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Paper 11
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BUTAMAX ™ ADVANCED BIOFUELS LLC
Petitioner

v.

GEVO, INC.
Patent Owner

Case IPR2013-00214
Patent 8,304,588 B2

Before JENNIFER S. BISK, RAMA G. ELLURU, and CHRISTOPHER L. CRUBMLEY, *Administrative Patent Judges.*

ELLURU, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

Butamax™ Advanced Biofuels LC ("Butamax") filed a Petition (Paper 2) ("Pet.") to institute an *inter partes* review of claims 1-28 of Patent 8,304,588 B2 (the "'588 patent") pursuant to 35 U.S.C. § 311 *et seq*. Patent Owner Gevo, Inc. ("Gevo") filed a preliminary response (Paper 8) to the Petition. We have jurisdiction under 35 U.S.C. § 314. For the reasons that follow, the Board has determined to institute an *inter partes* review.

I. BACKGROUND

The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a):

> THRESHOLD – The Director may not authorize an inter partes review to be instituted unless the Director determines that the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.

Butamax challenges claims 1-28 as unpatentable under 35 U.S.C. § 103(a). Pet. 11-59. We grant the Petition as to claims 1-28 on both asserted grounds.

The '588 patent, entitled "Recovery of Higher Alcohols from Dilute Aqueous Solutions," was issued on November 6, 2012, based on Application 13/344,464 ("the '464 application"), filed January 5, 2012. The '464 application is a continuation of Application 12/342,992 ("the '992 application"), filed on December 23, 2008 (U.S. Patent No. 8,101,808 ("the '808 patent")). Pet. 3. In addition to its present petition, Butamax concurrently filed a petition for *inter partes* review of U.S. Patent No. 8,283,505 ("the '505 patent") (IPR2013-00215), which issued from an application that is also a continuation of the '992 application. Pet. 3-4.

Butamax informs us of related litigations captioned *Butamax(TM) Advanced Biofuels LLC v. Gevo, Inc.*, No. 12-1301 (SLR) (D. Del. Oct. 8, 2012), involving the '505 patent; and *Gevo, Inc. v. Butamax(TM) Advanced Biofuels LLC*, No. 12-70 (SLR) (D. Del. Jan. 24, 2012), involving the '808 patent. *Id*. at 4.

A. Statutory Threshold Issues

1. Real Party-in-Interest

Gevo argues that Butamax fails to identify Dupont as a real party-in-interest pursuant to 35 U.S.C. § 312(a)(2). Prelim. Resp. 3-8. According to Gevo, "DuPont is a real party in interest because . . . DuPont is a privy of [Butamax] based on the fact that [Butamax] is a wholly owned joint venture between DuPont and BP Biofuels North America LLC, an indirect subsidiary of BP p.l.c." Prelim. Resp. 4.

We are not persuaded that DuPont is a "real party-in-interest" with respect to this proceeding. Whether a non-party is a "real party-in-interest" or "privy" for purposes of an *inter partes* review proceeding is a "highly fact-dependent question" that takes into account how courts generally have used the terms to "describe relationships and considerations sufficient to justify applying conventional principles of estoppel and preclusion." *Office Patent Trial Practice Guide*, 77 Fed. Reg. 48756, 48759 (Aug. 14, 2012) ("Trial Practice Guide"). The *Trial Practice Guide* provides guidance regarding factors to consider in determining whether a party is a real party-in-interest. A primary consideration includes whether a non-party exercises control over a petitioner's participation in a proceeding. *Id*. at 48759-60. Other considerations may include whether a non-party, in conjunction with control, funds the proceeding and directs the proceeding. *Id*. at 48760.

Gevo has not set forth persuasive evidence that DuPont exercises control over or is funding this proceeding. While Gevo contends that, for example, Gevo "believes" DuPont exercised or could have exercised control over Butamax's participation in this proceeding through its involvement in the filing of the Petition (Prelim. Resp. 6); that Butamax's board of directors includes at least one or more members that are also directors at DuPont (*id*. at 7); and that Butamax's declarant is a paid consultant for, and has an ongoing relationship with DuPont (*id*. at 7), these allegations do not establish DuPont's control over or funding of this proceeding.

Furthermore, the mere fact that DuPont and Butamax may have a mutual interest in the Board's review of the '588 patent (Prelim. Resp. 5-6) does not necessarily make DuPont a real party-in-interest. *Trial Practice Guide*, 77 Fed. Reg. 48759 (the Office's prior application of real party-in-interest principles in the *inter partes* reexamination context offers additional guidance); *see, e.g.*, Reexamination of U.S. Patent No. 6,374,180, Reexamination Control No. 95/001,852, (Dec. 13, 2011) at p. 4 ("[C]ommon interest among litigation defendants seeking to invalidate or defend against enforcement of a patent," the USPTO explained, "does not translate *ipso facto* into each defendant being a real party in interest where a request for reexamination is filed by only one of the defendants in the litigation.").

In the alternative, Gevo requests that the Board: (1) issue a show cause order to Butamax to establish the real parties-in-interest of the current proceeding, or (2) authorize Gevo to file a motion to take discovery to establish that DuPont is a real party-in-interest. Prelim. Resp. 8, n.3. We determine that Gevo's Patent Owner Preliminary Response has not justified granting such a request at this juncture.

2. Prior Consideration of References by Examiner

Gevo maintains that the Petition should be denied because "each of the [asserted] grounds is based on the same, or substantially the same, prior art and arguments previously presented to the Office and considered by the Examiner during the prosecution of the '588 patent" pursuant to 35 U.S.C. § 315(d)[1]. Prelim. Resp. 16.

Pursuant to section 315(d), we have the discretion to determine to how an *inter partes* review may proceed. We decline to exercise our discretion to reject the petition based upon Butamax's asserted reason because, as explained in more detail below, we conclude that Butamax's arguments with respect to the asserted prior art have merit and that Butamax has demonstrated a reasonable likelihood that the prior art references render the challenged claims unpatentable.

3. The Declaration of Andrew J. Daugulis, Ph.D., P.Eng.

Butamax presents testimony of Dr. Andrew J. Daugulis to support the proposed grounds of unpatentability. Ex. 1006 ("Daugulis Decl."). Gevo maintains that Dr. Daugulis' declaration lacks credibility because of the declarant's "undisclosed ongoing business relationship with DuPont (an undisclosed real party-in-interest)." Prelim. Resp. 15; *see also* Prelim. Resp. 13-16. This argument is not persuasive. Dr. Daugulis' qualifications include receiving a Ph.D. in Chemical Engineering from Queen's University in Kingston, Ontario, Canada. Ex. 1006 ¶ 9. In addition, he has been a Professor in the Department of Chemical Engineering at that University

[1] The Board interprets Gevo's argument with respect to section 325(d), which governs post grant review proceedings, as referring to section 315(d), which governs *inter partes* review proceedings.

since 1989. *Id*. at ¶ 11. Dr. Daugulis also has published more than 150 papers in peer-reviewed international journals in the areas of chemical engineering, biofuel production, and fermentation processes. *Id*. at ¶ 12. In light of Dr. Daugulis's qualifications, that Dr. Daugulis has a business relationship with DuPont (not a real party-in-interest, as discussed above) does not convince us that Dr. Daugulis's opinion on the patentability of the challenged claims lacks credibility.

Gevo also argues that Dr. Daugulis' testimony provides no analysis or articulated technical rationale and, therefore, is entitled to little or no weight. Prelim. Resp. 9-13. On the record before us, we find that the portions of Dr. Daugulis's declaration that we rely upon in this decision are supported by credible analysis and technical rationale and further are consistent with the teachings in the prior art. Furthermore, to the extent Gevo disagrees with Butamax's declarant, Gevo may submit the testimony of its own declarant and/or cross-examine Butamax's declarant.

B. The '588 Patent (Ex. 1001)

The '588 patent relates to a method for recovering C3-C6 alcohols, including isobutanol, from dilute aqueous solutions, such as fermentation broths. Ex. 1001, Abstract; 9:57-58. The Specification discloses several embodiments that, for example, include hydrolyzing a feedstock comprising a polysaccharide to produce fermentable hydrolysis products and fermenting the products in a fermentation medium to produce the C3-C6 alcohol. *Id*. at 4:22-27. The method may include extracting the C3-C6 alcohol into an alcohol-selective extractant. *Id*. at 5:66-6:1. In addition, the fermentation broth can be distilled wherein the C3-C6 alcohol and water are vaporized to form an alcohol-depleted liquid phase and a C3-C6 alcohol-enriched vapor

phase. *Id*. at 12:38-41; 4:49-52. The method may further include condensing the vapor phase to form a C3-C6 alcohol-rich liquid phase and a water-rich liquid phase and separating the two phases. *Id*. at 6:12-23.

C. Exemplary Claims

Claims 1 and 14 of the '588 patent are the only independent claims that are challenged, while claims 2-13 and 15-28 depend, either directly or indirectly, from claim 1 or 14. Claim 1 is representative of the challenged claims and is reproduced below:

> 1. A method for producing isobutanol in a retrofit ethanol production plant comprising:
>
> a. pretreating a feedstock to form fermentable sugars in a pretreatment unit;
>
> b. culturing a microorganism capable of producing isobutanol in a fermentation medium comprising the fermentable sugars in a fermentation unit to produce isobutanol;
>
> c. distilling a portion of the fermentation medium comprising isobutanol and viable microorganisms, thereby removing at least some of the isobutanol therefrom;
>
> d. returning the isobutanol-depleted portion of the fermentation medium from step (c) comprising viable microorganisms to the fermentation unit; and
>
> e. transferring the fermentation medium from the fermentation unit to a beer still;
>
> wherein said distilling forms a vapor phase comprising isobutanol and water, and said method further comprises:
>
> i. condensing the vapor phase to form an isobutanol-rich liquid phase and a water-rich liquid phase; and
>
> ii. separating the isobutanol-rich liquid phase from the water-rich liquid phase; and
>
> iii. returning said water-rich liquid phase to the fermentation unit.

D. The Prior Art

Butamax relies on the following prior art:

English	US 4,349,628	Sep. 14, 1982	Ex. 1002
D'Amore	US 2008/0132741 Al	Jun. 05, 2008	Ex. 1004

Glenn Hess, "BP and DuPont Plan 'Biobutanol,'" Chemical & Engineering News, June 26, 2006, at 9. (Ex. 1003)

B.L. Maiorella et al., "Biotechnology Report Economic Evaluation of Alternative Ethanol Fermentation Processes," 25 Biotechnology and Bioengineering 1003, 1003-1025 (1984). (Ex. 1005)

Further, as noted above, Butamax relies upon declaration testimony of its witness, Andrew J. Daugulis, Ph.D. Ex. 1006.

E. The Asserted Grounds

Butamax challenges claims 1-28 of the '588 patent on the following grounds:

Claims 1-28 under 35 U.S.C. § 103(a) as unpatentable over English, Hess, and D'Amore; and

Claim 1-28 under 35 U.S.C. § 103(a) as unpatentable over Maiorella, Hess, and D'Amore. Pet. 11.

Gevo's arguments include that Butamax's petition should be denied because the proposed two grounds of unpatentabiltiy are cumulative and duplicative of each other. Prelim. Resp. 23-24. We decline to exercise our discretion to deny either of the asserted grounds for that reason.

II. ANALYSIS

A. Claim Interpretation

Consistent with the statute and legislative history of the America Invents Act (AIA), the Board interprets claims using the "broadest

reasonable construction in light of the specification of the patent in which [they] appear[]." 37 C.F.R. § 42.100(b); *see also Trial Practice Guide*, 77 Fed. Reg. 48766.

There is a "heavy presumption" that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002). However, a "claim term will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the disputed claim term in either the specification or prosecution history." *Id.* "Although an inventor is indeed free to define the specific terms used to describe his or her invention, this must be done with reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

For purposes of this decision, we construe certain claim limitations as follows:

1. "retrofit ethanol production plant" (Claims 1 and 4)

The preambles of claims 1 and 14 recite "[a] method for producing isobutanol in a retrofit ethanol production plant." Because dependent claims 11-13 and 21-23 recite that the "output of the retrofit plant is at least about [a percentage] of the isobutanol equivalent of the ethanol maximum output of the plant before retrofit," those claims would be rendered meaningless if the term "retrofit ethanol production plant" were construed to be non-limiting. Thus, we conclude that the preambles of claims 1 and 14 are limiting because they are necessary "to give life, meaning and vitality" to the dependent claims. *See Allen Eng'g Corp. v. Bartell Indus.*, 299 F.3d 1336, 1346 (Fed. Cir. 2002).

Gevo argues that a "retrofit" ethanol plant denotes "an existing, functioning ethanol plant reconfigured for producing isobutanol," and that it "must have produced, or at the very least been capable of producing, ethanol prior to any such retrofit." Prelim. Resp. 26. Gevo contends that this "construction of 'retrofit' is consistent with the language of claims 11-13 and 21-12, which require a comparison of the plant output before, and after the retrofit, *i.e.*, the plant output before retrofit would necessarily have to have been known." *Id*. We disagree.

A plain and ordinary meaning of "retrofit" is "to adapt to a new purpose or need." MERRIAM-WEBSTER COLLEGIATE DICTIONARY 1065 (11th ed. 2008) (Ex. 3001). This plain and ordinary meaning of "retrofit" does not require an existing, functional plant. Furthermore, Gevo does not refer to any disclosure in the Specification that limits a "retrofit" plant to an existing, functional plant or to a plant that was capable of producing ethanol prior to any such retrofit. We also are not persuaded that claims 11-13 and 21-23 support Gevo's proposed construction. Those claims require a comparison of the output of the retrofit plant to the "ethanol maximum output" of the ethanol plant "before" retrofit. Ex. 1001, claims 11-13 and 21-23. For example, claim 11 recites "wherein the output of the retrofit plant is at least about 80% of the isobutanol equivalent of the ethanol maximum output of the plant before retrofit."

Under the broadest reasonable interpretation, the claim language of dependent claims 11-13 and 21-23 does not limit the required comparison to the "actual" output of ethanol before retrofit. The claims require a comparison of the ethanol "maximum output." Moreover, in discussing the comparison of alcohol production before and after retrofit, the Specification

contemplates a "theoretical" maximum output, as opposed to an actual output. Ex. 1001, 29:27-37. Thus, we determine that the claim language and the Specification do not support a narrow construction of "retrofit ethanol production plant" to an existing, functional ethanol production plant, as proposed by Gevo.

Accordingly, we construe "retrofit ethanol production plant" to mean an ethanol production plant that is adapted to a new purpose or need.

2. "fermentation medium" (Claims 1 and 14)

Both claims 1 and 14 recite a "fermentation medium" in several limitations. Butamax contends that "fermentation medium" should be construed to mean "fermentation medium that comprises microorganisms when explicitly stated, and otherwise, need not comprise microorganisms." Pet. 8. This is consistent with the Specification. Ex. 1001, 8:61-65. Gevo does not dispute this definition, but argues that Butamax incorrectly applies this definition to the claims. Prelim. Resp. 25-26.

Steps (b), (c), (d) of claim 1 recite "fermentation medium" and further explicitly specify that the fermentation medium comprises microorganisms. (Ex. 1001, 62:50-58.) Step (e) of claim 1 and step (h) of claim 14, however, each require "transferring the fermentation medium from the fermentation unit to a beer still" without explicitly specifying whether the fermentation medium comprises or does not comprise microorganisms. *Id*. at 62:59-60, 64:10-11. Butamax contends that the fermentation medium of step (e) of claim 1 and step (h) of claim 14 can either contain or not contain microorganisms. Pet. 8. Gevo, on the other hand, contends that because step (b) of claims 1 and 14 explicitly require a fermentation medium that contains microorganisms, the fermentation medium of step (e) of claim 1

and step (h) of claim 14 should be construed to mean a fermentation medium that also contains the same microorganisms. We disagree.

Step (e) of claim 1 and step (h) of claim 14 do not recite explicitly whether the claimed fermentation medium does or does not contain microorganisms, and neither refers to the fermentation medium from another step. Thus, according to the Specification (*id*. at 8:61-65), the claimed fermentation medium of those steps includes both fermentation medium that contains microorganisms as well as fermentation medium that does not contain microorganisms.

3. "pretreatment unit"

Both claims 1 and 14 require pretreating a feedstock to form fermentable sugars in a "pretreatment unit." Ex. 1001, 62:48-49, 63:44-45. The parties do not offer a construction for this term and the Specification does not set forth expressly a construction for this term. However, the Specification states that in some embodiments, the method includes "pretreating a feedstock to form fermentable sugars in the pretreatment unit." *Id*. at 5:30-34. Accordingly, based on the claim language and Specification, we determine that a person of ordinary skill in the art would understand "pretreatment unit" as "the location where the feedstock is pretreated to form fermentable sugars."

B. Asserted Grounds of Unpatentability

Butamax contends that under 35 U.S.C. § 103(a), claims 1-28 are unpatentable over English, Hess, and D'Amore, and over Maiorella, Hess, and D'Amore. Pet. 11-60. We conclude that Butamax has established a reasonable likelihood of prevailing on both grounds for the reasons explained below.

1. Obviousness of claims 1-28 over the Combination of English, Hess, and D'Amore

Butamax contends that the combination of English, Hess, and D'Amore renders obvious claims 1-28. Based on the evidence of record and Butamax's detailed argument, we are persuaded that there is a reasonable likelihood that Butamax will prevail in establishing that claims 1-28 would have been obvious over those references. Pet. 12-36.

English discloses a process for the manufacture of ethanol, or a like volatile organic compound such as butanol. Ex. 1002, Abstract. English's disclosure includes treating a feedstock to form a sugar and fermenting the sugar with microorganisms to produce ethanol. *Id*. at Abstract, 1:50-63, 2:58-3:3, 3:47-52. Hess describes modifying an ethanol fermentation facility to produce butanol. Ex. 1003, 9:1, ¶ 2. D'Amore discloses producing isobutanol by culturing microorganisms in the presence of carbohydrates. Ex. 1004, ¶¶ [0023], [0056]. Both English and D'Amore teach distilling a fermentation medium to recover their respective alcohols. Ex. 1002, 4:26-33, 7:50-62; Ex. 1004, ¶ [0039]. Moreover, D'Amore specifically teaches recovering isobutanol from a fermentation medium by using azeotrope distillation to produce a vapor phase, condensing the vapor phase to form isobutanol-rich and water-rich phases, and separating the two phases. *Id*. at ¶ 0039. English further teaches recycling the remaining fermentation medium after distillation to the fermentation unit. Ex. 1002, 1:37-2:2, 7:61-63.

Gevo maintains that Butamax has failed to establish a reasonable likelihood that independent claims 1 and 14 are unpatentable over the combination of English, Hess, and D'Amore. Prelim. Resp. 29-40. Gevo makes the following arguments.

Arguments as to Claims 1 and 14

Gevo makes several arguments that address the patentability of claims 1 and 14 together. First, Gevo argues that Hess does not teach a retrofit ethanol plant as recited in the preambles of both claims 1 and 14. Prelim. Resp. 31. Specifically, the preambles recite "[a] method for producing isobutanol in a retrofit ethanol production plant comprising . . . ." Gevo contends that Hess discloses only design changes to a new, mid-construction biofuel plant that was not operational at the time Hess was published. *Id*. Gevo's argument is unavailing because, as discussed above, we do not construe "retrofit ethanol production plant" to be limited to an existing, functioning ethanol plant or a plant that had been capable of producing ethanol prior to any such retrofit. Hess describes adapting an ethanol fermentation facility to produce butanol. D'Amore teaches that butanol and isobutanol share many common features that allow separation schemes devised for butanol to be applied to isobutanol. Ex. 1004, ¶ 0037. Moreover, a person of ordinary skill in the art would have understood that isobutanol is an isomer of butanol and that they have similar volatility. Ex. 1006, ¶¶ 29, 51. Thus, we determine that the subject matter as a whole, including the limitation "producing isobutanol in a retrofit ethanol production plant" recited in the preambles of claims 1 and 14, would have been obvious to a person of ordinary skill in the art. Ex. 1003, 9:1, ¶ 2.

Second, Gevo argues that English does not teach, either expressly or inherently, the claimed "pretreatment unit" in step (a) of claims 1 and 14, which recite "pretreating a feedstock to form fermentable sugars in a pretreatment unit." Prelim Resp. 31-32. As discussed above, we construe "pretreatment unit" as "the location where the feedstock is pretreated to form

fermentable sugars." English teaches treating feedstock to form fermentable sugars (Ex. 1002, 2:58-3:3), and thus, we determine that a person of ordinary skill would understand that English's treatment process occurs in a "pretreatment unit" as claimed.

Third, Gevo argues that English does not teach step (e) of claim 1 and step (h) of claim 14, which require "transferring the fermentation medium from the fermentation unit to a beer still." Prelim. Resp. 32-33. Specifically, Gevo asserts that the alcohol English describes is not a "fermentation medium" when sent to the stripping column (*i.e.*, beer still) because it does not contain microorganisms. We find this argument unconvincing as it relies on Gevo's overly-narrow construction of "fermentation medium" that we decline to adopt. Thus, we determine that the clarified alcohol described in English satisfies the claimed "fermentation medium" in step (e) of claim 1 and step (h) of claim 14.

Arguments as to Claim 1 Only

With respect to claim 1 only, Gevo argues that none of the references teach step (iii) of claim 1, which requires "returning said water-rich liquid phase [formed in steps (i) and (ii)] to the fermentation unit."

Butamax argues that based on English and D'Amore, a person of ordinary skill would have had a reason to recycle water and would have understood that the water-rich liquid formed after distillation and separation could be recycled to a finite number of places where water is needed in the process, including the fermentation unit. Pet. 19 (citing (Ex. 1006, ¶¶ 63, 64). English teaches minimizing the amount of water that is discarded (Ex. 1002, 1:53-56), and D'Amore teaches recycling water and discloses returning the water-rich liquid phase formed after distillation to a beer

column. Ex. 1004, ¶ 0057, Fig 2; Pet. 19. Thus, argues Butamax, returning the water-rich liquid phase to the fermentation unit would have been a design choice based on a cost/benefit analysis and a predictable solution, as it is one of the finite number of places to which the water-rich liquid phase could have been returned. Pet. 19-20.

Gevo disputes that the combination of asserted references teaches or suggests recycling the water-rich liquid phase to the fermentation unit as required by step (iii) of claim 1. Gevo contends that a person of ordinary skill would not have been motivated to recycle the water-rich liquid phase of D'Amore back to the fermentation unit because the alcohol concentration of D'Amore's water-rich liquid phase would be toxic to the microorganisms in the fermentation unit. Prelim. Resp. 34-35. In particular, referring to prior art, Gevo contends that butanol concentrations higher than approximately 1-2% inhibit, or are toxic to, microorganisms and D'Amore's water-rich liquid phase consists of 6% by weight isobutanol. *Id*. at 35 (citing Ex. 1004, ¶ [0057]). Gevo's argument lacks merit.

As Gevo acknowledges, it is the concentration of alcohol in the fermentation unit that is critical in determining whether it will inhibit or be toxic to the microorganisms in the fermentation medium. *Id*. at 34; *see also* Ex. 2016, ¶¶ 0006, 0036 (microorganism growth is inhibited at concentrations of less 2.0% w/v isobutanol when grown in a liquid medium at 37ºC). The 6% isobutanol concentration of D'Amore's water-rich liquid phase, formed from distillation and separation, is not indicative of the alcohol concentration of the fermentation medium in the fermentation unit. Furthermore, based on the prior art, a skilled artisan would have understood that the isobutanol concentration in the fermentation unit should be optimized to prevent the alcohol from inhibiting or causing toxicity to the microorganisms. *See In re Boesch*, 617

F.2d 272, 276 (CCPA 1980) ("[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.") (citation omitted). Therefore, we determine that the subject matter as a whole, including the requirement of recycling the water-rich liquid phase to the fermentation unit as recited by step (iii) of claim 1, would have been obvious to a person of ordinary skill in the art.

Arguments as to Claim 14 Only

With respect to claim 14 only, Gevo argues that the combination of references fails to disclose steps (c) and (e) of claim 14. Step (c) recites "extracting the fermentation medium with an alcohol-selective extractant, thereby forming a isobutanol-rich portion," and step (e) recites "distilling the isobutanol-rich portion of the fermentation medium from step (c)." Gevo argues that it is unclear how English can disclose step (e), when English does not teach the "isobutanol-rich" portion from step (c), "the very basis of step (e)." Prelim. Resp. 35-36. Gevo's argument is unpersuasive.

Gevo's argument improperly is based on what each reference teaches separately, and not on the teachings of the combined references. As the Federal Circuit has explained, "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference . . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). As Butamax asserts, D'Amore teaches extracting the fermentation medium with an isobutanol-selective extractant thereby forming an isbotunaol-rich portion. Ex. 1004, ¶¶ 0036, 0059. Furthermore, both English and D'Amore teach distilling a fermentation medium to recover their respective alcohols. Ex.

1002, 4:26-33, 7:50-62; Ex. 1004, ¶ 0039. Importantly, D'Amore specifically teaches that "[f]or fermentation processes in which isobutanol is the predominant alcohol, dry *isobutanol can be recovered by azeotropic distillation*." Ex. 1004, ¶ 0039 (emphasis added). Thus, the combined teachings of the asserted references include both the extraction step (c) and distillation step (e) of claim 14.

Reason to Combine

We credit Dr. Daugulis' opinion that a person of ordinary skill would have had reason to combine the teachings of the references in a manner that yields the claimed invention. Ex. 1006, ¶¶ 50-51. For example, all three references are directed to the production and recovery of volatile alcohols, such as ethanol or isobutanol, from a fermentation medium. *Id*. at ¶ 50.

Gevo argues that "[i]f, as the Petitioner alleges, English discloses a process for the manufacture of butanol, and as English asserts, his process and apparatus are suitable for such manufacture of butanol, then there is no reason or motivation to combine English with D'Amore, and the English process alone would be capable for such use." Prelim. Resp. 39. However, we agree with Butamax that one of ordinary skill in the art would have had reason to combine the teachings of English, Hess, and D'Amore and arrive at the claimed invention. The claims merely combine known elements (fermenting and distilling volatile alcohols) for their known purpose to achieve a predictable result (recovering alcohol). *See KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 416 (2007).

For the foregoing reasons, we conclude that there is a reasonable likelihood that Butamax will prevail on the ground that independent claims 1 and 14 are unpatentable as obvious over English, Hess, and D'Amore. We

further conclude that there is a reasonable likelihood that Butamax will prevail on the ground that dependent claims 2-13 and 15-28, the patentability of which Gevo has not argued separately, are unpatentable for the same reasons.

2. Obviousness of claims 1-28 over the Combination of Maiorella, Hess, and D'Amore

Butamax contends that the combination of Maiorella, Hess, and D'Amore renders obvious claims 1-28. Based on the evidence of record and Butamax's detailed argument (Pet. 36-59), we are persuaded that there is a reasonable likelihood that Butamax will prevail in establishing that claims 1-28 would have been obvious over those references.

Maiorella discloses a process for the manufacture of ethanol. Ex. 1005, Abstract. Maiorella's disclosure includes treating corn stover residue to form glucose. *Id*. at 1021:1, ¶ 1. Maiorella further describes cycling the fermenting medium through a selective ethanol recovery device to recover a concentrated ethanol product for distillation and an ethanol depleted fermentation medium for recycling to the fermentor for further reaction. Ex. 1005, 1005:1, ¶ 3, 1010:1, ¶ 1, 1015:2, ¶ 2; Fig. 17. The disclosures of Hess and D'Amore are discussed above.

Gevo maintains that Butamax has failed to establish a reasonable likelihood that independent claims 1 and 14 are unpatentable over the combination of Maiorella, Hess, and D'Amore. Prelim. Resp. 40-49.

Arguments as to Claims 1 and 14

Gevo makes similar arguments with respect to the patentability of both claims 1 and 14 over the combination of Maiorella, Hess, and D'Amore as it made with respect to the asserted ground discussed above.

First, as discussed above with respect to the first asserted combination of references, we determine that because Hess describes adapting an ethanol fermentation facility to produce butanol, Hess teaches the recited "production of isobutanol in a retrofit ethanol production plant" in the preamble of claims 1 and 14. Ex. 1003, 9:1, ¶ 2. *See* Prelim. Resp. 40-41.

Second, because Maiorella teaches the production of glucose from corn stover residue Ex. 1005, 1021:1 ¶ 1, a person of ordinary skill would understand that the treatment process occurs in a "pretreatment unit" as required by step (a) of claims 1 and 14. *See* Prelim. Resp. 41-42.

Third, Gevo argues that the alcohol without yeast Maiorella describes as being sent to the stripper (*i.e.*, the claimed "beer still") is not the "fermentation medium" recited in step (e) of claim 1 and step (h) of claim 14, which Gevo contends is unclarified fermentation medium. *Id*. at 42-43. As discussed above with respect to the first asserted combination of references, the clarified alcohol described in Maiorella satisfies the claimed "fermentation medium" in step (e) of claim 1 and step (h) of claim 14.

Arguments as to Claim 1 Only

For the same reasons discussed above with respect to the first asserted combination of references, Gevo's argument that none of the references teach step (iii) of claim 1, which requires "returning said water-rich liquid phase [formed in steps (i) and (ii)] to the fermentation unit," is unavailing. *See* Prelim. Resp. 43-45.

Arguments as to Claim 14 Only

With respect to claim 14 only, Gevo argues that Maiorella does not teach steps (c) and (d). Prelim. Resp. 45-46. Step (c) recites "extracting the fermentation medium with an alcohol selective extractant, thereby forming a

isobutanol-rich portion" and step (d) recites "returning the isobutanol-depleted portion of the fermentation medium from step (c) to the fermentation unit." Gevo argues that these steps include processes for isobutanol, but Maiorella only discloses ethanol production. This argument is unpersuasive because it argues each reference separately, when the obviousness inquiry is what the combined teachings of those references would have suggested to those of ordinary skill in the art. *Keller*, 642 F.2d at 425.

For the foregoing reasons, we conclude that there is a reasonable likelihood that Butamax would prevail on the ground that claims 1-28 are unpatentable as obvious over Maiorella, Hess, and D'Amore.

C. Hindsight

Gevo contends that both combinations of references are deficient because they are based on the hindsight combination of arbitrarily-selected processes within the asserted references. Prelim. Resp. 49-50. We are not persuaded by this argument. As we set forth above, Butamax has established that a person of ordinary skill would have had reason to select the identified teachings from the references.

D. Conclusion

We conclude that Butamax has demonstrated a reasonable likelihood of prevailing on the following grounds of unpatentability asserted in the Petition:

Claims 1-28 under 35 U.S.C. § 103(a) as unpatentable over English, Hess, and D'Amore; and

Claims 1-28 under 35 U.S.C. § 103(a) as unpatentable over Maiorella, Hess, and D'Amore.

III. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is granted as to claims 1-28 of the '588 patent;

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '588 patent is hereby instituted commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial;

FURTHER ORDERED that the trial is limited to the grounds and claims identified above and no other grounds are authorized as to these claims as they currently stand; and

FURTHER ORDERED that an initial conference call with the Board is scheduled for 2:00pm Eastern Time on October 21, 2013. The parties are directed to the Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48765-66 (Aug. 14, 2012), for guidance in preparing for the initial conference call, and should come prepared to discuss any proposed changes to the Scheduling Order entered herewith and any motions the parties anticipate filing during the trial.

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