

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 1 September 2017**

Case Number: T 1271/15 - 3.3.05

Application Number: 08779104.2

Publication Number: 2164611

IPC: B01D53/56, B01D53/94, B01J2/22,
B01J23/75, B01J35/04,
B01J37/00, B29C45/00,
C04B38/00, B01D46/24

Language of the proceedings: EN

Title of invention:
METHOD FOR PRODUCING CATALYSTS AND CATALYSTS THEREOF

Applicant:
YARA International ASA

Headword:
Method for catalyst/YARA

Relevant legal provisions:
RPBA Art. 13(1)
EPC Art. 84, 54, 56

Keyword:

Late-filed request - admitted (yes)

Claims - clarity (yes)

Novelty - (yes)

Inventive step - (yes)

Decisions cited:

T 1110/03

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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

Case Number: T 1271/15 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 1 September 2017

Appellant: YARA International ASA
(Applicant) P.O. Box 2464 Solli
0202 Oslo (NO)

Representative: Onsagers AS
Munkedamsveien 35
P.O. Box 1813 Vika
0123 Oslo (NO)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted on 19 January 2015 refusing European patent application No. 08779104.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: G. Glod
R. Winkelhofer

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application EP 08779104.2.

The following documents cited before the examining division are also cited in the present decision:

D1: JP 11 082 005 A
D2: US 4 743 578 A
D3: EP 1 961 930 A
D4: US 2007 238 256 A1
D5: WO 2006/009453 A
D7: US 6 328 915 B1
D8: US 2007 281 127 A1
D9: EP 0 377 960 A2
D10: JP 6 304481 A
D11: WO 99/32277 A1
D13: US 5 935 896 A
D14: GB 2 432 713 A
D15: EP 0 294 305 A2

II. With the statement of grounds of appeal, the appellant (applicant) submitted a new main request, three auxiliary requests and, inter alia, document

D1': English translation of D1 prepared by the USPTO

III. In a communication pursuant to Article 15(1) RPBA, the board expressed its preliminary opinion that none of the requests fulfilled the requirements of the EPC.

IV. On 19 July 2017, the appellant submitted new requests and

D18: Webster's Encyclopedic Unabridged Dictionary of the English Language, 1989, 1393.

V. Oral proceedings took place on 1 September 2017. At them, the appellant withdrew all previous requests and submitted a sole (main) request. The only independent claim of said request reads as follows:

"1. Method for production of a ceramic catalyst monolith, comprising the steps of

- preparing a ceramic powder formulation*
- heating the powder formulation*
- shaping a sample by injecting the fluid powder formulation into an injection mould, such that the fluid powder formulation fills all available space in the internal chamber of the mould, followed by cooling the injected powder formulation*
- de-binding the shaped sample, and*
- sintering the shaped sample*

wherein the prepared ceramic powder formulation has temperature controlled rheological properties and comprises a catalytic component, the formulation is heated up to at least the fluid state transition temperature and following the shaping the sample is cooled below the fluid state transition temperature before the de-binding and sintering steps to form a ceramic catalyst monolith, characterised in that the injection mould contains one or more pins, extending from one end to the opposite end of the internal chamber of the mould in order to form internal through-going channels in the catalyst monolith, wherein the pins have a stepwise decrease of the pin diameter."

Dependent claims 2 to 6 relate to preferred embodiments of said method.

VI. The arguments of the appellant can be summarised as follows:

"Stepwise" was clear to the skilled person, as shown by D18, and was understood as "in a steplike arrangement", which meant that several steps of undefined size could be present.

The invention was new, as D13 did not disclose a process wherein the injection mould contained one or more pins, extending from one end to the opposite end of the internal chamber of the mould in order to form internal through-going channels in the catalyst monolith, wherein the pins had a stepwise decrease of the pin diameter.

It was questionable whether the skilled person would combine D9 with D1. Even if the skilled person did so, the subject-matter of claim 1 would still not be obvious for the following reasons:

D1 related to sol-state moulding to produce a catalyst structure. D1 taught a tapered shape whereby the cross-sectional area of the passage diminished from an entrance hole to an exit hole. It provided no motivation to use a stepwise change in the cross-section of the channel, since it taught that the change should be gradual. The stepwise increase of the diameter led to regions of higher turbulence with high mass transfer. This was illustrated by figure 10.

VII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims of the sole request, filed during oral proceedings before the board of appeal on 1 September 2017.

Reasons for the Decision

1. Article 13(1) RPBA

The request was submitted during oral proceedings. It is a limitation to the method claims already present in auxiliary request 3.2 that was submitted in reaction to the communication pursuant to Article 15(1) RPBA. The request is clearly allowable, overcomes all previously raised objections and therefore promotes procedural efficiency. As a consequence the board sees no reason not to admit it into the proceedings.

2. Article 123(2) EPC

The requirements of Article 123(2) EPC are fulfilled for the following reasons:

Claim 1 is a combination of claim 1 as filed with page 7, line 10 ("monolith"); page 6, lines 30 to 33 and page 7, lines 12 and 13 of the application as filed.

Claims 2 to 4 correspond to claims 6, 7 and 9 as filed.

Claim 5 is based on page 10, lines 8 and 9 of the application as filed.

Claim 6 corresponds to claim 10 as filed, with the clarification that it is the injection pressure of the fluid powder formulation that is meant. This amendment is directly and unambiguously derivable from page 10, lines 1 to 10 of the application as filed.

3. Article 84 EPC

The clarity of the wording "stepwise" had been questioned during the appeal proceedings. However, the wording is considered clear, since in the present context it is given its ordinary meaning that the pin diameter decreases in a series of distinct stages. This can include one step or several steps of undefined size.

All other previously raised clarity objections have been overcome by the amendments made.

4. Article 54 EPC

D13 to D15 were considered by the examining division to anticipate the novelty of the then main request (points 4 to 6 of the impugned decision).

D13 relates to a catalyst support that can be produced by injection moulding (column 5, lines 58 to 61).

D14 relates to a ceramic metal halide that may be produced by injection moulding (page 8, lines 15 and 26).

D15 discloses a ceramic core for use in the investment casting of metals (claim 1) that can be produced by injection moulding (page 6, lines 49 and 50).

None of D13 to D15 discloses an injection mould containing one or more pins that have a stepwise decrease of the pin diameter.

Therefore the subject-matter of independent claim 1 and dependent claims 2 to 6 fulfils the requirements of Article 54 EPC.

5. Article 56 EPC

5.1 Invention

The invention relates to a method for manufacturing solid ceramic catalysts.

5.2 Closest prior art

In agreement with the appellant, D9 is considered to be the closest prior art. It discloses the preparation by injection moulding of a monolithic ceramic structure, preferably a honeycomb having about 4-370 through-and-through cells per square centimeter (page 5, lines 9 to 24). Although D9 does not explicitly disclose all the steps of the first part of claim 1, it was accepted that these steps are mostly inherent to injection moulding.

5.3 Problem to be solved

The problem to be solved is to provide a cost-effective method for manufacturing solid ceramic catalysts that generate turbulent flow in their internal channels and provide enhanced catalytic performance (page 4, lines 24 to 27).

5.4 Solution

As a solution to the problem, a method according to claim 1 is proposed, characterised in that the injection mould contains one or more pins, extending

from one end to the opposite end of the internal chamber of the mould in order to form internal through-going channels in the catalyst monolith, wherein the pins have a stepwise decrease of the pin diameter.

5.5 Success of the solution

It is credible that the change of the diameter of the flow-through channels can lead to turbulent flow and enhance the catalytic performance. This is also illustrated by figure 10 (in colour) that clearly shows that vorticity is increased when the diameter of the channel is increased by a step. It is accepted that this stands for better mass transfer of the reactants to the catalyst. Even if the number of steps were large and the size of a step rather small, it is still credible that some change in turbulence would occur that would positively impact the exchange between gas and surface of the channel.

5.6 Obviousness

D9 itself is silent about any changes in the diameter of the channels and does not provide any incentive to look for such channels.

D1' relates to a catalyst structure that has the flow holes in special shapes such that the gas is purified in an efficient manner (paragraph [0012], last sentence). To achieve this goal the gas flow holes are formed in a tapered shape whereby the cross-sectional area of the passage linearly diminishes from an entrance hole to an exit hole (page 10, lines 4 to 6).

The skilled person trying to solve the above problem gets some incentive from D1' to construct the through-

going channels in a tapered shape. D1' does not teach injection moulding. It also does not teach against injection moulding, but against extrusion moulding (paragraphs [0018] and [0029]). D1' is completely silent about the stepwise change of the diameter of the channel. The effect of the tapered shape is that the penetration of the gas into the catalyst layer over the entire area of the gas flow holes is promoted by maintaining the gas pressure over the entire area of the flow holes or by gradually increasing the pressure in the downstream direction (D1': page 10, lines 6 to 10). A stepwise change of the channel diameter would not have the effect of gradually increasing the pressure and would also influence the turbulence of the flow, so it cannot be argued that it would be an equivalent alternative to the tapering. The argument that the stepwise change of the diameter is obvious in view of the tapering is considered to be based on hindsight.

D2 only relates to the structure of the channels (i.e. hexagonal), and is completely silent about any change in their diameter.

D3 discloses that the honeycomb structural body is preferably made to have a tapered shape by either continuously decreasing the sectional area of the face perpendicular to the central axis or by continuously decreasing the thickness of the coat layer (paragraph [0020]). The wording "continuously" does not allow the conclusion that the skilled person would inevitably also recognise a stepwise change of diameter in that context.

D4 is a document according to Article 54(3) EPC and cannot be taken into consideration for the question of

inventive step. Although a post-published document may be taken into consideration for establishing common general knowledge (T 1110/03, reasons 2.1), the board is not convinced that D4 can be taken as an indication of what was known to the skilled person in the art. D4 does not relate to injection moulding, but describes a co-extrusion technique (paragraph [0009]), so the skilled person does not recognise it as disclosing state of the art with respect to injection moulding. Although D4 indicates that the rate of the radial thickening of the wall may be substantially linear along the radius or occur in discrete steps along the radius, it cannot be assumed that this was common general knowledge at the priority date of the patent in suit. D4 does not relate to turbulent flow and to enhanced catalytic performances, but to the mechanical strength of the substrate (paragraph [0005], lines 1 to 5). Therefore, D4 provides a specific teaching for a specific problem that cannot be regarded as common general knowledge.

D5, D8, D10 and D13 to D15 are not relevant, since they do not deal with a change in diameter of the channels.

D7 mentions tapered channels (column 4, lines 13 and 14; figure 5), but it specifically concerns an aerogel catalyst (column 2, lines 28 to 33), so the skilled person dealing with injection moulding has no incentive to turn to D7. Further D7 does not provide any indication towards a stepwise change of the channel diameter.

D11 discloses a cellular honeycomb body wherein the cross-sectional dimension of the plurality of channels decreases continuously to impart taper to the length portion of the body in that dimension (claim 2).

However, D11 is completely silent about turbulence and injection moulding and rather teaches towards extrusion moulding (page 13, lines 15 to 21). Further, D11 provides no hint towards a stepwise decrease of the channels.

- 5.7 To summarise, the solution to the posed problem is not rendered obvious by the prior art, although all the features present in claim 1 may be known from the prior art. However, the combination of the features is obvious only with hindsight knowledge of the present invention, so claim 1 involves an inventive step. The same applies to dependent claims 2 to 6.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent on the basis of claims 1 to 6 of the main request, filed in the oral proceedings of 1 September 2017, and a description to be adapted.

The Registrar:

The Chairman:



C. Vodz

J.-M. Schwaller

Decision electronically authenticated