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Datasheet for the decision of 11 February 2026

Case Number: T 0084/24 - 3.3.03

Application Number: 18752506.8

Publication Number: 3668904

IPC: C08F2/01, C08F10/02

Language of the proceedings: EN

Title of invention:
PROCESS FOR THE PREPARATION OF ETHYLENE HOMOPOLYMERS OR COPOLYMERS

Patent Proprietor:
Basell Polyolefine GmbH

Opponent:
The Dow Chemical Company

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - Main request (no) - Auxiliary request V (yes)

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Beschwerdekammern

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Case Number: T 0084/24 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 11 February 2026

Appellant: (Opponent)	The Dow Chemical Company 2211 H.H. Dow Way Midland MI 48674 (US)
Representative:	Boult Wade Tennant LLP Salisbury Square House 8 Salisbury Square London EC4Y 8AP (GB)
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Representative:	LyondellBasell c/o Basell Polyolefine GmbH Industriepark Hoechst, Bldg. E413 65926 Frankfurt am Main (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 16 November 2023 concerning maintenance of the European Patent No. 3668904 in amended form.**

Composition of the Board:

Chairman	D. Semino
Members:	D. Marquis
	L. Basterreix

Summary of Facts and Submissions

I. The appeal lies against the decision of the opposition division concerning maintenance of European patent No. 3 668 904 on the basis of the claims of the main request filed with letter of 17 August 2023, an adapted description and drawing sheets 1-3 of the patent specification.

II. Claim 1 of that request read as follows:

"1. A process for the preparation of ethylene homopolymers or copolymers in a facility, the facility comprising a high-pressure tubular reactor used in a continuous flow mode with a reaction fluid comprising or consisting of ethylene being introduced into the reactor at a reactor inlet and polymer leaving the reactor at a reactor outlet and the facility further comprising a preheater having an inlet and an outlet, wherein the process comprises the following steps:

a) compressing the reaction fluid to an elevated pressure;
b) heating at least a portion of the reaction fluid in the preheater;
c) introducing the reaction fluid heated in step b) into the reactor at the reactor inlet; and
d) polymerizing the reaction fluid at the elevated pressure in the presence of free-radical polymerization initiators in the reactor,

wherein the average velocity of the reaction fluid at the outlet of the preheater is lower than the average velocity of the reaction fluid in the tubular reactor at the reactor inlet and the ratio of the average

velocity of the reaction fluid in the tubular reactor at the reactor inlet to the average velocity of the reaction fluid in the preheater at the outlet of the preheater is in the range from 1.5 to 2.2".

III. The following documents were *inter alia* submitted during the opposition proceedings:

D2: WO 2013/132011 A1

D3: Ethylene Polymers, Encyclopaedia of polymer science and engineering, Vol. 6. 1986, paqes 404-406

D4: US 4,175,169

IV. The decision under appeal, as far as it is relevant to the present appeal, concluded that claim 1 of the main request involved an inventive step starting from D2 (either Figures 3-6 or Figure 7) as the closest prior art.

V. The opponent (appellant) lodged an appeal against the decision of the opposition division.

VI. The patent proprietor (respondent) submitted six sets of claims as auxiliary request I-VI with the reply to the statement of grounds of appeal.

VII. Oral proceedings before the Board were held on 11 February 2026.

VIII. The final requests of the parties were as follows:

- The appellant requested that the decision under appeal be set aside and the patent be revoked.

- The respondent requested that the appeal be dismissed, or in the alternative, that the patent be maintained on the basis of the claims of auxiliary requests V, VI or I-IV (in this order) submitted with the reply to the statement of grounds of appeal.

Claim 1 of auxiliary request V corresponded to claim 1 of the main request with the following addition at the end of the claim:

"wherein the preheater consisted of two preheater units and a first preheater unit is arranged on a first branch line and a second preheater unit is arranged on a second branch line; and wherein the process comprises the following steps:

a') providing a first flow of compressed reaction fluid comprising a first portion of the reaction fluid and providing a second flow of compressed reaction fluid comprising a second portion of the reaction fluid by compressing the reaction fluid to an elevated pressure and splitting at least a portion of a single flow of the reaction fluid into the first flow and the second flow of compressed reaction fluid;

b') conducting the first flow of the first portion of the reaction fluid through the first preheater unit and heating the first portion of the reaction fluid in the first preheater unit, and
conducting the second flow of the second portion of the reaction fluid through the second preheater unit and heating the second portion of the reaction fluid in the second preheater unit;

c') combining the first and second portion of the reaction fluid by recombining the first flow and the second flow of the reaction fluid and introducing the recombined flow of the reaction fluid heated in step b') into the reactor at the reactor inlet; and

d') polymerizing the reaction fluid at the elevated pressure in the presence of free-radical polymerization initiators in the reactor."

IX. The parties' submissions, in so far as they are pertinent, may be derived from the reasons for the decision below. The disputed points concerned inventive step of the subject-matter of claim 1 of the main request and of auxiliary request V in view of D2 as the closest prior art.

Reasons for the Decision

Main request

1. Inventive step in view of D2

1.1 D2 was chosen as the closest prior art in the decision under appeal (section 18.1). This choice was contested by the respondent in appeal who argued that D2 would not be a suitable starting point to assess inventive step of the main request because D2 would not be concerned with optical properties or the conversion rate of ethylene in the preparation of LDPE polymers (rejoinder, page 7, penultimate paragraph). The respondent also argued at the oral proceedings before the Board that D4 would be the closest prior art.

1.2 The first question to be answered is whether D2 could reasonably be considered to be the closest prior art

for the subject-matter of claim 1 of the main request. The boards have repeatedly pointed out that the closest prior art for assessing inventive step is normally a prior art document disclosing subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention. The closest prior art should additionally have the most relevant technical features in common, i.e. requiring the minimum of structural modifications, a further criterion for the selection of the most promising starting point being the similarity of the technical problem (Case Law of the Boards of Appeal, 11th Edition 2025, I.D.3.1).

1.3 The patent in suit concerns a process for the preparation of ethylene homopolymers or copolymers in a facility comprising a high-pressure tubular reactor (paragraph 1). The process generally involves a) compressing the reaction fluid to an elevated pressure, b) heating at least a portion of the reaction fluid in the pre-heater, c) introducing the reaction fluid heated in step b) into the reactor at the reactor inlet, and d) polymerizing the reaction fluid at an elevated pressure in the presence of free-radical polymerization initiators in the reactor (paragraph 8). Paragraph 6 of the patent in suit discloses that the process addresses the problem of fluctuations in the product quality caused by fluctuations of process conditions within the reactor that may be attributed to pressure pulsations induced by the secondary compressor.

1.4 D2 concerns a generally similar type of process for the preparation of ethylene copolymers which involves a compressor, a pre-heater and a reactor (claim 1) in a high pressure apparatus (page 3, line 23). D2 is in the same general field of the preparation of ethylene

polymers (page 1, first paragraph). Besides, the observations made on page 2, lines 18-30 and page 3, line 30 to page 4, line 2 in D2 concerning the influence of the process parameters on the overall efficiency of the production process can be seen as having the same overall purpose as the goal of the patent in suit, namely to address product quality by a better control of fluctuations in process conditions.

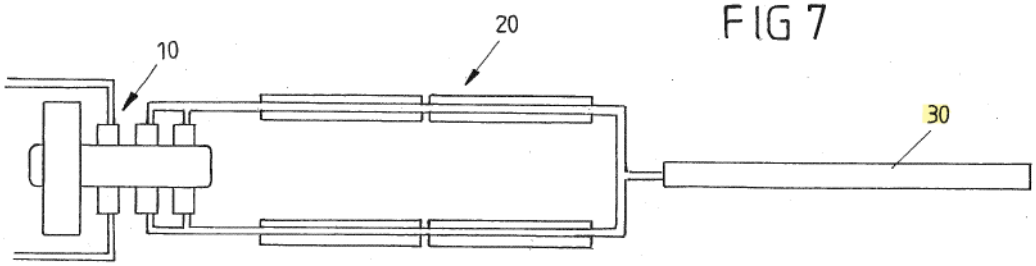
1.5 The Board thus finds that it was reasonable to consider D2 as the closest prior art in the decision under appeal. D2 does not mention specific properties of the copolymers produced, such as their optical properties addressed in the patent in suit, or even the conversion rate of ethylene as argued by the respondent, but it nonetheless relates to the optimization of the same process as that disclosed in the patent in suit in order to provide copolymers of satisfying properties. Besides, in order to be relevant as the closest prior art, a document does not have to disclose all the problems solved by the claimed invention (Case Law of the Boards of Appeal, 11th Edition 2025, in the following Case Law, I.D.3.5) and does not even need to mention or address the same specific purpose (in the present case the mitigation of a pressure drop arising between the pre-heater and the reactor discussed in paragraph 53 of the patent in suit) to be a reasonable choice of closest prior art (Case Law, I.D.3.3).

1.6 The respondent argued at the oral proceedings that D4 would be more suitable than D2 as the document to be taken as the closest prior art. Little information was laid out by the parties about the selection of D4 as the closest prior art instead of D2, because the possible choice of D4 as the closest prior art was not discussed by any of the parties in the written phase of

the appeal proceedings. This is, however, not the decisive point. Indeed, even if D4 could have ultimately been considered as a document representing the closest prior art, that alone would not preclude an assessment of inventive step in view of any other document of the prior art like D2, which is, possibly alongside D4, a legitimate and valid representation of the closest prior art. It is in this respect constant case law of the Boards of Appeal that if the skilled person has a choice of several workable routes which might lead to the invention, i.e. routes starting from different documents, the rationale of the problem solution approach requires that the invention be assessed relative to all these possible routes, before an inventive step can be acknowledged (Case Law, I.D. 3.3). It follows that the possible relevance D4 may have had for the present invention is of no significance to the present assessment of inventive step starting from document D2.

1.7 The opposition division considered two starting points within D2 for the assessment of inventive step, the first starting point being the process shown in Figures 3-6 and the other starting point being the process shown in Figure 7 of D2. The process corresponding to Figure 7 is the one relevant to the present decision and is hereby reproduced.

FIG 7



1.8 The respondent contested the choice of the process shown in Figure 7 of D2 as the closest prior art

(rejoinder, page 8). The process shown in that figure corresponded to the one disclosed in example 3 which was identified as a comparative example. That process was intended to show the effect of adding the comonomer (octadiene) to the pre-heater, contrary to the main teachings otherwise provided in D2. It would therefore not be a suitable starting point to assess inventive step in the opinion of the respondent.

1.8.1 The arrangement shown in Figure 7 of D2 is described in the passage on page 14, last paragraph to page 15, first paragraph. Further details of the process are provided in the discussion of example 3 on pages 18-20 of D2. These passages of D2 disclose that the process of Figure 7 involves two ethylene feed streams that are first compressed in the compressor units 10 and then introduced into two pre-heater units 20, in which the temperature of the ethylene is increased. The streams are then combined before being fed to the reactor 30. The process of example 3 involves therefore two separate reactive streams through the compressor and pre-heater units (visible in Figure 7) so that "if the feed compositions into the two separate streams are different, the two preheater units will also show different compositions usually called side A and Side B, as shown in Figure 8" (page 19, first full paragraph).

1.8.2 The passage on page 19, lines 7-13 of example 3 discusses the point of addition of reactive compounds (including chain transfer agents and/or co-monomers) in the system for which several variants are envisaged. It is in particular apparent that a preferred point of addition of the reactive compounds is located "downstream from the compressor unit 10, preferably downstream from the preheater unit 20, i.e. into the

reactor 30". That variant is according to claim 1 of D2 and is a valid starting point for the assessment of inventive step of claim 1 of the main request. In order to exemplify that effect on the system, the same passage mentions another variant in which octadiene as specific co-monomer is added to either side A or side B on the pre-heater as derivable from lines 11-13 and in Figure 8. That variant, which is not according to D2, is disclosed in further details on pages 19 and 20 and in Figure 8.

1.8.3 That variant is comparative because the comonomer is not added as defined in features (b1) or (b2) of claim 1 of D2, but that does not disqualify it as a valid representation of the closest prior art. It is in particular consistent case law of the Boards of Appeal that comparative examples in a document may represent valid starting points for the assessment of inventive step if the selected starting point was a realistic/ technically sensible springboard in the same technical field and with the same purpose as the patent in suit (Case Law, I.D.3.7.2). The process used to produce the data in Figure 8 and shown in Figure 7 is technically close to the process of operative claim 1. It is used to produce copolymers of ethylene and it contains the same steps a)-d) defined in claim 1 for the same purpose of providing ethylene copolymers by a high pressure process. It is also not an unrealistic starting point within D2 as the assembly shown in Figure 7, using pre-heaters 20 in parallel, recombining the streams of ethylene before entering the reactor 30 corresponds to a technically feasible one and even to a preferred embodiment of the patent in suit (paragraph 58) and is one that was used in its examples as well (paragraph 88). Besides, the addition of the comonomer to the pre-heaters is not excluded in claim 1 of the

patent in suit either nor it is deemed disadvantageous in the patent in suit. In this respect the choice of that embodiment as the closest prior art would also not be unreasonable.

1.9 The Board therefore finds that any of the variants envisaged in example 3 of D2 in which the reactive components are added "downstream from the preheater unit 20, i.e. into the reactor 30" or on the pre-heater could have been considered as valid representations of the closest prior art. Any of these starting points leads in anyway to the same conclusion as shown hereafter.

1.10 It was undisputed that the process of example 3 of D2 did not explicitly disclose the ratio of the average velocity of the reaction fluid in the tubular reactor at the reactor inlet to the average velocity of the reaction fluid in the pre-heater at the outlet of the pre-heater (referred to as the "average velocity ratio" hereafter).

1.11 The appellant argued on the basis of Figure 7 of D2 that it would be possible to infer the velocity ratio used in example 3 based on the dimension of the tubing shown in Figure 7, where it is known that the pre-heater 20 has a diameter of 39 mm and the tubing exiting the pre-heaters 20 and entering the tubular reactor 30 is shown as being of the same diameter (statement of grounds of appeal, point 5.8). It is, however, beyond doubt from the passage of D2 on page 11, line 13 that Figure 7 only shows a schematic drawing of the process apparatus described in example 3. In this respect, the Board agrees with the established case law that schematic drawings conventionally included in patent documents indicate

the essential elements of the invention but can not be used to derive a ratio between two dimensions (Case Law, I.C.4.6). In view of this, the Board concludes that no "average velocity ratio" can be derived from the information available for example 3 and Figure 7 of D2.

1.12 The process of claim 1 of the main request therefore differs from the process shown in example 3 and in Figure 7 of D2 in an average velocity ratio in the range of 1.5 to 2.2.

1.12.1 The opposition division came to the conclusion that an effect was not shown for the distinguishing feature over the arrangement shown in Figure 7 of D2. As a result the technical problem was considered as the provision of an alternative process for (co)polymerizing ethylene in a reactor setup comprising two pre-heaters and a tubular reactor (decision under appeal, point 18.4.1).

1.12.2 The respondent considered that the distinguishing feature solved the objective technical problem of providing an improved heating system with a low pressure drop resulting in an increased conversion rate, wherein product quality was continuously high and pressure pulsations were avoided or at least reduced (rejoinder, page 11, first paragraph and patent in suit, paragraph 7).

1.12.3 The respondent argued at the oral proceedings before the Board that the examples of the patent in suit established the presence of an effect over D2, especially an improved haze and gel count caused by the selection of an average velocity ratio in the range defined in operative claim 1 and that in any case the

respondent had not shown that an effect had not been obtained.

1.12.4 As regards the purported effect, it is established case law of the Boards that an unexpected effect demonstrated in a comparative test can be taken as an indication of inventive step on condition that the nature of the comparison with the closest state of the art is such that the alleged advantage or effect is convincingly shown to have its origin in the distinguishing feature or combination of distinguishing features of the invention as compared with the closest state of the art (Case Law, I.D.4.3.2). In the present case it is therefore to be determined whether the patent in suit established the presence of a causal link between the choice of the average velocity ratio with the range defined in claim 1 of the main request, 1.5 to 2.2, and the effects referred to by the respondent (reduced pressure pulsations, improved haze and gel count).

1.12.5 Examples 1 and 2 and the comparative example of the patent in suit show a process for the continuous polymerization of ethylene in a high-pressure tubular reactor. Example 1 discloses a process using an assembly wherein the ethylene stream enters primary and secondary compressors before being heated in a combination of two pre-heaters arranged in parallel and the two reaction fluid streams are combined after having passed the pre-heater units and fed to the reactor inlet. An average velocity ratio of 2.0 is used in that example (paragraphs [0088] and [0089] of the patent in suit). Example 2 was carried out as in example 1, however, instead of a combination of two pre-heater units, a single tubular pre-heater is used. An average velocity ratio of 1.86 is used in that case

(paragraph [0091] in the patent in suit). In the comparative example the process of example 1 was repeated with the difference that instead of operating the two pre-heater units in parallel, the two pre-heater units were arranged in serial mode resulting in a single tubular pre-heater and an average velocity ratio of 1.0 is used (paragraph [0093] in the patent in suit). It is apparent therefrom that among the examples of the patent in suit only the assembly of example 1, with two pre-heaters used in parallel, corresponds to the assembly of Figure 7 of D2 used as the starting point within D2. The patent in suit however does not offer a comparative example with that assembly and an average velocity ratio outside the range defined in operative claim 1 that could have shown that the ratio was causally linked to an effect. The assemblies used in example 2 and the comparative example are similar to one another in that only one pre-heater is said to have been used but neither of them is representative of that of Figure 7 of D2 and the Board sees no reason to attribute any effect seen in the copolymer produced to the selection of the average velocity ratio in the presence of relevant differences in the assembly used in the polymerization process. In view of this the Board does not see any reason to deviate from the problem formulated by the opposition division as the provision of an alternative to the process of Figure 7 of D2.

1.12.6 The question of obviousness is therefore whether the skilled person starting from the process of Figure 7 of D2 would have expected a process with an average velocity ratio in the range of 1.5 to 2.2, as defined in claim 1 of the main request, to provide an alternative process for (co)polymerizing ethylene in a reactor setup comprising two pre-heaters and a tubular

reactor.

1.12.7 The appellant considered the teachings of D3 and D4 to be relevant to the question of obviousness. The appellant argued that D3 and D4 already taught that the control of the velocity of the streams in a process was part of the common general knowledge and that a velocity ratio of the gas used within the range according to claim 1 in example 3 of D2 would belong to the normal design conditions of this process.

1.12.8 In particular, the teaching of D3 can be seen as being relevant to D2, especially since relevant parameters of the polymerization process of example 3 of D2 are generally addressed in D3. Indeed, in D3 the general teaching is provided that a velocity of at least 10 m/s is necessary in a tubular polymerisation reactor to which compressed ethylene is fed. The gas velocity in each of the pre-heaters of example 3 of D2 can be estimated to be 6.2 m/s on the basis of information provided on page 18, lines 29-36 of D2 (see calculations in the statement of grounds of appeal, section 5.17 not disputed by the respondent). A selection of a velocity in the reactor of just above 10 m/s according to the teaching of D3 would automatically result in a ratio within the range of claim 1. Moreover, the recombination of the two streams exiting the pre-heaters of example 3 of D2 on the condition that the diameter of the pipe leading to the reactor is kept at 39 mm would result in a velocity of the stream leading to the reactor of about 12.4 m/s, which would also be according to the teaching of D3 and result in a ratio according to claim 1.

1.12.9 This means that the process conditions used in D2 and the requirement defined in operative claim 1 wherein

the average velocity of the reaction fluid at the outlet of the pre-heater is lower than the average velocity of the reaction fluid in the tubular reactor at the reactor inlet belong to the normal process conditions in the preparation of ethylene copolymers. It is correct that neither D3, nor D4 explicitly mention the ratio of the average velocity of the reaction fluid in the tubular reactor at the reactor inlet to the average velocity of the reaction fluid in the pre-heater at the outlet of the pre-heater and appropriate values for it. However, in view of the considerations in the previous paragraph, the Board finds that the operation of the process for the preparation of ethylene copolymers as disclosed in Figure 7 of D2 with a chosen average velocity ratio between 1.5 and 2.2, for instance through control of the pipes diameter, would be within the normal abilities of a skilled person, simply looking for an alternative process. The Board therefore comes to the conclusion that claim 1 of the main request lacks an inventive step starting from the embodiment of Figure 7 of D2 as the closest prior art.

Auxiliary request V

2. Inventive step

2.1 Claim 1 of auxiliary request V corresponds to claim 1 of the main request with the following addition at the end of the claim:

"wherein the preheater consisted of two preheater units and a first preheater unit is arranged on a first branch line and a second preheater unit is arranged on a second branch line; and wherein the process comprises

the following steps:

a') providing a first flow of compressed reaction fluid comprising a first portion of the reaction fluid and providing a second flow of compressed reaction fluid comprising a second portion of the reaction fluid by compressing the reaction fluid to an elevated pressure and splitting at least a portion of a single flow of the reaction fluid into the first flow and the second flow of compressed reaction fluid;

b') conducting the first flow of the first portion of the reaction fluid through the first preheater unit and heating the first portion of the reaction fluid in the first preheater unit, and
conducting the second flow of the second portion of the reaction fluid through the second preheater unit and heating the second portion of the reaction fluid in the second preheater unit;

c') combining the first and second portion of the reaction fluid by recombining the first flow and the second flow of the reaction fluid and introducing the recombined flow of the reaction fluid heated in step b') into the reactor at the reactor inlet; and

d') polymerizing the reaction fluid at the elevated pressure in the presence of free-radical polymerization initiators in the reactor".

2.2 Claim 1 of auxiliary request V therefore requires the compression of a single stream of reaction fluid which is separated into two streams that are recombined after having been heated in respective pre-heaters.

2.3 The appellant maintained their objection of lack of inventive step based on Figure 7 of D2 against claim 1 of auxiliary request V.

2.4 The process of operative claim 1, in addition to the distinguishing feature identified in the discussion of the main request, differs from the process of Figure 7/ example 3 of D2 in that the reaction fluid is compressed in a single stream before being separated into two streams whereas in D2 two streams of reaction fluid pass separately first through the compressor units and then through the subsequent pre-heaters (page 19, first paragraph). The Board does not find in the patent in suit evidence of an effect linked to this additional distinguishing feature over D2 nor was any effect alleged by the respondent. The problem is therefore the provision of an alternative to the process of Figure 7 of D2 also with regard to the additional distinguishing feature.

2.5 The operation of the process of Figure 7 of D2 in which two distinct streams of reactant fluid are passed through the compressors and pre-heaters has the explicit purpose of providing streams of different compositions which condition is necessary to conduct the tests of example 3 of D2 (page 15, first paragraph and page 19, second paragraph). Starting from the process shown in Figure 7 of D2 and discussed in its example 3 requiring two separate and different streams through the compressor units and the pre-heaters, the skilled person would have found it unreasonable to undertake a modification of the process which would go against the clear purpose of the example taken as a starting point.

2.6 No other documents were cited that could show a motivation for the skilled person to undertake this modification. Indeed, while a compression of a single stream would theoretically be amongst the possible options of the process designer, this choice would be unreasonable in the context of example 3 of D2 as explained in the previous paragraph. The Board therefore concludes that it has not been shown that the process of claim 1 of auxiliary request V is obvious over the available prior art.

3. As no further objection was raised against auxiliary request V by the appellant (minutes of the oral proceedings, page 2, fifth paragraph), there is no further point for the Board to decide.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the claims of auxiliary request V filed with the reply to the statement of grounds of appeal after adaptation of the description if necessary.

The Registrar: The Chairman:

D. Hampe D. Semino

Decision electronically authenticated