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**Datasheet for the decision of 4 October 2021**

**Case Number:** T 0596/18 - 3.3.10

**Application Number:** 01110529.3

**Publication Number:** 1166865

**IPC:** C07C51/25, C07C57/04, F28D7/16, B01J12/00, B01J19/24

**Language of the proceedings:** EN

**Title of invention:**
Method for starting up reactor and reactor system

**Patent Proprietor:**
NIPPON SHOKUBAI CO., LTD.

**Opponent:**
THE DOW CHEMICAL CO.

**Headword:**

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
Inventive step - (no)

**Decisions cited:**
T 0493/12

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 0596/18 - 3.3.10**

# D E C I S I O N
# of Technical Board of Appeal 3.3.10
# of 4 October 2021

| | |
|---|---|
| **Appellant:** (Opponent) | THE DOW CHEMICAL CO.<br>2030 Dow Center<br>Midland, Michigan 48674 (US) |
| **Representative:** | Boult Wade Tennant LLP<br>Salisbury Square House<br>8 Salisbury Square<br>London EC4Y 8AP (GB) |
| **Respondent:** (Patent Proprietor) | NIPPON SHOKUBAI CO., LTD.<br>1-1, Koraibashi 4-chome<br>Chuo-ku<br>Osaka-shi, Osaka 541-0043 (JP) |
| **Representative:** | Mai Besier<br>European Trademark Attorneys<br>Patentanwälte<br>Kreuzberger Ring 18a<br>65205 Wiesbaden (DE) |
| **Decision under appeal:** | **Interlocutory decision of the Opposition Division of the European Patent Office posted on 5 January 2018 concerning maintenance of the European Patent No. 1166865 in amended form.** |

**Composition of the Board:**

| | |
|---|---|
| **Chair** | P. Gryczka |
| **Members:** | R. Pérez Carlón |
| | T. Bokor |

## Summary of Facts and Submissions

I. The opponent (appellant) lodged an appeal against the decision of the opposition division on the maintenance of European patent No. 1 166 865 in the form of the main request then pending.

II. Notice of opposition had been filed on grounds including lack of inventive step (Article 100(a) EPC).

III. This is the second appeal on this case. The board in the previous decision T 493/12 concluded that the reactor system of claim 1 of the patent as granted was not inventive over the reactor system of D1, which was the closest prior art for that subject-matter.

The board admitted into the proceedings auxiliary request 2tris, whose claim 1 was directed to a method for starting up a reaction system. However, the closest prior art for the method claims had not yet been ascertained. Since it was not the duty of the Boards of Appeal to decide upon questions raised for the first time during appeal proceedings, the board decided to remit the case to the opposition division for further examination on the basis of auxiliary request 2tris.

Auxiliary request 2tris upon remittal is the main and sole request of the respondent (patent proprietor) in these appeal proceedings. It was also the main request before the opposition division in the decision under appeal.

IV. Claim 1 of the main request reads as follows:

*"A method for starting up a reactor system, wherein the*

*reactor system is comprising a shell-and-tube type reactor (50) forming therein a plurality of chambers (51, 52) partitioned with an intermediate tube sheet, means for storing a heat medium led out of said chambers, heating means (22, 23) for heating the heat medium led out of said storing means, and means for supplying said heat medium heated by said heating means to an elevated temperature to at least one of said chambers, and is characterized by the fact that said storing means is comprising one tank (32) capable of storing at least part of the heat medium in said component chambers and said tank has a volume smaller than the amount of the heat medium circulated within the component chambers,*
*wherein the method is characterized by introducing a gas of a temperature in the range of 100-400°C into the reaction tubes thereby initiating temperature elevation and then circulating the heat medium in a heated state to the outside of the reaction tubes, wherein the reactor is adapted to circulate a heat medium having a solid point in the range of 50-250°C to the outside of the reaction tubes."*

V. The documents filed during the opposition proceedings include the following:

D1 US 3,850,232
D2 US 5,161,605
D8 DE 25 19 229 B1

VI. The opposition division concluded that document D1 was the closest prior art for the claimed method. D1 did not disclose introducing a hot gas into the reaction tubes when starting the reaction. Neither did it disclose a reactor having a plurality of chambers partitioned with an intermediate tube sheet. The

problem underlying the claimed invention was to provide an improved method for starting up a reactor system requiring less operating expenses. The claimed solution, characterised by introducing into the reaction tubes a gas of a defined temperature, and by circulating a heat medium to the outside of the heating tubes, wherein the reactor was adapted to circulate a heat medium having a solid point in the range of 50°C to 250°C to the outside of the reaction tubes, would not have been obvious for the skilled person and was thus inventive.

VII. In a communication in preparation for oral proceedings, the board informed the parties that they should be prepared to discuss whether a document such as D8, disclosing a method for starting up a reactor system, would come even closer to the claimed invention.

D8 disclosed starting up a reactor system by pre-warming a tube-and-shell reactor by blowing a hot gas into the tubes, and then introducing into it a molten salt at a temperature above 150°C. The problem underlying the claimed invention was to provide an alternative method for starting up a reaction system. The claimed solution was characterised by the construction design of the reaction system, and would have been obvious for a person skilled in the art.

VIII. The respondent did not file any substantive response to the board's communication.

IX. The appellant agreed with the board that D8 was a suitable starting point for examining inventive step. The problem underlying the claimed invention was to provide an alternative method for starting up a reaction system. There was no technical relationship

between the claimed method and the apparatus features required in claim 1. Thus, the claimed solution, characterised by the reactor system's design, was not inventive.

X. With a letter dated 14 July 2021, the respondent informed the board that it would not be attending the already summoned oral proceedings. It requested a decision according to the state of the file.

XI. With a letter dated 19 August 2021, the appellant withdrew its request for oral proceedings on the condition that the board would revoke the patent.

XII. The board cancelled the already summoned oral proceedings.

XIII. The final requests of the parties, in writing, were as follows:

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

- The respondent requested that the appeal be dismissed.

## Reasons for the Decision

1. The appeal is admissible.

Inventive step

2. Closest prior art

2.1 Claim 1 of the main request relates to a method for starting up a reactor system.

2.2 The opposition division concluded, in agreement with the parties, that document D1 was the closest prior art.

D1 discloses a reactor and a cooling system for cooling said reactor. It does not explicitly disclose how to start up the reaction system.

2.3 The board informed the parties in a communication in preparation for oral proceedings that it was inclined to consider D8 as a suitable starting point for examining inventive step. This document is directed, as claim 1 of the pending request, to a method for starting up a reactor. The respondent did not provide any arguments in this respect.

Document D8 discloses how to start up a reactor system having a shell-and-tube reactor (column 1, line 42) heated by means of a molten salt (column 1, line 60) after a shutdown, for example due to the change of the catalyst (column 1, lines 53-57).

The molten salt is stored during shutdown in a container, (column 1, line 68). It has a melting point of about 150°C (column 1, line 61). Since it is solid at room temperature, it cannot be used for pre-warming the system after a shutdown (column 1, lines 61-65).

D8 discloses that the system is to be brought to operating temperature by heating the salt's storage container and by blowing hot gas into the tubes before allowing the molten salt to flow into the reactor (column 2, lines 3-7).

Document D8 does not disclose that the plurality of chambers of the reactor is partitioned with an intermediate tube sheet, or the volume of the heat medium storing tank. It does not disclose the temperature of the gas blown into the tubes, either.

The opposition division concluded that document D8 disclosed blowing hot gas through the outer part of the contact tubes and not to through the tubes (point 4.1 of the decision, second paragraph). The board is, however, inclined to follow the appellant's argument (statement of grounds of appeal, points 1.2.1 and 4.4.3) that D8 also discloses blowing heating gas through the tubes ("durch die Kontaktrohre") on column 2, lines 6-7.

2.4 Problem underlying the claimed invention

There is no evidence on file which could link an effect either to the temperature of the gas used or to the features of the reactor system on the method for starting up.

Having regard to D8, the problem underlying the claimed invention is thus to provide an alternative method for starting up a reaction system.

2.5 Solution

The solution to this technical problem is the method for starting up a reactor system of claim 1. The system comprises a shell-and-tube reactor, means for heating it with a molten salt, and a storage tank for said molten salt. The method requires heating the reaction tubes with a gas, and is characterised in that

- the plurality of chambers of the reactor are partitioned with an intermediate tube sheet,

- the volume of the tank for storing the heating medium is smaller than the amount of heat medium circulated within the chambers, and

- the temperature of the gas is in the range of 100-400°C.

2.6 Success

The problem of providing an alternative method for starting up a reactor system has been credibly solved by the claimed method.

2.7 It thus remains to be decided whether the proposed solution to the objective problem defined above would have been obvious for the skilled person in view of the prior art.

2.8 Gas temperature of 100-400°C

D8 does not disclose the temperature of the gas used for heating the tubes of the reactor. However, seeking to put the teaching of D8 into practise, the skilled person would have needed to choose the temperature of the hot gas blown. The aim of blowing gas into the tubes of the reactor is to bring them to a temperature at which the molten salt flows (over 150°C). A temperature within the range set by claim 1 would thus have been an obvious option.

2.9 Apparatus features

The apparatus features of the reactor system required

by claim 1 are known from the prior art and would have been an obvious option to the skilled person, seeking an alternative.

2.9.1 D1 discloses a tank (27) whose volume is smaller than the amount of the heat medium circulated within the component chambers (T 493/12, Reasons 2.2, last sentence). This feature would thus have been obvious for a person of the art seeking an alternative.

2.9.2 Tube-and-shell reactors having an inner tube sheet are also known. Figure 5 of D2 discloses a reactor whose housing (72) is divided into two sections (76) and (78) by a plate (74). This apparatus feature would also have been obvious seeking an alternative.

2.10 Thus, the skilled person would have considered to employ a gas at a temperature within the range set by claim 1. The features of claim 1 related to the design of the reactor system which is started up do not go beyond an arbitrary selection of equally possible alternatives well known in the prior art in the context of shell-and-tube reactors.

2.11 The board thus concludes that the claimed method is not inventive (Article 56 EPC) and the respondent sole request not allowable.

3. Having regard at the board's conclusion on the issue of inventive step, it is not required to decide on any other point.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chair:

C. Rodríguez Rodríguez P. Gryczka

Decision electronically authenticated