot overcome the finding concerning the Main Request that the claimed process lacks an inventive step (Article 56 EPC). The Second Auxiliary Request is consequently also not allowable.

First Auxiliary Request

9. Claim 1 of the First Auxiliary Request differs from claim 1 of the Second Auxiliary Request in that it does not quantify the duration of the simultaneous presence of co-monomers A and B in the reactor during the transition. It was undisputed that the subject-matter of claim 1 of the First Auxiliary Request therefore encompasses that defined with claim 1 of the Second Auxiliary Request, with the consequence that any conclusion concerning lack of inventive step in respect of the Second Auxiliary Request would be equally valid for the First Auxiliary Request. Accordingly, the First Auxiliary Request is also not allowable, as its claim 1 lacks an inventive step within the meaning of Article 56 EPC.

Conclusion

10. As the subject-matter of claim 1 according to all requests does not involve an inventive step, there is no need for the Board to decide on any other issue and the patent is to be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

B. ter Heijden D. Semino

Decision electronically authenticated