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Datasheet for the decision of 15 March 2024

Case Number: T 0144/22 - 3.3.06

Application Number: 10739380.3

Publication Number: 2454343

IPC: C10G3/00, C10G45/02, C10G45/58

Language of the proceedings: EN

Title of invention:
Process for producing hydrocarbons by hydrogenating a terpene feed

Patent Proprietor:
UPM-Kymmene Corporation

Opponent:
Neste Oyj

Headword:
Terpene feed hydrogenation / UPM-KYMMENE

Relevant legal provisions:
EPC Art. 56, 100(a)

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 0144/22 - 3.3.06

DECISION
of Technical Board of Appeal 3.3.06
of 15 March 2024

Appellant: (Opponent)	Neste Oyj Keilaranta 21 02150 Espoo (FI)
Representative:	Zacco Denmark A/S Arne Jacobsens Allé 15 2300 Copenhagen S (DK)
Respondent: (Patent Proprietor)	UPM-Kymmene Corporation Alvar Aallon katu 1 00100 Helsinki (FI)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 23 November 2021 rejecting the opposition filed against European patent No. 2454343 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	L. Li Voti
	R. Cramer

Summary of Facts and Submissions

I. The opponent's appeal is against the decision of the opposition division to reject the opposition against European patent no. 2 454 343, granted with claim 1 as follows:

"*1. A process for producing fuel hydrocarbon components, comprising:*
providing a terpene feed selected from a group consisting of crude sulphate turpentine derived from kraft pulping process of wood, crude turpentine derived from mechanical pulping of wood, distillation bottoms from turpentine distillation, turpentine evaporated from crude tall oil, sulphur-containing C_5 *to* C_{10} *hydrocarbon streams from wood processing, and mixtures thereof;*
subjecting the terpene feed and a hydrogen gas to a hydrogenation step at a temperature range from 330°C to 425°C and at a pressure of 10 to 150 bar, in the presence of a hydrodesulphurization catalyst selected from one of the following: NiO/MoO_3, CoO/MoO_3 *and a mixture of* NiO/MoO_3, *and* CoO/MoO_3 *on a support selected from* Al_2O_3 *and* Al_2O_3-SiO_2, *to produce hydrocarbon components.*"

Dependent claims 2 to 9 relate to particular embodiments of this process.

II. With its statement of grounds of appeal and its further letter dated 24 October 2022, the appellant submitted that above claim 1 lacked an inventive step in view of **D5** (US 2,857,439) combined with **D2** (US 3,280,207). **D6a**

(English translation of FI 100248) and **D12** (EP 1741768 A1) were also cited.

III. In its replies to the appellant's submissions the patent proprietor (and respondent) defended the patent as granted and filed four sets of claims as auxiliary requests 1 to 4.

IV. In reply to the board's preliminary opinion, the appellant filed the further document **D13** (Handbook of Petroleum Processing, by D.S.J. STAN JONES and P.R. PUJADÓ, 2008, pages v-xiv and 321-354).

V. At the oral proceedings held on 15 March 2024 the final parties' requests were the following:

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

The respondent requested that the appeal be dismissed, or alternatively, that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the claims of one of the 1st to 4th auxiliary requests filed with the reply to the statement of grounds of appeal. Further it requested that D12 and D13 not be admitted into the proceedings.

Reasons for the Decision

1. *Patent as granted - Inventive step*

1.1 Claim 1 at issue relates to a process for producing fuel hydrocarbon components from a terpene feed. As explained in the patent ([0005]-[0007] and [0013]), unsaturated bicyclic terpenes contained in turpentine are too reactive for use as fuel components and the high sulphur content of turpentine has prevented its use for fuel application. Moreover, even though catalytic processes for converting terpenes to cymenes (suitable as fuel components) were known, they had the drawback that the activity of the catalysts used was destroyed by the presence of sulphur even at low concentrations.

According to the patent ([0014]-[0015]), the purpose of the invention was thus to provide a simple, efficient and economical process enabling the treatment of in particular sulphur contaminated terpene feeds to provide valuable products useful in a fuel application.

1.2 Both parties convened that D5 represented a suitable starting point for the assessment of inventive step, as this document (column 1, lines 52-70) concerns the provision of a process enabling the production of p-cymene from sulphur-contaminated terpenes, such as sulfated turpentine, without appreciable shortening of the catalyst life, and thus this prior art has a similar goal as the patent in suit.

It was also common consent that the closest prior art was represented by the process of example 1, in which a sulfur contaminated terpenic mixture of a sulfate turpentine origin containing 55-60% of dipentene is dehydrogenated to p-cymene by treating it with hydrogen at 350°C in the presence of a platinum on activated alumina catalyst.

1.2.1 As stated in the passage bridging columns 2 and 3 of D5, the catalyst used in said example 1 maintained its activity substantially constant throughout the entire run lasting 25 hours and the product contained a high p-cymene content. Moreover, example 1A, which repeats example 1 with a feed containing substantially no sulphur provides similar results, thus showing that (column 3, lines 27-29) the sulphur in the feed of example 1 had substantially no effect on the extent of the reaction or on the activity of the catalyst.

1.3 The board thus finds that D5 already provided a solution to the technical problem addressed in the patent in suit. Since there is no evidence that the process of claim 1 at issue provides throughout its entire scope any advantage over the closest prior art, the technical problem underlying the claimed invention has to be reformulated in less ambitious terms as the provision of a further process for the preparation of hydrocarbons useful in a fuel application starting from a terpene-containing feed.

It is not in dispute that the process of claim 1 at issue provides a solution to this technical problem.

1.4 Since the process of D5/example 1 includes the treatment with hydrogen at 350°C of a terpene feed in accordance with the requirements of claim 1 at issue, it differs from claim 1 at issue only in that the applied pressure is not indicated and the catalyst used is not a HDS catalyst selected from NiO/MoO_3, CoO/MoO_3 and a mixture of NiO/MoO_3 and CoO/MoO_3 on a support selected from Al_2O_3 and Al_2O_3-SiO_2.

1.5 It remains thus to be evaluated whether or not it was obvious for the skilled person, faced with the above technical problem, to use in the process according to D5/example 1 a pressure within the range of 10 to 150 bar and to replace the platinum-on-alumina catalyst with the HDS catalyst claimed and indicated above.

1.5.1 D5 discloses (column 5, lines 40-48) that the pressure at which the process is performed has an effect on the effective life of the catalyst and that it is preferred to select a higher pressure up to a maximum of about 750 psig, i.e. about 52 bar, and preferably up to about 500 psig., i.e. about 34 bar. Therefore, it was obvious for the skilled person faced with the technical problem posed to select a pressure even at the preferred higher limit disclosed in D5, i.e. a pressure within the limits of claim 1 at issue.

1.5.2 As regards the catalyst, the appellant argued that it was obvious for the skilled person to try the NiMo catalyst disclosed in D2 for the process according to D5, since D2 (column 1, lines 10-15, 32-34, 36-40 and 55-56; column 2, lines 11-36 lines 70-72; example 1), suggested the use of such a catalyst in hydrocarbon processes including aromatisation, disproportionation, oligomerisation and polymerisation, in particular for the conversion of terpenes like limonene (dipentene) into 3-p-menthene and p-cymene by a disproportionation reaction, i.e. the same reaction of dipentene to p-cymene occurring in D5.

1.5.3 However, the board remarks that the disproportionation reaction according to D2 (dehydrogenation to p-cymene and hydrogenation to p-menthene) does not require **the addition of hydrogen gas to the feed of departure** as in D5 and concerns only one of the terpene conversion reactions occurring necessarily during the process of D5/example 1 starting from a different feed comprising a mixture of terpenes and even some sulphur (which is apparently not contained in the feed of D2). The board also notes that, even though not any terpenic feed of claim 1 at issue contains necessarily sulphur, and the addition of hydrogen in D5 (column 2, lines 17-20) is presumed to counteract the normal deleterious effect of sulphur, also D5/example 1A, i.e. the same process as in example 1 of D5 carried out on a feed substantially free of sulphur, includes **the addition of hydrogen to the starting feed** and leads to a similar product as example 1. Therefore, the addition of hydrogen to the starting feed is manifestly an essential step of the process disclosed in this document.

Moreover, the fact that equimolar amounts of hydrogen are produced in D2 **during** dehydrogenation, as submitted by the appellant, is not a reason for considering the process of D2 wherein hydrogen is not added to the feed of departure to be equatable with that of D5, wherein the above mentioned dehydrogenation also occurs but the addition of hydrogen to the feed of departure is nevertheless considered to be essential (see also D5: column 5, lines 6-8).

Therefore, in the board's view, the process of D2 is different from that of D5 and the skilled person would not consider its teaching to be obviously applicable to the latter document.

1.5.4 The board also remarks that, as stated in D2 (column 2, lines 21-35; column 3, lines 7-9 and example 1), the NiMo catalyst used is prepared by thermal decomposition of the complex $(NH_4)_6NiMo_9O_{32}\cdot 6H_2O$, wherein nickel is in the unusual **tetravalent** state, with this catalyst being then activated with a stream of air at 500°C for about 10-20 hours and needing reactivation under air after reaction.

This catalyst is thus in the board's view different from the HDS NiO/MoO_3 catalyst according to claim 1 at issue wherein nickel is in the **divalent** state.

Moreover, since D2 requires the used catalyst to be reactivated by calcination in air after reaction, the skilled person would not have considered this catalyst as being a suitable alternative to that used in D5 wherein no reactivation, let alone with air, is needed after reaction.

1.5.5 Therefore the skilled person faced with the technical problem posed and looking for further catalysts to be used as an alternative to that of the closest prior art would not have derived any suggestion from document D2, which concerns a different process, for selecting an HDS catalyst as required in claim 1 at issue as a substitute for the platinum catalyst of D5 with a reasonable expectation of success.

1.5.6 This conclusion also applies even if D6a, D12 and D13 were considered since all these documents, cited for showing inter alia the common generally known sulphur tolerability of the HDS NiMo catalyst of claim 1 at issue, relate to processes and reactions different from those of D2 and D5, D6a concerning the hydrogenation of tall oil, D12 (paragraphs [0037] and [0061], claim 9) the hydrotreatment of plant oils/fats such as tall oil or animal oils/fats and in particular the transformation of triglycerides, and D13 the hydrotreating of petroleum fractions.

Therefore, none of these documents is relevant for the assessment of inventive step, and there is thus no need to discuss the admissibility of documents D12 and D13.

1.6 The board thus concludes that the subject-matter of claim 1 as granted and by the same token that of claims 2 to 9, which depend thereon, is not obvious from the known state of the art, and thus involves an inventive step.

2. It follows from the above considerations that the ground for opposition under Article 100(a) and 56 EPC does not prejudice the maintenance of the patent as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

Beschwerdekammern des Europäischen Patentamts
Boards of Appeal of the European Patent Office
Chambres de recours de l'Office européen des brevets

A. Pinna J.-M. Schwaller

Decision electronically authenticated