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**Datasheet for the decision
of 17 November 2022**

Case Number: T 0503/19 - 3.3.10

Application Number: 03778140.8

Publication Number: 1558353

IPC: C07C303/06, C07C309/04,
C07C29/00, C07C31/04, C01B3/34

Language of the proceedings: EN

Title of invention:

ANHYDROUS CONVERSION OF METHANE AND OTHER LIGHT ALKANES INTO
METHANOL AND OTHER DERIVATIVES, USING RADICAL PATHWAYS AND
CHAIN REACTIONS WITH MINIMAL WASTE PRODUCTS

Patent Proprietor:

Veolia North America Regeneration Services, LLC

Opponents:

Herzog, Martin
Grillo Werke AG
ARKEMA FRANCE

Headword:

ANHYDROUS CONVERSION OF METHANE / Veolia North America

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - (no)

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0503/19 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 17 November 2022

Respondent: Veolia North America Regeneration Services, LLC
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted on
11 December 2018 concerning maintenance of the
European Patent No. 1558353 in amended form.

Composition of the Board:

Chairman P. Gryczka
Members: J.-C. Schmid
T. Bokor

Summary of Facts and Submissions

I. Appellant II (opponent 2) and appellant III (opponent 3) lodged an appeal against the interlocutory decision of the opposition division which found that the European patent No. 1 558 353 could be maintained on the basis of the claims 1 to 3 of auxiliary request 7 filed during oral proceedings on 11 October 2018.

The patent proprietor also filed an appeal against said decision, but withdrew it with the letter dated 17 October 2022. It is accordingly respondent in the appeal proceedings.

Claim 1 of the request maintained by the opposition division reads as follows:

"1. A method for converting methane into methanesulfonic acid, comprising the following steps:

a. removing hydrogen atoms from methane, thereby generating methyl radicals, each having an unpaired electron;

b. contacting the methyl radicals with sulfur trioxide, under conditions that enable the methyl radicals to react with the sulfur trioxide in a manner that forms methylated oxide radicals having sufficient reactivity to remove hydrogen atoms from methane; and,

c. reacting the methylated oxide radicals with methane, under conditions that enable the methylated oxide radicals to remove hydrogen atoms from the methane, thereby forming methanesulfonic acid while also generating newly-formed methyl radicals,

wherein said steps are initiated by a radical initiator compound and then sustained on a steady-state basis by adding appropriate quantities of methane and the sulfur trioxide to a reactor device, and

wherein said steps are carried out in an entirely anhydrous manner, and wherein any use of any salts is avoided."

- II. The appellants and the party as of right (opponent 1) filed an opposition requesting revocation of the patent-in-suit in its entirety on the grounds of lack of novelty and inventive step (Article 100(a) EPC) and insufficiency of disclosure of the invention (Article 100(b) EPC). *Inter alia*, document (2) *N. Basickes et al, "Radical-Initiated Functionalization of Methane and Ethane in Fuming Sulfuric Acid" J. Am. Chem. Soc., 1996, vol. 118, pages 13111-12,* was cited in the opposition proceedings.
- III. In their respective statements setting out the grounds of appeal, appellants II and III submitted that the subject-matter of the claims maintained by the opposition division lacked an inventive step starting from document (2) as the closest prior art.
- IV. By a communication dated 13 December 2021, the parties were summoned to an oral proceedings to be held on 17 November 2022.
- V. By a letter dated 28 December 2021, opponent 1, party as of right announced that it will not take part in the scheduled oral proceedings.

- VI. By a letters dated 8 March 2022 and 13 July 2022, appellants II and III, respectively, announced that they will not take part in the oral proceedings.
- VII. By a communication pursuant to Article 15(1) RPBA dated 3 August 2022 the Board informed the parties that it may arrive at the conclusion that the subject-matter of claim 1 of all requests does not involve an inventive step.
- VIII. By a letter dated 17 October 2022, the patent proprietor (now respondent) withdrew its appeal and requested that the appeals of the opponents 2 and 3 be dismissed (i.e. that the patent be maintained on the basis of the claim set that was found allowable by the opposition division and that was re-filed as auxiliary request 8 with a letter dated 5 September 2019), or subsidiarily that a patent be maintained on the basis of the auxiliary request 9 filed with the letter dated 5 September 2019.
- According to the respondent document (2) taught that $K_2S_2O_3$ was the best initiator (paragraph bridging the first two columns), and thus clearly taught away from the subject matter of present claim 1 which required the absence of salts. It further submitted that document (2) failed to disclose that all steps are carried out in an entirely anhydrous manner.
- IX. Appellants II and III (opponents 2 and 3) requested that the decision under appeal be set aside and the patent be revoked.
- X. The party as of right (opponent 1) did not file any submission in the appeal proceedings.

Reasons for the Decision

Inventive step

Main request - claims maintained by the opposition division

1. *Closest prior art*

The Board, in agreement with the parties and the opposition division considers that document (2) represents the closest prior art to the invention.

This document discloses steps a, b and c of the process of claim 1 of *the main request*. This document also discloses that these steps are initiated by a radical initiator.

The radical initiator can be $K_2S_2O_8$, $HgSO_4$, $Ce(SO_4)_2$ or H_2O_2 (hydrogen peroxide).

Document (2) specifically discloses the use of hydrogen peroxide as initiator (table 1, last entry). Before reacting with methane (step a), hydrogen peroxide is added to fuming sulphuric acid comprising from 27 to 33 wt.% SO_3 (see page 13111, left-hand column, second paragraph). Consequently, the aqueous hydrogen peroxide is converted to an anhydrous product, H_2O reacting with SO_3 to produce H_2SO_4 and H_2O_2 reacting with sulfuric acid to produce Caro's acid.

The Board therefore concludes that steps a, b and c of the process disclosed in document (2), when hydrogen peroxide is used as *initiator*, are therefore carried out in an entirely anhydrous manner and without any salts.

2. *Technical problem*

The respondent defined the problem to be solved as the provision of an industrial scale process for the preparation of MSA from methane with less by-products.

3. *Solution*

The proposed solution is the process of claim 1 of the main request characterized in that the process is sustained on a steady-state basis by adding appropriate quantities of methane and sulfur trioxide to the reactor.

4. *Success*

In the absence of any evidence, it is not credible that less by-products are formed by the claimed process.

The technical problem should therefore be reformulated into the provision of an industrial scale process for the preparation of MSA from methane.

5. *Obviousness*

One obvious way to upscale a process is to run it continuously. It should be regarded within the normal competence of the skilled person to find the appropriate parameters to achieve a steady state by continuously adding the appropriate quantities of reactants and initiator, if required. In this respect, the Board notes that the patent in suit does not contain any indication as to how the steady state is to be achieved, which implies that this must be done by relying on the general knowledge of the skilled person.

6. According to the respondent document (2) taught that $K_2S_2O_3$ was the best initiator, and thus taught away from the subject matter of present claim 1 which requires the absence of any salts.

However, document (2) discloses a process comprising steps (a), (b) and (c) using H_2O_2 as the initiator, i.e. already without any salts - see last entry of table 1 on page 13111. The difference between the claimed process and that of document (2) is therefore not characterized by the absence of a salt but consists only in operating the process on a steady-state basis by adding appropriate quantities of methane and sulfur trioxide to the reactor. Therefore, the respondent's argument should be rejected.

7. The Board therefore arrives at the conclusion that the subject-matter of claim 1 of the main request does not involve an inventive step.

Auxiliary request 9

8. Claim 1 of this request additionally requires that the initiation step is carried out in an entirely anhydrous manner.

Document (2) discloses that the initiator is hydrogen peroxide. In fact, hydrogen peroxide is more of a precursor of the initiator, as it is first mixed with fuming sulphuric acid, which transforms it into an anhydrous initiator (see page 13111, left-hand column, second paragraph).

The initiation reaction of the process disclosed in document 2 is therefore also carried out in an entirely anhydrous manner. The Board notes that in the contested

patent the initiator is also prepared by mixing aqueous hydrogen peroxide with SO₃ (see paragraphs [0125]-[129]).

Therefore, the additional feature of auxiliary request 9 that the initiation reaction is carried out in an entirely anhydrous manner does not distinguish the claimed subject matter from the process disclosed in document (2).

9. Therefore, the subject matter of the claim of auxiliary request 9 lacks an inventive step for the same reasons as for the main request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated