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Datasheet for the decision of 10 June 2015

Case Number: T 0094/13 - 3.3.05

Application Number: 05804333.2

Publication Number: 1817350

IPC: C08F10/00, B01J19/24, B01J19/18

Language of the proceedings: EN

Title of invention:
SLURRY PHASE POLYMERISATION PROCESS

Patent Proprietor:
INEOS Manufacturing Belgium NV

Opponent:
Total Research & Technology Feluy

Headword:
Slurry polymerisation/INEOS

Relevant legal provisions:
EPC Art. 54(1), 54(2), 56, 83

Keyword:
Disclosure of the invention (sufficient)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:
T 0409/91, T 0435/91, T 1743/06, T 0045/09, T 1276/08, T 0641/07

Catchword:

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European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0094/13 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 10 June 2015

Appellant: (Opponent)	Total Research & Technology Feluy Zone Industrielle C 7181 Seneffe (BE)
Representative:	Leyder, Francis Total Research & Technology Feluy Zone Industrielle C 7181 Seneffe (BE)
Respondent: (Patent Proprietor)	INEOS Manufacturing Belgium NV Scheldelaan 482 2040 Antwerpen (BE)
Representative:	King, Alex Mathisen & Macara LLP Communications House South Street Staines-upon-Thames, Middx TW18 4PR (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 16 November 2012 maintaining European patent No. 1817350 in amended form.**

Composition of the Board:

Chairman	G. Raths
Members:	J.-M. Schwaller
	O. Loizou

Summary of Facts and Submissions

I. This appeal lies from the interlocutory decision of the opposition division to maintain European patent No. 1 817 350 in amended form on the basis of the set of claims according to the main request amended during the oral proceedings of 24 October 2012, with independent claims 1, 14 and 16 reading:

"1. A process comprising polymerizing an olefin monomer optionally together with an olefin comonomer in the presence of a polymerization catalyst in a diluent in a loop reactor which comprises at least 2 horizontal sections and at least 2 vertical sections to produce a slurry comprising solid particulate olefin polymer and the diluent wherein the Froude number in at least 20% of the length of the vertical sections of the reactor loop is less than 85% of the Froude number in at least 20% of the length of the horizontal sections of the loop, and further wherein the horizontal sections consist of no more than 20% of the reactor length."

"14. A loop reactor of a continuous tubular construction comprising at least two horizontal sections and at least two vertical sections wherein the internal cross sectional area of at least 20% of the vertical sections is at least 5% greater than the largest internal cross sectional area that covers at least 20% of the horizontal sections, and further wherein the average internal diameter of the loop reactor is over 500 millimeters."

"16. A loop reactor of a continuous tubular construction comprising at least two horizontal sections and at least two vertical sections wherein the average internal diameter of the two vertical sections

is 5-90% greater than the average internal diameter of the horizontal sections, and further wherein the average internal diameter of the loop reactor is over 500 millimeters."

Claims 2 to 13 and claims 15 and 17 represent particular embodiments of independent claims 1, 14 and 16 respectively.

II. The following documents cited during the opposition procedure are relevant for the present decision:

D2: US 6 239 235 B1

D3: FR 2 248 288

III. With its statement of grounds of appeal dated 15 March 2013, the opponent (the "appellant") submitted a declaration from Mr Van Grambezen and contested the conclusions of the opposition division.

The appellant argued in particular that it was impossible to know where and how the Froude number was to be measured, and therefore the invention could not be reproduced (Article 83 EPC). Further, it held the subject-matter of claim 1 to lack novelty and inventive step over the disclosure of document D3, and the subject-matter of claim 14 to lack inventive step over document D3.

IV. With its response dated 19 July 2013, the patentee ("the respondent") submitted a set of observations contesting the appellant's remarks. Further, it requested document D3 not be admitted into the appeal proceedings and, in case the board did not allow the

main request, it submitted five sets of amended claims as auxiliary requests 1 to 5.

V. At the oral proceedings of 10 June 2015, the board admitted document D3 into the proceedings. During the discussion, the appellant further contested the novelty of claim 14 over D3 and the lack of inventive step of claims 14 and 16 over D3. During the discussion of inventive step, the board referred to document D2 to draw the appellant's attention to the fact that this document disclosed the problem of fouling in slurry polymerisation loop reactors.

VI. After closing the debate, the chairman ascertained that the parties' requests were as follows:

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

The respondent requested that the appeal be dismissed or, alternatively, that the patent be maintained on the basis of one of the sets of claims according to the first to fifth auxiliary requests dated 19 July 2013.

Reasons for the Decision

1. Disclosure of the invention

1.1 It is established jurisprudence that the requirements for sufficiency of disclosure are met if the invention, as defined in the claims, could be performed at the filing date of the application by a person skilled in the art in the whole area claimed without undue burden, using common general knowledge and having regard to further information given in the patent in suit (see

e.g. T 409/91, OJ 1994, 653, reasons 3.5; T 435/91, OJ 1995, 188, reasons 2.2.1; T 1743/06, reasons 1.1).

When the definition of the claimed invention includes one parameter, the skilled person should furthermore be able to check whether the parameter is complied with while the invention is carried out (see e.g. decisions T 0045/09, points 1.1 and 1.3 of the reasons; T 1276/08, point 1.1 of the reasons; T 0641/07, point 1 of the reasons).

1.2 In the case at issue, the claimed invention relates to a process and a reactor, with the process being in particular characterised by a parameter, the "Froude number".

1.3 The first question to be answered is whether the parameter at issue is a common one and whether the skilled person is able to check whether this parameter is complied with while the invention is carried out.

1.3.1 As indicated in the contested decision, the "Froude number" is a well-known standard engineering parameter discussed e.g. in Perry's Chemical Engineer's Handbook.

Furthermore, in the contested patent, paragraph [0012], the Froude number (Fr) is clearly defined, namely as being

$$v^2/(g(s-1)D)$$

where v is the slurry velocity, g the gravitational constant, s the specific gravity of the solid and D the pipe diameter.

1.3.2 The appellant did not dispute the fact that parameters v, g, s and D - and the Froude number -were commonly

known and easily quantifiable at any point in the claimed reactor by a person skilled in the art. It nevertheless argued that the invention was insufficiently disclosed because the patent did not disclose:

i) at which location in the reactor the Froude number was to be measured and

ii) the definition of the velocity to be used for the calculation, or in other words whether the Froude number was to be calculated using the absolute or the average value of the slurry velocity.

1.3.3 For the board, these two points do not concern the issue of disclosure of the invention, and therefore Article 83 EPC, because - as indicated above - the Froude number can be easily calculated at any point in the reactor, and so the skilled person is able to check whether the Froude number is complied with while the invention is carried out.

1.4 The second question to be answered is whether the invention - in particular the process according to claim 1 - could be performed at the filing date of the application by a person skilled in the art in the whole area claimed without undue burden, using common general knowledge and having regard to further information given in the patent in suit.

1.4.1 The board notes that the patent provides some information, in particular in its claims 14 to 17, as to how the reactor is to be designed for carrying out a process fulfilling the Froude number requirements defined in claim 1. From independent claims 14 and 16,

the skilled person learns in particular that the reactor must have:

i) an internal cross-sectional area of at least 20% of the vertical sections at least 5% greater than the largest internal cross-sectional area covering at least 20% of the horizontal sections, or

ii) an average internal diameter of the two vertical sections 5 to 90% greater than the average internal diameter of the horizontal sections.

1.4.2 The appellant argued that despite this information, it was impossible to carry out the process defined in claim 1, because the dimensions of the claimed reactors were so extreme (average diameter > 500 mm) that it would have been uneconomical to reproduce them and to test by trial and error their suitability for the claimed process.

Further, the description was insufficient regarding in particular the velocity of the slurry and the point where the Froude number was to be measured, so that the engineers could not make any assumptions for building an accurate simulation model of the reactor loop claimed (see Mr van Grambrezen's declaration).

1.4.3 For the board, the first argument is totally irrelevant for the process according to claim 1, since this claim is not at all limited to any diameter of the reactor, so that it would have been possible to put into practice the subject-matter of claim 1 merely by manufacturing a loop reactor having a reasonable diameter, such as the one disclosed in D3, which is described as having an internal volume of 36 litres,

and thus a diameter substantially smaller than the 500 mm defined in claims 14 and 16.

Regarding the second argument, the board is of the opinion that the skilled person could reasonably assume that the velocity to be retained for calculation of the Froude number was an average of the velocities of the slurry across a given cross-section of the reactor and that the Froude number was to be measured on the central axis of the reactor; otherwise the Froude number would have been meaningless, since near the surface of the reactor its value is zero or close to zero. The board therefore does not accept the content of Mr van Grambrezen's declaration.

1.5 The board notes that there is no evidence on file to show that a skilled person was unable to carry out the invention. Since in the present case the appellant did not succeed in identifying any information gap, in the absence of compelling evidence the board has no reason to agree that the claimed invention does not meet the requirements of Article 83 EPC.

2. Admissibility of D3

The board notes that document D3, although not filed with the notice of opposition, was filed with the opponent's letter of 3 October 2011 in response to the patentee's amended claims (see letter of 14 May 2010).

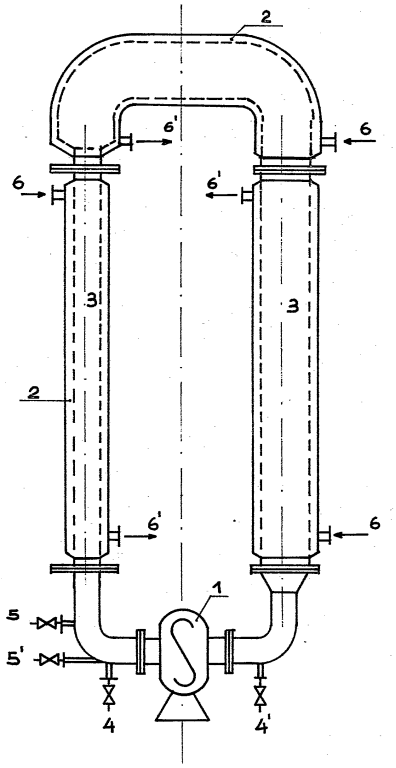
The content of D3 being closely related to the amendment in claim 1 to the effect that "the horizontal sections consist of no more than 20% of the reactor length" (see in this respect the Figure of D3 reproduced below), the board holds D3 to be *prima facie*

relevant and therefore it is admitted into the proceedings under Article 114(1) EPC.

3. Novelty

3.1 D3, claim 1, discloses a process for polymerising vinyl monomers, characterised in that the polymerisation is carried out in an annular reactor having a height to width ratio greater than 1 and a circulating pump in its bottom part, and wherein the volume of the vertical leg into which said pump discharges has a volume of between about 5 and 30% of the total reactor volume.

The reactor used for said polymerisation reaction is of the type illustrated here:



At page 1, lines 25 to 27 of D3, the height to width ratio of the reactor is described as being preferably greater than 5 and the volume of the vertical leg into which the pump discharges as corresponding preferably to about 15% of the total reactor volume.

The parties agreed that the above relationship between width, length and volume implied that the diameter of the second vertical leg was larger than the diameter of the vertical leg into which the pump discharges, with the consequence that the Froude number in at least 20% of the length of the vertical sections of the reactor loop was lower than the Froude number in at least 20% of the length of the horizontal sections of the loop.

The appellant argued that the above relationship between width, length and volume further implied that the Froude number in at least 20% of the length of the vertical sections of the reactor loop was less than 85% of the Froude number in at least 20% of the length of the horizontal sections of the loop, so that the subject-matter of claim 1 lacked novelty over D3.

At the oral proceedings, the board asked the appellant whether it had any evidence for this statement; its answer was negative.

In this context and in the absence of compelling evidence, it follows that the novelty of the subject-matter of claim 1 is to be acknowledged, since at least the feature that "*the Froude number in at least 20% of the length of the vertical sections of the reactor loop is less than 85% of the Froude number in at least 20% of the length of the horizontal sections of the reactor length*" is not directly and unambiguously derivable from the disclosure of document D3.

3.2 The same conclusion holds for the subject-matter of claims 14 and 16, since document D3 merely discloses the total volume of the loop reactor (26 litres), not

its absolute diameter, let alone an "average internal diameter of over 500 mm".

3.3 It follows that claims 1, 14 and 16, and therefore claims 2 to 13, 15 and 17 which depend thereon, do not lack novelty as alleged by the appellant. The set of claims as maintained by the opposition division therefore meets the requirements of Article 54 EPC.

4. Inventive step

(A) Claims 1 to 13

4.1 Invention

The present invention is directed to a process comprising olefin polymerisation (claims 1 to 13) and a loop reactor (see (B) claims 14 to 17).

4.2 Closest state of the art

The appellant held document D3 to be the most suitable starting point for assessing inventive step (for the disclosure of document D3, see point 3.1 above).

4.3 Problem

According to the contested patent (paragraph [0010]), the problem underlying the invention was the provision of an improved process for polymerising an olefin monomer which, in comparison to conventional ones, enabled the residence time for a given length of reactor to be increased while simultaneously minimising any increase in the risk of reactor fouling, and which made possible the design and operation of vertical slurry loop reactors with reduced total and specific

energy consumption.

4.4 Solution

As a solution to this problem, the contested patent proposes the process according to claim 1 at issue, which is in particular characterised in that the Froude number in at least 20% of the length of the vertical sections of the reactor loop is less than 85% of the Froude number in at least 20% of the length of the horizontal sections of the loop.

4.5 Success of the solution

As to the success of the solution, the appellant argued that is was commonly known that there were no fouling problems in polymerisation loop reactors; it followed that the problem had to be reformulated as a mere alternative process for polymerising olefin monomers.

The board cannot accept this argument, because document D2, which relates to a similar high-solids slurry polymerisation process, clearly and unambiguously discloses (D2; column 1, lines 54 to 58) that a limiting factor in the operation of such a process is fouling due to polymer build-up in the reactor.

In this context and in the absence of evidence to the contrary, the board cannot conclude that the problem underlying the patent (see point 4.3 above) has not been solved. There is therefore no need to reformulate the problem underlying the invention.

4.6 Obviousness

As to the question of obviousness, it has to be

determined whether the proposed solution was obvious for a person skilled in the art in the light of the state of the art.

4.6.1 None of the known documents discloses or suggests to reduce the Froude number in at least 20% of the vertical sections of the reactor loop to less than 85% of the Froude number in at least 20% of the horizontal sections of the loop. There is also no suggestion at all in any of the known documents to increase the diameter in at least 20% of the vertical sections of the loop reactor in such a manner that the Froude number in these sections is less than 85% of the Froude number in at least 20% of the length of the horizontal sections of the loop, let alone any suggestion in any of said documents to carry out these features with the aim of solving the problem identified under point 4.3 above.

4.6.2 The appellant argued that the claimed invention lacked an inventive step with respect to the content of D3, which disclosed a problem similar to the one underlying the contested patent - namely the reduction of energy costs - and so the limitation to the value 85% was merely an arbitrary choice, since there was no effect linked to the selection of this value.

The board cannot accept this argument, because the reference to energy savings in D3 is made in comparison to an autoclave reactor, not with respect to existing loop reactors as in the present invention. Document D3 furthermore does not at all address the problem of fouling of the loop reactor, let alone suggest increasing the diameter of certain vertical sections with the aim of solving this problem or the problem of reducing the energy costs. It follows that a skilled

person faced with the problem of reducing fouling or energy consumption in a slurry polymerisation process carried out in a loop reactor would not find any solution to the above problem in D3.

4.6.3 The same conclusion arises from the content of the other documents cited during these proceedings, which do not disclose or suggest the solution proposed in claim 1 at issue.

4.6.4 It follows that, having regard to the state of the art, the subject-matter of claim 1, and that of claims 2 to 13 which depend thereon, is not obvious to a person skilled in the art, and thus involves an inventive step within the meaning of Article 56 EPC.

(B) Claims 14 to 17

4.7 For similar reasons to those set out above, the board came to the same conclusion regarding the subject-matter of independent reactor claims 14 and 16.

The reasoning is in particular identical to that set out in points 4.1 to 4.3 above.

4.8 Solution

As a solution to the problem identified in point 4.3 above, the contested patent proposes a loop reactor according to the subject-matter of claims 14 or 16 at issue, which is characterised in that the average internal diameter of the reactor is over 500 mm **and** in that the reactor has either:

i) an internal cross-sectional area of at least 20% of the vertical sections at least 5% greater than the

largest internal cross-sectional area that covers at least 20% of the horizontal sections (for claim 14), or

ii) an average internal diameter of the two vertical sections 5 to 90% greater than the average internal diameter of the horizontal sections (for claim 16).

4.9 Success of the solution

To the question whether the problem identified in point 4.3 has indeed been solved by the above alternative solutions, the same reasoning as in point 4.4 applies.

4.10 Obviousness

As to the question of obviousness, the board is of the opinion that a loop reactor according to claim 14 or 16 is not derivable from the state of the art because none of the known prior-art documents discloses or suggests either of the features i) and ii), let alone is there any suggestion in any of said documents to carry out these features with the aim of solving the problem identified under point 4.3 above.

The appellant argued that the values "*at least 5% greater than ...*" (claim 14) and "*5-90% greater than ...*" (claim 16) were arbitrarily chosen, since there was no evidence in the patent for any effect, and thus they were obvious for a skilled person.

The board cannot accept this argument because the absence of evidence in a patent for an effect does not necessarily mean that the features in question are obvious. Furthermore, there is no evidence on file that at least the problem of reducing the fouling was not solved. In the absence of such evidence, the subject-

matter of claims 14 or 16 cannot be held to be derivable in an obvious manner from the known prior-art documents. Therefore, claims 14 and 16, as well as claims 15 and 17 which depend thereon, involve an inventive step, and so meet the requirements of Article 56 EPC.

5. Conclusion

As the appellant has not succeeded in establishing that the set of claims as maintained by the opposition division does not meet the requirements of the EPC, its appeal must fail and the decision of the opposition division becomes final.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated