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Datasheet for the decision of 30 August 2017

Case Number: T 1670/15 - 3.3.05

Application Number: 09783231.5

Publication Number: 2331250

IPC: B01J8/24, C08F10/00

Language of the proceedings: EN

Title of invention:
Apparatus and process for gas phase fluidised bed polymerisation reaction

Patent Proprietor:
Ineos Sales (UK) Limited

Opponent:
Basell Polyolefine GmbH

Headword:
Gas phase polymerisation/INEOS

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - unexpected improvement shown

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It can be changed at any time and without notice.

Decisions cited:

Catchword:

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Case Number: T 1670/15 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 30 August 2017

Appellant: (Opponent)	Basell Polyolefine GmbH Brühler Strasse 60 50389 Wesseling (DE)
Representative:	Seelert, Stefan Basell Polyolefine GmbH Intellectual Property Bldg. C657, 2nd floor Industriepark Höchst 65926 Frankfurt am Main (DE)
Respondent: (Patent Proprietor)	Ineos Sales (UK) Limited Hawkslease Chapel Lane Lyndhurst Hampshire SO43 7FG (GB)
Representative:	King, Alex Mathisen & Macara LLP Communications House South Street Staines-upon-Thames, Middx TW18 4PR (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 23 June 2015 rejecting the opposition filed against European patent No. 2331250 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	H. Engl
Members:	J.-M. Schwaller
	O. Loizou

Summary of Facts and Submissions

I. The present appeal lies from the decision of the opposition division to reject the opposition against European patent No. 2 331 250, with independent claims 1 and 6 reading:

"*1. An apparatus for gas phase fluidised bed polymerisation of olefins, which apparatus comprises:*

A) a first section which is an upright cylindrical section having a diameter, D_1, and cross-sectional area, A_1, and
B) a second section, provided vertically above the first section and centred about a common vertical axis to the upright cylindrical first section, the base of the second section having a cylindrical cross-section of diameter D_1 and being joined to the top of the first section, and the horizontal cross-sectional area of the second section above its base being greater than the cross-sectional area of the first section,
characterised in that:
i) D_1 is greater than 4.5 metres, and
ii) the second section has a maximum horizontal cross-sectional area, A_2, which is between 3.2 and 6 times the cross-sectional area, A_2, of the first section."

"*6. A process for polymerisation of olefins, which process comprises polymerising one or more olefins under fluidised bed reaction conditions in an apparatus according to any one of claims 1 to 5*".

Dependent claims 2 to 5 and 7 to 9 relate to specific embodiments of independent claims 1 and 6 respectively.

II. The following documents cited in opposition proceedings are of relevance for the present decision:

D1: WO 99/61485

D2: US 6 117 399

D3: WO 03/054 036 A1

D4: Chemical Processing Handbook, edited by John J. McKetta, pages 892-924 (1993)

D5: US 4 882 400

D6: EP 0 571 826 A2

D7: EP 0 963 786 A1

D8: EP 0 855 411 A1

III. The opposition division decided that the claimed subject-matter was novel, as documents D1 to D3 did not disclose the claimed ratio of the cross-sectional area of the second zone to the first zone ("the A_2/A_1 ratio").

Furthermore, the opposition division considered that anyone of documents D1 to D4 could be taken to represent the closest prior art, with the technical problem being to provide a fluidised bed apparatus and process for polymerisation of olefins having increased flexibility. This problem was successfully solved by an apparatus and a process wherein the A_2/A_1 ratio was between 3.2 and 6. The proposed solution was not obvious in view of the prior art, which either recommended lower A_2/A_1 ratios or taught reduced gas velocity in the second zone of the reactor.

IV. With its response to the statement of grounds of appeal the respondent (patentee) submitted four auxiliary requests.

V. In a communication dated 23 June 2017, the board gave a preliminary and unbinding opinion on the case.

A further submission by the appellant was received by letter dated 7 July 2017.

VI. At the oral proceedings before the board, the discussion focused on the questions of admissibility of the appeal and of inventive step of the claimed subject-matter, starting from document D8 as the closest state of the art.

VII. The appellant (opponent) essentially argued as follows:

Inventive step:

Claim 1 of the opposed patent as granted related to an apparatus for gas phase fluidised bed polymerisation of olefins, comprising an upright cylindrical section (the fluidisation section) and on top of this section a disengagement zone having a larger diameter. The upright cylindrical section had a diameter D_1 of greater than 4.5 m. The claimed apparatus was characterised in that the maximum horizontal cross-sectional area A_2 of the disengagement zone was between 3.2 and 6 times the cross-sectional area A_1 of the cylindrical section.

Fluidised bed reactors for the gas phase polymerisation of olefins having a cylindrical cross-sectional diameter of more than 4.5 m were known from documents D1 to D4 and D8.

A fluidised bed reactor with a horizontal cross-sectional area A_2 of the disengagement zone of between 1.7 and 4.8 times the cross-sectional area A_1 of the cylindrical part of the reactor was known from document D5. D6 and D7 recommended a velocity reduction in the disengagement zone of 3 to 6 times, corresponding to an A_2/A_1 ratio of 3 to 6.

The disputed patent in paragraph [0007] stated that it was "significantly advantageous" to provide a disengagement zone with a cross-sectional area which was large compared to the cross-sectional area of the fluidisation zone, without however explaining what the exact benefit achieved by this feature was.

Furthermore, according to paragraph [0059] of the patent, the invention provided *"increased flexibility for the person skilled in the art to optimise the polymerisation process"*. However, it appeared that the ostensible increased flexibility simply consisted in the possibility of varying the amount of entrainment.

Neither did the examples of the patent illustrate the ostensible advantages of the claimed subject-matter. It was general knowledge of the skilled person that increasing the dimensions of the disengagement zone and thus reducing the gas velocity caused a decrease in the amount of entrained polymer. This relation held true independently of the size of the reactor. The claimed lower limit of 3.2 for the A_2/A_1 ratio was arbitrary. The alleged flexibility of the process was merely an inevitable and predictable consequence of operating the reactor with a relatively larger diameter of the disengagement zone.

According to the contested decision, the objective

technical problem was increased flexibility in reactor operation. In this context, "increased flexibility" should be understood as implying a "reactor of lower entrainment of fines". The obvious solution for this problem was however to increase the diameter of the disengagement zone.

Therefore, starting with any of documents D1, D2, D3, D4 or D8, each of which taught that an A_2/A_1 ratio of 3.0 or slightly below was sufficient to operate a fluidised bed rector, the skilled person would consider increasing the diameter of the disengagement zone when confronted with the technical problem of "increasing flexibility", i.e. to decrease the total amount of entrained particles, at otherwise unchanged conditions. The skilled person would merely have to combine the disclosure of D1, D2, D3, D4, or D8 with the A_2/A_1 ratios as taught by D5, D6 or D7 and thus arrive at the claimed subject-matter. Accordingly, the subject-matter of claim 1 of the disputed patent lacked an inventive step.

VIII. The respondent (patentee) essentially argued as follows:

Admissibility of the appeal:

The appeal was unsubstantiated and should be rejected as inadmissible. It lacked arguments as to why the key parts of the contested decision were incorrect. The specific analysis the appellant put forward with respect to inventive step was based on multiple "closest prior art" documents, to be combined with a large number of "secondary references". Such a "pick and mix" approach with mostly unsubstantiated arguments placed an undue burden on the respondent and the appeal

board.

Novelty was no longer disputed.

Inventive step:

D6, D7 with D1, D2, D3 or D4:

D6 and D7 did not represent the closest prior art. Both D6 (page 6, line 40) and D7 ([0025]) referred to a "Leerrohrgeschwindigkeit" which the appellant translated as "empty tube velocity" or "superficial gas velocity". However, the actual paragraphs referred to by the appellant in D6 and D7 for the ratios of velocities in the different sections did not refer to this parameter but instead to a "Kreisgasgeschwindigkeit" or "circulating gas velocity". This latter term, although not entirely clear, most likely referred to the "real velocities" in use with solids being taken into account, and not to the superficial velocities. In a reactor whose diameter increased from a fluidisation zone to a disengagement zone, the real gas velocity decreased both by a factor proportional to the change in voidage and by a factor proportional to the diameter squared. Therefore, an overall 3 to 6-fold velocity reduction for "real velocity" required significantly less than a 3 to 6-fold increase in cross-sectional area A_2/A_1 ratio. Consequently, even if for the sake of the argument D6 or D7 were to be combined with D1 to D4, the claimed process or apparatus would not be obtained.

D1 to D4, D8:

D1 to D4 disclosed area A_2/A_1 ratios in the range 2.5 to 2.9, either explicitly or by way of reference to

further documents. The Unipol reactor depicted in D4 had an estimated diameter ratio of about 1.7 and hence an area ratio of about 2.9. D8 disclosed in the examples a reactor diameter of 5 m and an A_2/A_1 ratio of 3.0. According to said documents, particle entrainment was sufficiently low at these ratios to ensure that there was no motivation to adopt the claimed higher values.

IX. Requests

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

The respondent requested that the appeal be rejected as inadmissible, or be dismissed, or in the further alternative, that the patent be maintained in amended form on the basis of the claims of one of the auxiliary requests 1 to 4, filed with its response to the grounds of appeal of 1 March 2016.

Reasons for the Decision

1. Admissibility of the appeal

The board considers the appeal to be admissible. Detailed reasoning is not required as the appeal is not successful on its merits, as will be set out below.

2. Main request – inventive step

Applying the problem-solution approach, the board came to the conclusion that the subject-matter of the granted claims (main request) involves an inventive step for the following reasons:

2.1 The invention relates to a process and apparatus for gas phase fluidised bed polymerisation of olefins, the apparatus comprising an upright cylindrical section having a diameter D_1 of greater than 4.5 m and on top of this section a disengagement zone of a larger diameter.

2.2 Document D8, which represents the closest state of the art, discloses a gas phase fluidised bed polymerisation reactor of the above type which is illustrated in the example as having a cylindrical cross-sectional diameter of 5 m and a disengagement zone with an internal diameter of up to 8.66 m. This represents an A_2/A_1 ratio of 3.

2.3 According to the contested patent (paragraph [0033]), the problem underlying the current invention consists in the provision of an improved gas phase fluidised bed polymerisation apparatus and process which, in comparison to conventional ones, reduces the entrainment of particle fines, increases flexibility and improves overall productivity of the polymerisation process.

2.4 As a solution to this problem, the contested patent proposes an apparatus and a process according to claims 1 and 6 as granted, the subject-matter of which is distinguished from that of D8 in that the A_2/A_1 ratio is between 3.2 and 6, and so greater than the one in D8.

2.5 Examples 4 and 5 of the patent show that the problem identified in point 2.3 above is credibly solved by the proposed solution because, in addition to having a lower entrainment rate, the claimed apparatus provides for increased flexibility in the sense that the

polymerisation process can be carried out with increased fluidising velocity and/or gas density, thus allowing an increase in the production rate of the order of 10 to 15%.

This has not been contested by the appellant.

2.6 As regards the obviousness of the claimed subject-matter over the closest prior art, it has to be determined whether the proposed solution was obvious in the light of the state of the art, in particular in the light of documents D5, D6 or D7. These documents were presented by the appellant as being particularly relevant, because they disclose gas phase fluidised bed polymerisation reactors having an A_2/A_1 ratio of greater than 3.

For the board, the proposed solution is not obvious for the following reasons:

2.6.1 D5 discloses a process for gas phase polymerisation of olefins which teaches (column 4, lines 28 to 38) that in order to obtain the best performance of the fluidised bed reactor, the dimensions of the disengagement chamber are generally such that the ratio of the diameter of the disengagement chamber and the diameter of the upright cylindrical section of the fluidised bed reactor is between 1.3 and 2.2, and preferably between 1.5 and 2.0. Expressed in terms of cross-sectional areas, this represents an A_2/A_1 ratio of between 1.7 and 4.8, preferably between 2.3 and 4.0.

The board notes that the examples of D5 are carried out in a fluidised bed polymerisation reactor having an A_2/A_1 ratio of 3.0 and a cylindrical section having a diameter D1 of 0.9 m, i.e. a rather small diameter, and

a lower A_2/A_1 ratio in comparison to the ones defined in the claims of the contested patent.

So even if D5 in general teaches a range of A_2/A_1 ratios which overlaps with the terms of claims 1 and 6 as granted, the dimensions of the reactor illustrated by the examples – which in patents generally represent best modes of carrying out the invention – clearly fall outside the terms of the current invention.

In addition, D5 neither suggests the improved flexibility nor the increase in production rate underlying the invention currently described in the contested patent. So even if the skilled person faced with the problem underlying the contested patent would consider the disclosure of D5, it would not find in D5 the solution as proposed in claims 1 and 6 as granted.

2.6.2 The same conclusion arises from documents D6 and D7 which disclose gas phase fluidised bed polymerisation reactors having at their upper end a disengagement zone with an increased diameter which reduces the velocity of the circulated gas (D6: page 6, lines 53 to 56; D7: Figure 1). In order to reduce the entrainment of fine particles in these reactors, both documents' teaching is to reduce the velocity of the circulated gas in the disengagement zone to from one third to one sixth of the velocity of the circulated gas in the polymerisation zone (D6: page 6, lines 56 to 58; D7: paragraph [0027]). The appellant argued that the velocity of the circulated gas was inversely proportional to the cross-sectional areas of the respective zones, from which it followed that the A_2/A_1 ratio was in the range of 3 to 6.

If in favour of the appellant and contrary to the opinion of the opposition division, the above conclusion regarding the A_2/A_1 ratio was assumed to be correct, the board is of the opinion that the skilled person faced with the problem identified in point 3.2 above would not arrive at the subject-matter of current claims 1 and 6, because neither D6 nor D7 suggests the improved flexibility let alone the increase in production rate underlying the invention described in the contested patent. So even if the skilled person took D6 or D7 into consideration, he or she would not find in these documents the solution as proposed in claims 1 and 6 as granted.

2.6.3 The appellant argued that the lower entrainment of particles fines was in fact the obvious consequence of the larger diameter of the disengagement zone, and that the ostensible improved flexibility of the apparatus was merely an inevitable and foreseeable consequence of operating the reactor with a larger diameter of the disengagement zone.

The board does not find this argument convincing. Although it might appear obvious to increase the diameter of the disengagement in order to lower the entrainment rate of fine particles, there is no evidence on file, nor does it appear to be common general knowledge, that the improved flexibility and the increase in production rate obtained thereby – as shown in particular in examples 4 and 5 of the contested patent – is the inevitable consequence of operating the reactor with a larger A_2/A_1 ratio. The board therefore holds the appellant's conclusion as being the result of an inadmissible ex-post facto analysis.

2.6.4 It follows from the above considerations that starting from document D8 – or alternatively from one of documents D1, D2, D3 or D4, each teaching that a fluidised bed polymerisation reactor having an A_2/A_1 ratio of 3.0 or below can be operated at a sufficiently low rate of particles entrainment – the skilled person had no incentive in view of the teachings of documents D5, D6 or D7 to increase the relative area of the disengagement zone beyond that ratio with a view to increasing flexibility or production rate.

3. For the reasons indicated above, the subject-matter of claims 1 and 6 of the disputed patent, and by the same token that of dependent claims 2 to 5 and 7 to 9, which include all the features of claims 1 and 6 respectively, involves an inventive step within the meaning of Articles 52(1) and 56 EPC.

4. Since the claims of the main request meet the requirements of the EPC, there is no need to consider the lower-ranking requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Vodz H. Engl

Decision electronically authenticated