UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REG Synthetic Fuels, LLC,
Petitioner

v.

Neste Oyj,
Patent Owner

IPR2018-01375
U.S. Patent No. 8,859,832

PATENT OWNER'S RESPONSE

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ABBREVIATION	DESCRIPTION
’832 patent	Neste’s U.S. Patent No. 8,859,832 (Ex. 1001)
Aalto	Swedish Patent No. 520633 (Ex. 1013); English translation (Ex. 1014)
HDO	hydrodeoxygenation
HDS	hydrodesulphurization
IPR	*Inter partes* review
Italics	Emphasis added unless otherwise noted
Jakkula	European Patent App. No. 1396531 A2 (Ex. 1005)
MD	middle distillate
Monnier	U.S. Patent No. 5,705,722 (Ex. 1006)
Neste or Patent Owner	Neste Oyj
Oldřich	Czech Patent No. 283575 (Ex. 1016); English translation (Ex. 1017)
REG or Petitioner	REG Synthetic Fuels, LLC

I. Introduction

REG's obviousness grounds are deficient as a matter of law. REG uses hindsight reasoning to reconstruct the claimed process of the '832 patent from conflicting teachings in the prior art. Contrary to REG's assertions, a person of ordinary skill in the art would have had no motivation or reasonable expectation of success in combining the cited references. Grounds 1 and 2 seek to combine Jakkula with Monnier (*See* Pet. 13-32), but Jakkula and Monnier present opposite teachings regarding the use of sulphur. Whereas Jakkula teaches maintaining the activity of its hydrotreatment and isomerization catalysts by *removing sulphur*, Monnier suggests *adding sulphur* to maintain activity of the hydrotreatment catalyst. These approaches are mutually exclusive. Moreover, the prior art did not recognize any problems with Jakkula's process relating to the removal of sulphur. Thus, a skilled artisan would not have modified Jakkula to add sulphur to the hydrotreatment feed as REG contends.

In Grounds 4 and 5, REG seeks to combine Aalto with Monnier. (*See* Pet. 38-56.) But Aalto is older than and cumulative to Jakkula—both contain nearly identical hydrotreatment and isomerization examples—and thus a skilled artisan would have recognized that these repetitive references provide substantially the same disclosures and that Jakkula was the latest version before the '832 patent's filing date. (*Compare* Ex. 1005, 7-10 (Examples 1 and Tables 1 and 2), *with* Ex.

1014, 5-11 (Example 1 and Tables 1 and 4).) A person of ordinary skill would not have disregarded the later, more detailed teachings of Jakkula in favor of the more rudimentary description in Aalto. Thus, the conflict between Jakkula and Monnier regarding sulphur removal, which makes it inappropriate to combine their teachings, is equally relevant to Grounds 4 and 5.

Ground 3 seeks to combine Jakkula with Oldřich. (*See* Pet. 32-38.) In view of Jakkula's repeated teachings to remove sulphur to extend the life of hydrotreatment and isomerization catalysts, a person of ordinary skill in the art would not have sought to modify Jakkula by using Oldřich's disclosed "middle distillate" petroleum feedstock containing significant sulphur levels. Oldřich is also not directed to producing diesel-range hydrocarbons, seeking instead to achieve a petrol fuel containing no diesel-range middle distillates. Oldřich is thus contrary to Jakkula's explicit aim of producing diesel fuels. Accordingly, combining Jakkula with Oldřich would not have led a person of ordinary skill to the claimed invention for this additional reason.

Because all of REG's grounds seek to combine conflicting references in a way that would frustrate Jakkula's removal of sulphur at every opportunity to protect hydrotreatment and isomerization catalysts, a person of ordinary skill would have had no motivation or reasonable expectation of success in combining the asserted references. (*See, e.g.*, Ex. 2002, ¶¶ 24-27.) REG's arguments to the contrary are based on improper hindsight reasoning. Thus, Neste respectfully requests that the Board deny the Petition and confirm the patentability of the ’832 patent claims.

II. Background

A. The ’832 Patent

The ’832 patent discloses an improved process for manufacturing diesel-range hydrocarbons from bio oils and fats. (Ex. 1001, 1:18-22; Ex. 2002, ¶¶ 17-19.) The process requires two steps: first, a hydrotreating step and second, an isomerization step. (Ex. 1001, 5:25-26; Ex. 2002, ¶ 17.) The hydrotreating step transforms triglycerides, fatty acids, and their derivatives into n-paraffins. (Ex. 1001, 5:26-32; Ex. 2002, ¶ 17.) The subsequent isomerization step converts the n-paraffins into diesel-range branched alkanes. (Ex. 1001, 5:32-34.) Both steps require the use of a catalyst. (Ex. 1001 5:34-40; Ex. 2002, ¶ 17.)

Converting natural triglycerides and fatty acids into paraffin compositions involves saturating double bonds and removing oxygenates (-OH, -COH, -COOH, etc.). (Ex. 2002, ¶¶ 9-16.) The oxygen can be removed by several competing reactions. Hydrodeoxygenation (or HDO) refers to removing oxygen in the form of water and replacing it with hydrogen. (Ex. 1001, 4:64-67; Ex. 2002, ¶ 10.) For example:

$$C_{17}H_{35}COOH + 3H_2 \rightarrow C_{18}H_{38} + 2H_2O$$

Hydrodecarboxylation removes the oxygen as CO_2. (Ex. 1001, 5:1-5; Ex. 2002, ¶ 10.) For example:

$$C_{17}H_{35}COOH \rightarrow C_{17}H_{38} + CO_2$$

And hydrodecarbonylation removes the oxygen as CO. (Ex. 1001, 5:1-5; Ex. 2002, ¶ 10.) For example:

$$C_{17}H_{35}COOH + H_2 \rightarrow C_{17}H_{36} + CO + H_2O$$

$$C_{17}H_{35}COOH \rightarrow C_{17}H_{34} + CO + H_2O$$

Hydrodecarboxylation and hydrodecarbonylation require less hydrogen but yield paraffins with one less carbon atom than paraffins produced by HDO. (Ex. 1001, 4:64-5:5; Ex. 2002, ¶ 10.)

Claim 1 requires that at least one organic or inorganic sulphur compound is present in the hydrotreated feed. (Ex. 1001, 16:4-5; Ex. 2002, ¶ 18.) Claims 10 and 19 require that the sulphur is present in an amount from 50 to 20,000 w-ppm, calculated as elemental sulphur. (Ex. 1001, 17:5-7; Ex. 2002, ¶ 19.)

B. Level of Ordinary Skill

Neste submits that a person of ordinary skill in the art at the time of the invention in July 2005 would have had a degree in chemical engineering or chemistry and at least two to three years of experience with processes for manufacturing diesel-range hydrocarbons from biorenewable feedstocks. (Ex. 2002, ¶¶ 22-23.) REG's proposed level of ordinary skill, requiring either an advanced degree or at least a decade of working experience, is unreasonably high. (*Id.* at ¶ 23.) Thus, Neste requests that the Board adopt its proposed level of ordinary skill in this proceeding. Neste submits, however, that the ’832 patent claims are patentable over the prior art irrespective of the particular level of ordinary skill in the art.

C. Claim Construction

For purposes of this IPR proceeding, Neste respectfully submits that it is unnecessary for the Board to expressly construe any of the ’832 patent claim terms identified by REG. (*See* Pet. 8-11; Ex. 2002, ¶¶ 20-21.) REG does not apply its claim constructions in its proposed obviousness grounds, and Neste’s arguments in this Patent Owner Response do not depend on disputing any of REG’s proposed constructions. Thus, while Neste does not necessarily agree with REG’s proposed constructions, Neste submits that it is unnecessary for the Board to decide those issues in this proceeding. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (claim terms need only be expressly construed if “necessary to resolve the controversy”).

III. A Person of Ordinary Skill Would Have Had No Motivation or Reasonable Expectation of Success in Combining Jakkula with Monnier (Grounds 1 and 2)

Grounds 1 and 2 propose to combine Jakkula’s process with Monnier’s teaching of adding sulphur to a hydroprocessing feed. (*See* Pet. 13-32.) A person of ordinary skill in July 2005, however, would have had no motivation or reasonable expectation of success in combining Jakkula with Monnier. (Ex. 2002, ¶¶ 28-44.) When a proposed combination violates a reference's principle of operation, as REG's Jakkula-Monnier combination does here, it cannot establish obviousness. *Fisher & Paykel Healthcare Ltd. v. Resmed Ltd.*, IPR2017-00059, Paper 27, at 45 (PTAB March 7, 2018); *Plas-Pak Indus., Inc. v. Sulzer Mixpac AG*, 600 F. App'x 755, 758-59 (Fed. Cir. 2015) (finding nonobviousness where a reference "rife with statements" describing its principle of operation conflicted with the secondary reference in the challenger's proposed combination).

Jakkula describes a two-step process for producing diesel-range hydrocarbons from biological raw materials such as vegetable oil. (Ex. 1005, ¶ [0001].) The first step is hydrotreatment, which involves chemical reactions such as hydrodeoxygenation ("HDO") or hydrodesulphurization ("HDS"). (*Id.*, ¶¶ [0016], [0007]; Ex. 2002, ¶ 29.) During hydrotreatment, hydrogen gas is mixed with the biological feedstock and then passed through one or more catalyst beds. (Ex. 1005, ¶ [0020].) Hydrotreatment (e.g., HDO) removes oxygen from the oil and breaks up its structure, typically using a NiMo or CoMo catalyst. (*Id.*, ¶¶ [0007], [0020].) In the second step, the product is contacted with an isomerization catalyst. (*Id.*, ¶ [0026].) In the isomerization step, hydrocarbons are branched to provide a high quality diesel fuel. (*Id.*, ¶¶ [0016], [0032].)

The hydrotreatment catalyst, like all catalysts, is subject to poisoning and inhibition. (Ex. 2002, ¶ 30.) For this reason, Jakkula teaches removal of "nitrogen, sulphur and phosphorus that are known catalyst poisons and inhibitors inevitably reducing the service life of the catalyst and necessitating frequent regenerations thereof." (Ex. 1005, ¶ [0006].) While the HDO catalyst is described as having "some resistance to catalyst poisons," Jakkula teaches that "[t]he service life of the catalysts may be extended both in the HDO step and the isomerization step by removing by-products produced from the withdrawn streams and from the streams to be recycled." (*Id.*, ¶ [0060]; Ex. 2002, ¶ 30.)

To extend the service life of hydrotreatment and isomerization catalysts, Jakkula teaches removing sulphur at essentially every stage of its process. First, as Dr. Klein explains, Jakkula urges conducting a pretreatment (e.g., prehydrogenation) of the raw materials to remove impurities, including nitrogen, sulphur, and phosphorus. (Ex. 2002, ¶ 31; Ex. 1005, ¶¶ [0006]-[0007], [0021]-[0022].) Jakkula's Example 2 is directed to a prehydrogenation purification process. (Ex. 1005, ¶ [0074], Table 3; Ex. 2002, ¶ 32.) Jakkula states that "[p]retreatment and purity of the raw materials contribute to the service life of the catalyst." (Ex. 1005, ¶ [0007].) Dr. Sughrue agrees that this pretreatment is important to "remove impurities and extend the service life of the catalyst." (Ex. 1002, ¶ 105.) Jakkula additionally states that prehydrogenation may also improve operational performance and diesel fuel product yield. (Ex. 2002, ¶ 32; Ex. 1005, ¶ [0062] ("The yield of the final product (diesel) is also considerably improved by the prehydrogenation.").

Thus, Jakkula teaches pre-treating raw bio oils and/or fats to remove sulphur and other impurities to preserve the service life of the catalyst, as well as to improve the diesel fuel yield from its hydrotreatment and isomerization steps. (Ex. 2002, ¶ 28-33.) It would accordingly be contradictory to Jakkula's disclosure to *add sulphur* to the hydrotreatment feed in view of Jakkula's emphasis on removing sulphur from the raw materials before its hydrotreatment process even begins. (Ex. 2002, ¶ 33.)

Second, Jakkula teaches removing sulphur during the hydrotreatment step itself. (Ex. 2002, ¶ 34.) For example, Jakkula repeatedly describes removing "sulphur and phosphorous compounds and other impurities" from the hydrotreatment stream during hydrotreatment. (Ex. 1005, ¶¶ [0037], [0051], [0056]; *see also id.*, ¶¶ [0041], [0043].) In its sole hydrotreatment example, Jakkula specifies the use of a "typical desulphurization catalyst." (*Id.*, ¶ [0070].) Jakkula discloses that the further-purified hydrocarbons in the hydrotreatment stream are then returned to the hydrotreatment catalyst beds as "recycled streams" and further processed. (*Id.*, ¶¶ [0037], [0051], [0056], [0041], [0043].)

As Dr. Klein explains, a skilled artisan would understand that recycling the purified hydrotreatment streams to the reactor would dilute the fresh feed, further lowering the total sulphur content of the overall feed in contact with the hydrotreatment catalyst. (Ex. 2002, ¶ 35.) This is important for maintaining service life of the hydrotreatment catalyst. (*Id.*) Indeed, while hydrotreatment catalysts may have "some resistance to catalyst poisons" (Ex. 1005, ¶ [0010]), Jakkula states that the "service life of the catalysts [including, specifically, the HDO catalyst] may be extended" during hydrotreatment by "removing by-products from the withdrawn streams and from the streams to be recycled." (*Id.*, ¶ [0060].) Again, as Dr. Klein explains, it would make no sense to *add* sulphur to the hydrotreatment feed in Jakkula while continually *removing* sulphur and recycling purified hydrotreatment streams to help extend the catalyst's service life. (Ex. 2002, ¶ 35.)

Third, Jakkula discloses yet an additional purification step to remove sulphur and other impurities after hydrotreatment but before the product is isomerized. (Ex. 2002, ¶ 36.) Jakkula states that downstream of the last hydrotreatment catalyst bed, "sulphur and phosphorus compounds and other impurities are removed as a stream." (Ex. 1005, ¶ [0051].) Thus, even after the pretreatment and hydrotreatment steps for removing sulphur, Jakkula emphasizes the need to remove additional sulphur with this intermediate purification step between hydrotreatment and isomerization. Indeed, Jakkula states that "[i]t is substantial for the process that the impurities are removed *as completely as possible* before the hydrocarbons are contacted with the isomerization catalyst." (Ex. 1005, ¶ [0026].) Thus, a skilled artisan would have understood that sulphur should not be added to the hydrotreatment feed given its necessary removal at each stage of Jakkula's process. (Ex. 2002, ¶ 36.)

Fourth, Jakkula also instructs that "[c]atalyst poisons can be removed by utilizing the counter-current operation in the isomerization [step]." (Ex. 1005, ¶ [0060].) Jakkula reinforces that the service life of the isomerization catalyst can be extended by "removing by-products produced from the withdrawn streams and from the streams to be recycled." (Ex. 2002, ¶ 37; Ex. 1005, ¶ [0060].) One of ordinary skill would recognize from Jakkula's disclosure that the isomerization product may be recycled back into the upstream hydrotreatment reactor. (Ex. 1005, ¶ [0042] ("[T]he feed is also mixed with an isomerization product 83 to dilute the feed to the HDO step.").) The recycled product would dilute the fresh feed in the hydrotreatment process to an even lower level of sulphur. This too would have strongly counseled against *adding* sulphur to Jakkula's hydrotreatment feed. (Ex. 2002, ¶ 38.)

After isomerization in Example 1, Jakkula reports achieving a sulphur content of zero in a processed tall oil feedstock. (Ex. 1005, ¶ [0073], Table 2.) Jakkula confirms that this hydrotreated/isomerized product had "excellent" properties and a "considerably improved" performance at low temperatures, in contrast to Monnier's product, which Jakkula describes as having "poor low temperature performance." (Ex. 2002, ¶ 39; Ex. 1005, Table 2, ¶¶ [0073], [0004].)

In sum, given Jakkula's repeated emphasis on seeking to completely remove sulphur throughout its process for producing diesel fuels, one of ordinary skill would not have sought to *add sulphur* during Jakkula's hydrotreatment step. (Ex. 2002, ¶ 40.) Indeed, whereas Monnier teaches spiking a hydrotreatment feed with 1000 w-ppm of sulphur (Ex. 1006, 4:15-18), Jakkula teaches removing sulphur through a pretreatment process to purify the feed before hydrotreatment even begins. (Ex. 2002, ¶¶ 32-33; Ex. 1005, ¶¶ [0006]-[0007], [0021]-[0022].) Jakkula then instructs that one should further remove sulphur during hydrotreatment and dilute the feed with hydrotreatment product to further lower sulphur concentrations. (Ex. 2002, ¶¶ 34-35; Ex. 1005, ¶¶ [0037], [0051], [0056], [0041], [0043].) Jakkula then applies yet an additional post-hydrotreatment purification step, explaining that, notwithstanding previous sulphur removal, it is important to remove impurities "as completely as possible." (Ex. 2002, ¶ 36; Ex. 1005, ¶ [0026].) Finally, Jakkula removes sulphur in a fourth step during isomerization and recycles this even-further purified isomerized product back into the hydrotreatment feed for dilution purposes. (Ex. 2002, ¶¶ 37-38; Ex. 1005, ¶¶ [0042], [0060].)

Through these multiple sulphur-removal steps, Jakkula reports several benefits from its disclosed process. *Fisher*, IPR2017-00059, Paper 27 at 45 ("benefits, both lost and gained, should be weighed against one another" when considering a proposed combination of references (quoting *Winner Int'l Royalty*

Corp. v. Wang, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000))). Jakkula, for example, discloses that by removing sulphur as a catalyst poison, the activity of the hydrotreatment and isomerization catalysts can be further preserved. (Ex. 2002, ¶ 40.) Also, following a prehydrogenation process to remove sulphur and other impurities, Jakkula states that the properties of the resulting hydrotreated and isomerized product are "excellent" with improved low temperature performance and "considerably better than that of . . . products obtained using prior art processes." (*Id.*; Ex. 1005, ¶¶ [0066], [0073].) In addition, as Jakkula discloses, pre-hydrotreatment purification to remove sulphur and other impurities also results in operational improvements (e.g., shortened production time) and improved diesel fuel product yield. (Ex. 2002, ¶ 32; Ex. 1005, ¶ [0062].)

Thus, a person of ordinary skill would not have understood Jakkula's process to have suffered any issues with the "loss of sulphided active sites on the catalyst surface," which Monnier seeks to prevent. (Ex. 2002, ¶ 40; Ex. 1006, 4:14-17.) Because the prior art did not recognize any such problems with Jakkula's process, a skilled artisan would not have been motivated to modify Jakkula with Monnier to add sulphur. *Novartis Pharm. Corp. v. Watson Labs., Inc.*, 611 F. App'x 988, 995-96 (Fed. Cir. 2015) (finding no motivation to modify a prior art formulation where the prior art did not identify any known problem with that formulation); *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1356-57 (Fed. Cir. 2013) (same). Rather, Jakkula criticizes Monnier's process, which involved spiking a hydrotreatment feed with 1000 w-ppm sulphur, as resulting in a product with "poor low temperature performance." (Ex. 2002, ¶ 41; Ex. 1005, ¶ [0004]); *Plas-Pak*, 600 F. App'x at 758-59.

REG's unsupported allegations in the Petition do not account for Jakkula's repeated emphasis on removing sulphur. (Pet. 13-16; Ex. 2002, ¶¶ 42-44.) Instead, REG simply cites Monnier's discussion of a potential "loss of sulphided active sites on the catalyst surface." (Pet. 15 (quoting Ex. 1006, 4:15-18).) But REG overlooks the absence of any disclosed problem with Jakkula's hydrotreatment catalyst operation, let alone any problem arising from the absence of adding sulphur. *Novartis*, 611 F. App'x at 995-96 (finding no motivation to modify prior art in the absence of any known problem). One of ordinary skill would have recognized Jakkula's (1) strong emphasis on removing sulphur, identified as a known catalyst poison to both hydrotreatment and isomerization catalysts, (2) importance attached to improving the service life of the catalyst, and (3) "excellent" results in obtaining a diesel fuel with superior low temperature performance. (Ex. 2002, ¶ 44.) Thus, a skilled artisan would not have been motivated to add sulphur to Jakkula's process, let alone for the purpose of addressing an illusory, unsupported alleged problem with sulphided active sites. (Ex. 2002, ¶¶ 40-44); *Fisher*, IPR2017-00059, Paper 27 at 45 (finding that a challenger's arguments premised on changing a reference's principle of operation, when assessed against "unsupported evidence of benefits from the proposed combination," supported nonobviousness); *Plas-Pak*, 600 F. App'x at 758-59. Thus, it is only through the improper use of hindsight that REG proposes combining Monnier with Jakkula to arrive at the claimed invention of the '832 patent. *Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1377-78 (Fed. Cir. 2012) (discussing the "prohibited reliance on hindsight").

Accordingly, a person of ordinary skill in July 2005 would not have changed Jakkula's principle of operation by adding sulphur as taught by Monnier. The '832 patent claims are thus patentable over the references asserted in REG's Grounds 1 and 2.

IV. A Person of Ordinary Skill Would Have Had No Motivation or Reasonable Expectation of Success in Combining Aalto with Monnier (Grounds 4 and 5)

Grounds 4 and 5, like Grounds 1 and 2, seek to combine Monnier's teaching of adding sulphur to the Aalto/Jakkula process. (*See* Pet. 38-56.) But instead of citing the more recent and more pertinent disclosure in Jakkula, REG attempts to reach back to the more rudimentary description of the Jakkula process in the earlier Aalto application. When, as here, the state of the art has advanced since an initial disclosure was made, a person of ordinary skill in the art would not ignore more recent developments and blindly follow an outdated or superseded disclosure. 35 U.S.C. § 103 (pre-AIA) (obviousness must be assessed as of "the time the invention was made”). Accordingly, a person of ordinary skill looking to improve on the teachings of the prior art at the time of the ’832 patent’s invention in July 2005 would have considered and followed the more advanced disclosure in Jakkula. (Ex. 2002, ¶¶ 45-49.)

Indeed, under 35 U.S.C. § 103, the person of ordinary skill in the art would have been aware of all relevant art in the area of the invention. “In determining whether such a suggestion [of success] can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention.” *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988). Therefore, a person of ordinary skill aware of Aalto in July 2005 also would have been aware of Jakkula. Indeed, Jakkula lists Aalto among its inventors and was filed more than six years after Aalto. (Ex. 1005, cover page.)

Jakkula describes the same process as Aalto, but with a more advanced and detailed disclosure of that process. (Ex. 2002, ¶ 47.) For example, Aalto outlines the same two-step process for preparing a diesel fuel from vegetable oil as was later described in Jakkula: catalyzed hydrogenation and isomerization. (Ex. 1014, 1:6-8; 3:13-14; Ex. 2002, ¶ 47.) Both references share substantially the same disclosures, including nearly identical hydrotreatment and isomerization examples. (*Compare*

Ex. 1005, 7-10 (Example 1 and Tables 1 and 2), *with* Ex. 1014, 5-11 (Example 1 and Tables 1 and 4); Ex. 2002, ¶ 47.)

Thus, a skilled artisan would have recognized that these repetitive references provide substantially the same disclosures. (Ex. 2002, ¶¶ 47-49; Ex. 1002, ¶ 124 (Dr. Sughrue conceding that "Aalto discloses removing catalyst poisons from the hydrotreated feed . . . .") Neither Aalto nor Jakkula discloses any problems relating to sulphided active sites on a catalyst. (*Id.*, ¶ 47.) Moreover, since Jakkula is not only more recent but more explicit regarding the effect of sulphur on the hydrotreatment process, a skilled artisan would have looked to Jakkula's updated disclosure in determining whether to add sulphur to the hydrotreatment feed in the Jakkula/Aalto process. (*Id.*, ¶¶ 48-49.) As a result, for at least the same reasons discussed above for Grounds 1 and 2, a person of ordinary skill would have had no motivation or reasonable expectation of success in combining Aalto and Monnier to arrive at the claimed invention. (*Id.*, ¶ 49.)

The most significant difference between Aalto and Jakkula is that the earlier reference, Aalto, does not contain as many specific disclosures directed to extending catalyst life by removing impurities such as sulphur. (*Id.*) As discussed above, this is the overwhelming directive of Aalto's follow-on reference, Jakkula. (*Supra* Section III.) It is often the case that a later disclosure will expand upon the teachings of an earlier one in ways that direct future efforts in the field of the invention.

(Ex. 2002, ¶ 49.) A skilled artisan would not have tried to improve the Aalto/Jakkula process by modifying it in a way that was directly contrary to the updated understanding expressed in Jakkula. Rather, a person of ordinary skill, aware of the Aalto/Jakkula process, would have used the more up-to-date teachings of Jakkula as a guide. Obviousness must be judged at the time of the invention under 35 U.S.C. § 103, and at the time of the invention of the '832 patent in July 2005, the Aalto/Jakkula process was understood to require the removal of sulphur to protect catalyst activity and achieve improved diesel fuel product yield. (Ex. 2002, ¶¶ 28-44); *Fisher*, IPR2017-00059, Paper 27 at 45 (finding nonobviousness after weighing benefits gained and lost in a proposed combination of references).

V. A Person of Ordinary Skill Would Have Had No Motivation or Reasonable Expectation of Success in Combining Jakkula with Oldřich (Ground 3)

Ground 3 seeks to combine the process of Jakkula with Oldřich's teaching of feeding a mixture of bio oils and petroleum to a hydrogenation process. (*See* Pet. 32-38.) Oldřich specifies that the petroleum fraction it uses may include high amounts of sulphur. (Ex. 1017, 2.) REG incorrectly alleges that a skilled artisan would have been motivated to combine the sulphur-laden feed of Oldřich with the process of Jakkula. (Pet. 34; Ex. 1002, ¶ 118; Ex. 2002, ¶¶ 50-65.)

REG's Ground 3 fails for at least three reasons. First, as set forth above in Section III, Jakkula teaches extending hydrotreatment and isomerization catalyst life by repeatedly removing sulphur in up to four different steps in its process—not adding a sulphur-laden petroleum co-feed as Oldřich discloses. Second, Oldřich and Jakkula are directed to different processes: Oldřich seeks to obtain motor vehicle petrol containing no diesel fuel components, whereas Jakkula explicitly seeks to produce useful diesel fuels with improved low temperature performance. Third, using the petroleum feed from Oldřich would also defeat Jakkula's goal to create diesel fuel from biological starting materials. For all of these reasons, a person of ordinary skill in the art would have had no motivation or reasonable expectation of successfully combining Jakkula with Oldřich. *Fisher*, IPR2017-00059, Paper 27 at 45; *Plas-Pak*, 600 F. App'x at 758-59.

A. Oldřich's Teaching of Augmenting a Feed with a Sulphur-Containing Co-Feed Directly Conflicts with Jakkula's Teaching of Removing Sulphur

As discussed in Section III above, Jakkula overwhelmingly teaches maintaining catalyst activity by sulphur removal. Oldřich, on the other hand, discloses a feed containing large amounts of sulphur. (Ex. 1017, 1-2.) It states that "the petroleum fraction added during hydrogenation is a medium distillate . . . containing up to 1.5 [or 2] wt% sulphur," which equates to up to 15,000 to 20,000 w-ppm sulphur. (Ex. 1017, 2; Ex. 2002, ¶ 51.) Oldřich's disclosure of significant amounts of sulphur in its feedstock is incompatible with Jakkula's teaching of removing sulphur from its process, particularly its instructions on "pretreatment and purity of the raw materials." (Ex. 2002, ¶ 51; Ex. 1005, ¶ [0007]; *see also supra* Section III.) Further, Oldřich fails to identify any benefits arising from the high sulphur content of its petroleum-based feedstocks, and Jakkula fails to disclose any problems with its process that could be addressed by adding sulphur to its hydrotreatment feed. (Ex. 2002, ¶¶ 40, 51); *Novartis*, 611 F. App'x at 995-96; *Leo Pharm.*, 726 F.3d at 1355.

Accordingly, a skilled artisan would have had no motivation or reasonable expectation of success in combining the process of Jakkula with the sulphur-laden feed of Oldřich. (Ex. 2002, ¶¶ 51-52.)

B. Oldřich and Jakkula Are Directed to Producing Different, Incompatible Products

Oldřich is not directed to the manufacture of diesel-range hydrocarbons as claimed in the '832 patent. (Ex. 1001, claim 1.) Instead, Oldřich is directed to forming "petrol," which it distinguishes from diesel fuels. (Ex. 1017, 1-2; Ex. 2002, ¶ 53.) Oldřich is therefore also inconsistent with the disclosure of Jakkula, which describes how to produce renewable diesel fuels with improved low temperature performance. (Ex. 1005, ¶¶ [0001], [0062], [0066], [0073]; Ex. 2002, ¶ 53.)

Indeed, Oldřich states that its process was "devised for producing motor-vehicle petrol." (Ex. 1017, 1.) Oldřich contrasts this petrol with diesel fuels, referring to processed medium distillate fractions as a "Diesel fuel." (Ex. 1017, 4.) Oldřich states that "[m]edium distillates are at present regarded as inferior to petrol fractions." (Ex. 1017, 1.) As Oldřich explains, its process involves "totally cleav[ing]" petroleum fractions into smaller hydrocarbons to produce petrol—not middle distillate (diesel-range) fractions. (Ex. 1017, 4; Ex. 2002, ¶ 55.) Oldřich's Table 3 reports that when the middle distillate ("MD") fractions involved in its hydrotreatment process were recycled, the final product contained zero middle distillate (diesel-range) fractions. (Ex. 1017, Table 3; Ex. 2002, ¶ 55.)

Accordingly, Jakkula and Oldřich are not properly combinable because Oldřich seeks to break down the diesel-range hydrocarbons that Jakkula seeks to produce. *Plas-Pak*, 600 F. App'x at 758-59; (Ex. 2005, ¶¶ 53-55.)

C. Oldřich's Use of a Petroleum Feed Conflicts with Jakkula's Purpose of Preparing Diesel Fuel from Biological Materials

Jakkula's process is intended to produce renewable diesel-range hydrocarbons "of biological origin from biological starting materials" (*i.e.*, oils and fats from plants and animals). (Ex. 1005, ¶ [0001].) This focus on a biological feedstock is apparent throughout the reference. (Ex. 2002, ¶¶ 57-65.) The title of Jakkula is "Process for producing a hydrocarbon component *of biological origin*." (Ex. 1005, title.) Its abstract also describes a "a process for producing a hydrocarbon component *of biological origin*." (*Id.*, abstract) Jakkula further discloses that a "*biological raw material* . . . serves as the feed stock," not any petroleum-based feedstock. (*Id.*)

Throughout the specification, Jakkula instructs a skilled artisan to use biological feedstocks. The first sentence of the specification states: "The invention relates to an improved process for producing a hydrocarbon component *of biological origin from biological starting materials* such as vegetable oils, animal fats and similar materials . . . ." (Ex. 1005, ¶ [0001].) The second sentence confirms that in the art, "[e]ver increasing interest is directed to the use of hydrocarbon components *of biological origin* in fuels," stressing the "desirable" use of renewable biological starting materials to "replace fossil ones." (Ex. 1005, ¶ [0002].) Accordingly, in the general description of the invention, Jakkula states that "[t]he process of the invention comprises at least two steps, . . . *a biological raw material serving as the feed stock*." (Ex. 1005, ¶ [0014].) And throughout the specification, the feed is referred to as "biological raw material" or "biological starting material." (*See, e.g.*, Ex. 1005, ¶¶ [0036], [0039].) Jakkula never mentions the possibility of adding petroleum to the feed, and one of ordinary skill would have recognized from the disclosure that doing so would be inconsistent with the Jakkula's overarching purpose to make renewable diesel fuels from biological feedstocks. (Ex. 2002, ¶ 59.)

Unlike Jakkula, Oldřich describes a process for hydrogenating a feedstock that is mostly petroleum. According to the specification, "vegetable oil with petroleum fractions . . . is initially introduced, in a volume ratio of 1:5 - 1:200." (Ex 1017, 2.) This means that the amount of biological raw material in Oldřich's feed is, at most, 16.7%, and potentially as low as 0.5%. (Ex. 2002, ¶ 60.) A skilled artisan would not have considered this to be a "biological starting material" as used in Jakkula's process. (*Id.*) Thus, a skilled artisan would have understood that Oldřich conflicts with Jakkula's central purpose of creating renewable diesel fuel from "biological raw materials." (*Id.*) Because Jakkula and Oldřich conflict in this fundamental aspect of their disclosures, a person of ordinary skill in the art in July 2005 would have had no motivation or reasonable expectation of successfully producing a diesel-range hydrocarbon of "biological origin" by using the feedstock from Oldřich. (*Id.*)

REG contends that any hydrocarbon can be added to the feed of the Jakkula process because Jakkula states that a "suitable hydrocarbon may also be added to the feed." (*See* Pet. 32-33; Ex. 1002, ¶¶ 118-119; Ex. 1005, ¶ [0025].) But this argument disregards Jakkula's disclosure and is impermissibly based on hindsight reasoning. *Mintz*, 679 F.3d at 1377-78 (referring to the "prohibited reliance on hindsight"). Jakkula does not suggest adding any and all hydrocarbons to its feed. Rather, it indicates only that "suitable hydrocarbon[s]" may be added to the feed. (Ex. 1005, ¶ [0025].)

Given the broader context of Jakkula's disclosure, a skilled artisan would not have understood the petroleum fractions disclosed in Oldřich to be "suitable" for Jakkula's process. (Ex. 2002, ¶¶ 61-65.) Because Jakkula's diluents are limited to "suitable" hydrocarbons, it is understood that some hydrocarbons would be unsuitable. (*Id.*, ¶ 62.) To understand the distinction, a skilled artisan would have looked to known examples and relied on the overall teachings of Jakkula. *In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) ("It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." (citation omitted)).

Jakkula identifies an example of a "suitable" hydrocarbon as "a product from [Jakkula's own] isomerization step." (Ex. 2002, ¶ 63.) This is evident from paragraph [0025] of Jakkula, which states that "a product from the isomerization step or *another* suitable hydrocarbon may also be added to the feed of the HDO step." (Ex. 1005, ¶ [0025].) The word *another* here indicates that "the product from the isomerization step"—i.e., a purified and processed hydrotreated and isomerized hydrocarbon from a biological source—is a "suitable hydrocarbon." The petroleum fractions of Oldřich are plainly not in the same category. (Ex. 2002, ¶ 63.)

Another suitable hydrocarbon in Jakkula would be hydrotreated product recycled back to the hydrotreatment feed as a diluent. Jakkula, for example, states:

> A gas stream 42 is withdrawn both after the last HDO catalyst bed 21 and between the catalyst beds 20 and 21, and further passed to a process unit 43, where said withdrawn gas streams are cooled and partly condensed

> . . . . Condensed hydrocarbons are returned as cooling streams (recycled streams) 41 to suitable catalyst beds."

(Ex. 1005, ¶ [0037].) Figure 1 shows that the recycled hydrocarbons in stream 41 may be added to the "biological starting material" stream 10. (Ex. 1005, Fig. 1, ¶ [0036].) In view of this disclosure, a skilled artisan would have understood that Jakkula's statement that "another suitable hydrocarbon may also be added to the feed of the HDO step" refers to these recycled light hydrocarbons produced during HDO. (Ex. 2002, ¶ 64.)

Accordingly, "suitable hydrocarbons" must be read within the context of the Jakkula reference as a whole. *Hedges*, 783 F.2d at 1041. As discussed above, Jakkula overwhelmingly teaches removing sulphur (including through pretreatment of raw materials) to protect catalyst activity and extend catalyst life. (*See supra* Section III.) As a result, a skilled artisan would expect a "suitable" hydrocarbon to be of biological origin and largely free from sulphur. (Ex. 2002, ¶ 65.) Both of these qualities are consistent with the isomerization and hydrotreatment product recycle described in Jakkula, which would necessarily be of biological origin given Jakkula's specific disclosure of using original raw materials of biological origin. (Ex. 2002, ¶ 65.) The petroleum fraction taught in Oldřich, on the other hand, would not be "suitable" both because it is not of biological origin and because it contains high amounts of sulphur.

Accordingly, for at least these reasons, a person of ordinary skill in the art in July 2005 would have had no motivation or reasonable expectation of success of combining Jakkula with Oldřich to arrive at the claimed invention. REG's arguments to the contrary are unsupported and based on improper hindsight reasoning.

VI. Conclusion

Neste respectfully requests that the Board deny the Petition and uphold the patentability of all challenged claims of the '832 patent.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

The undersigned certifies that a copy of the foregoing **PATENT OWNER'S RESPONSE** contains 5,714 words, excluding those portions identified in 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

Dated: May 20, 2019

By: */Pier D. DeRoo/*
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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing **PATENT OWNER'S RESPONSE** was served on May 20, 2019 via email directed to counsel of record for the Petitioner at the following:

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