

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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BUTAMAX ADVANCED BIOFUELS LLC,  
Petitioner,

v.

GEVO, INC.,  
Patent Owner.

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Case IPR2014-00144  
Patent 8,487,149 B2

Before SHERIDAN K. SNEDDEN, CHRISTOPHER L. CRUMBLEY, and  
GEORGIANNA W. BRADEN, *Administrative Patent Judges*.

BRADEN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
35 U.S.C. § 318 and 37 C.F.R. § 42.73

## I. INTRODUCTION

Butamax Advanced Biofuels LLC (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–19 of U.S. Patent No. 8,487,149 B2 (“the ’149 patent”) pursuant to 35 U.S.C. § 311–319. Paper 1 (“Pet.”). Gevo, Inc. (“Patent Owner”) did not file a preliminary response to the Petition. On May 22, 2014, we instituted an *inter partes* review of claims 1–14 and 16–19 on certain grounds of unpatentability alleged in the Petition. Paper 9 (“Dec. to Inst.”). After institution of trial, the Patent Owner filed a Patent Owner Response (Paper 17, “PO Resp.”), to which Petitioner filed a Reply (Paper 18, “Reply”). An oral argument was held on January 14, 2015.<sup>1</sup>

We have jurisdiction under 35 U.S.C. § 6(c). In this Final Written Decision, issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73, we determine Petitioner has shown by a preponderance of the evidence that claims 1–14 and 16–19 of the ’149 patent are unpatentable.

### A. *Related Proceedings*

Petitioner informs us of no related litigations. Pet. 2. Concurrent with the present *inter partes* review, Petitioner also requested review of, and the Board instituted trial on, the following claims in patents in the same family as the ’149 patent: claims 1–23 of U.S. Patent No. 8,193,402, Case IPR2014-00142 (PTAB May 22, 2014) (Paper 13); claims 1–21 of U.S. Patent No. 8,378,160, Case IPR2014-00143 (PTAB May 22, 2014) (Paper 9); and claims 1–21 of US Patent No. 8,546,627, Case IPR2014-00250 (PTAB May 22, 2014) (Paper 8). Because of overlapping issues between the four proceedings, we consolidated the oral hearings for IPR2014-00250, IPR2014-00142, IPR2014-00143, and IPR2014-00144. *See*

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<sup>1</sup> A transcript (“Tr.”) of the oral hearing is included in the record. Paper 29.

Paper 21. Additionally, Petitioner requested review of, and the Board instituted trial on claims 1–15 of unrelated U.S. Patent No. 8,373,012 in IPR2014-00402. *See* Paper 11.

*B. The '149 Patent (Ex. 1001)*

Transportation fuels are defined as mixtures of typically aliphatic and (optionally) aromatic hydrocarbons that meet a collection of physical properties and requirements, as defined in standards such as ASTM D4814 (gasoline), ASTM D975 (diesel fuel), ASTM D910 (aviation gasoline), and ASTM D1655 (jet fuel). Ex. 1001, 12:24–17:34. Gasoline, for example, is defined not by its composition, but by its ability to function in a spark ignition engine according to properties defined by ASTM D4814. *Id.* at 11:45–52. Such properties include vapor pressure, energy density, octane number, water solubility, thermal oxidation stability, gum content, and drivability. *Id.* at 15:36–54. The properties of gasoline can be adjusted by modifying the amounts and types of organic molecules that make up the gasoline. *Id.* For example, the octane number of a gasoline mixture can be raised by adding high octane components. *Id.*

The '149 patent, titled “Renewable Compositions,” describes methods for making renewable hydrocarbons. *Id.* at 3:66–4:61. The methods involve preparing a feedstock from a biomass to serve as a carbon source. *Id.* at 5:49–6:16. The feedstock is fermented with microorganism(s) to form C<sub>2</sub>–C<sub>6</sub> alcohols. *Id.* at 3:65–67. The alcohols are dehydrated to form C<sub>2</sub>–C<sub>6</sub> olefins (alkenes). *Id.* at 4:5–7. The olefins are reacted with an oligomerization catalyst to form more highly alkylated aromatic hydrocarbons, for example, C<sub>6</sub>–C<sub>24</sub> unsaturated oligomers. *Id.* at 4:9–11 and 10:1–16. The dehydration step and oligomerization step may be carried out separately or combined into a single process. *Id.* at 23:59–63. The olefins then are reduced to heat-stable saturated hydrocarbons in a hydrogenation

reaction. *Id.* at 23:64–24:3. The '149 patent discloses that the compositions produced according to the methods of the patent meet the fuel-defining ASTM specifications. *Id.* at 18:35–47.

*C. Illustrative Claim*

Claim 1 is the only independent claim of the '149 patent, and is reproduced below:

1. A process for preparing renewable hydrocarbons comprising:
  - (a) culturing a microorganism capable of producing one or more C<sub>2</sub>–C<sub>6</sub> alcohols in a fermentor, thereby forming a fermentation broth comprising microorganisms and one or more C<sub>2</sub>–C<sub>6</sub> alcohols;
  - (b) removing a portion of the fermentation broth from the fermentor;
  - (c) distilling the portion, thereby forming an alcohol-depleted liquid phase and an alcohol-enriched vapor phase comprising water and one or more C<sub>2</sub>–C<sub>6</sub> alcohols;
  - (d) condensing the alcohol-enriched vapor phase formed in step (c), thereby forming an alcohol-rich liquid phase and a water-rich liquid phase; and
  - (e) separating the alcohol-rich phase liquid from the water-rich liquid phase using a liquid-liquid separator;
  - (f) dehydrating at least a portion of the one or more C<sub>2</sub>–C<sub>6</sub> alcohols in the alcohol-rich phase of step (e), thereby forming a product comprising one or more C<sub>2</sub>–C<sub>6</sub> olefins;
  - (g) isolating the one or more C<sub>2</sub>–C<sub>6</sub> olefins;
  - (h) oligomerizing at least a portion of the one or more C<sub>2</sub>–C<sub>6</sub> olefins isolated in step (g), thereby forming a product comprising one or more C<sub>6</sub>–C<sub>24</sub> unsaturated oligomers; and
  - (i) hydrogenating at least a portion of the product of step (h) in the presence of hydrogen, thereby forming a product comprising one or more C<sub>6</sub>–C<sub>24</sub> saturated alkanes;

whereby the product of step (i) itself meets the requirements of at least one of ASTM D4814, ASTM D975, ASTM D910, or ASTM D1655, or a blend of at least 10% of the product of step (f) with a mixture of hydrocarbons meets the requirements of at least one of ASTM D4814, ASTM D975, ASTM D910 or ASTM D1655; and

wherein said steps (b) – (e) are conducted simultaneously with step (a).

*Id.* at 59:24–60.

*D. Prior Art References Alleged to Support Unpatentability Challenges*

The following prior art references were asserted in the instituted grounds:

Reference	Patent/Printed Publication	Date	Exhibit
D'Amore	US Patent Pub. No. 2008/0132741 A1	June 5, 2008	1003
ASTM D4814	American Society for Testing and Measurement, <i>Standard D4814</i> , “ <i>Standard Specification for Automotive Spark-Ignition Engine Fuel</i> ,” ASTM International, West Conshohocken, PA, <a href="http://www.astm.org">http://www.astm.org</a> .	Sept. 2007	1014
ASTM D975	American Society for Testing and Measurement, <i>Standard D975</i> , “ <i>Standard Specification for Diesel Fuel Oils</i> ,” ASTM International, West Conshohocken, PA, <a href="http://www.astm.org">http://www.astm.org</a> .	Aug. 2007	1015
ASTM D910	American Society for Testing and Measurement, <i>Standard D910</i> , “ <i>Standard Specification for Aviation Gasolines</i> ,” ASTM International, West Conshohocken, PA, <a href="http://www.astm.org">http://www.astm.org</a> .	Aug. 2007	1016
ASTM D1655	American Society for Testing and Measurement, <i>Standard D1655-07</i> , “ <i>Standard Specification for Aviation Turbine Fuels</i> ,” ASTM International, West Conshohocken, PA, <a href="http://www.astm.org">http://www.astm.org</a>	July 2007	1017

Petitioner further relies on the Declaration of Dr. Joseph T. Joseph (Ex. 1030) and the Second Declaration of Dr. Joseph T. Joseph (Ex. 1040).

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