UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AVRAHAM M. BANIEL,
ROBERT P. JANSEN, ASHER VITNER,
and ANTHONY BAIADA

Appeal 2008-0512
Application 11/352,593
Technology Center 1700

Decided: December 7, 2007

Before BRADLEY R. GARRIS, CHARLES F. WARREN, and THOMAS A. WALTZ, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting claims 3 through 10, 16 through 24, and 27 through 32 in the Office Action mailed August 3, 2006. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2006).

We affirm the decision of the Primary Examiner.

Claim 3 illustrates Appellants' invention of a process for recovery of 1,3-propanediol from a fermentation broth, and is representative of the claims on appeal:

3. A process for the recovery of 1,3-propanediol from a fermentation broth comprising 1,3-propanediol, comprising the steps of:

contacting a fermentation broth that comprises water, 1,3-propanediol, and at least one contaminant selected from glycerol, glucose, and butanetriol, with at least one solvent extractant to form a first mixture, wherein the solvent extractant is selected from the group consisting of pentanol, propan-1-ol, hexanol, oleyl alcohol, 4-methyl pentan-2-one, isopropyl acetate, tributyl phosphate, oleic acid, soya oil, castor oil, and combinations thereof,

separating the first mixture into a first phase and a second phase,

wherein the first phase comprises a majority of the solvent extractant and at least some of the 1,3-propanediol that was present in the fermentation broth, and the weight ratio in the first phase of 1,3-propanediol to at least one of glycerol, glucose, or butanetriol is greater than the weight ratio of 1,3-propanediol to the same contaminant in the fermentation broth prior to the fermentation broth being contacted with the solvent extractant,

wherein the second phase comprises a majority of the water and at least some of the contaminant from the fermentation broth,

recovering 1,3-propanediol by removing the first phase from the second phase,

contacting the removed first phase with a first quantity of aqueous solution to form a second mixture, and

separating the second mixture into a third phase and a fourth phase,

wherein the third phase comprises a majority of solvent extractant of the first phase, and

wherein the fourth phase comprises 1,3-propanediol and a majority of the first quantity of aqueous solution, and the weight ratio in the fourth phase of the 1,3-propanediol to at least one of .glycerol, glucose, or butanetriol is greater than the weight ratio of 1,3-propanediol to the same

contaminant in the fermentation broth prior to the fermentation broth being contacted with the solvent extractant.

The Examiner relies upon the evidence in these references (Ans. 4):

Matsuyama	US 5,356,812	Oct. 18, 1994
Eyal	US 6,171,501 B1	Jan, 9, 2001
Ames	US 6,361,983 B1	Mar. 26, 2002
Burch	US 6,428,767 B1	Aug. 6, 2002
Herold	US 2004/0262221 A1	Dec. 30, 2004

Appellants request review of the ground of rejection under 35 U.S.C. § 103(a) advanced on appeal: claims 3 through 10, 16 through 24, and 27 through 32 as unpatentable over Burch in view of Ames, Matsuyama, Eyal, and Herold. Br. 4; Ans. 5.

Appellants argue the claims as a group. Br. 4-8. Thus, we decide this appeal based on independent claim 3. 37 C.F.R. § 41.37(c)(1)(vii) (2006).

The issue in this appeal is whether the Examiner has carried the burden of establishing a prima facie case of obviousness in the ground of rejection advanced on appeal.

The plain language of claim 3 specifies a process comprising at least the first step of contacting any manner of fermentation broth that comprises at least any amount of water, any amount of 1,3-propanediol, and any amount of at least one contaminant selected from glycerol, glucose, and butanetriol with any amount of one or more of the specified solvent extractants. We note here that the open-ended term "comprising" and "comprises" used throughout the claim, opens the claim to encompass processes that include any manner of additional steps, reagents and reactants. *See, e.g.*, *Exxon Chem. Pats., Inc. v. Lubrizol Corp.*, 64 F.3d 1553, 1555 (Fed. Cir. 1995) ("The claimed composition is defined as comprising-

meaning containing at least-five specific ingredients."); *In re Baxter*, 656 F.2d 679, 686 (CCPA 1981) ("As long as one of the monomers in the reaction is propylene, any other monomer may be present, because the term 'comprises' permits the *inclusion* of other steps, elements, or materials."). Thus, all that the fermentation broth must contain to satisfy the first part of the first clause is a mixture of any amount of water, any amount of 1,3-propanediol and any amount of one or more of the stated contaminants. Indeed, the transitional term "comprising" would open the claim to processes in which the fermentation broth was subjected to any manner of clarification step to remove cell debris and other matter from the broth, and any manner of water reduction step prior to contacting the resulting mixture of water, 1,3-propanediol, and one or more of the stated contaminants with one or more specified solvent extractants.

The "first mixture" formed from contacting the broth with the specified extractant in the first step is separated into two phases by any separation means in the specified second step. The "second phase" contains a majority amount of the water and at least some amount, however small, of the contaminant. The "first phase" comprises a majority amount of the solvent extractant and at least some amount of the 1,3-propanediol, wherein the weight ratio of the 1,3-propanediol in the first phase to at least one of the contaminants is greater to any extent, however small, than the weight ratio of 1,3-propanediol to the same contaminant in the fermentation broth prior to contacting the fermentation broth with the solvent extractant to form the "first mixture," regardless of the difference.

The recovered "first phase" is contacted with any amount of a "first quantity" of any manner of "aqueous solution" to form a "second mixture" in a third step which is separated into two phases by any separation means in a fourth step. The "third phase" contains a majority amount of the solvent extractant and at least some amount, however small, of the contaminant. The "fourth phase" comprises a majority amount of the "first quantity of aqueous solution" and at least some amount of the 1,3-propanediol, wherein the weight ratio of the 1,3-propanediol in the fourth phase to at least one of the contaminants is greater to any extent than the weight ratio of 1,3-propanediol to the same contaminant in the fermentation broth prior to contacting the fermentation broth with the solvent extractant to form the "first mixture," regardless of the difference.

Thus, the first separation step separates the majority of the water containing at least some contaminant from the majority of the solvent extractant containing at least some of the 1,3-propanediol and some contaminant. The second separation step separates the majority of the solvent from the majority of the aqueous solution extractant containing at least some 1,3-propanediol and some contaminant.

In this scheme, the weight ratio of 1,3-propanediol to the same contaminant resulting from the first extraction using a specified solvent and from the second extraction using any aqueous solution can be the same or different, that is, a reduction in the amount of contaminant via the second extraction is not required.

There is no limitation on the manner in which the phases are separated, including the manner in which the 1,3-propanediol is separated

from the majority amount of the "first quantity of aqueous solution." There is no "second quantity of aqueous solution" specified in claim 3.

We find Burch would have disclosed to one of ordinary skill in this art a process for recovering 1,3-propanediol from a fermentation broth which can contain glucose and/or glycerol, can involve extraction with organic solvents, distillation, and column chromatography as known in the art. Burch, e.g., col. 12, ll. 41-47, citing Matsuyama; *see also* col. 1, ll. 11-22, col. 2, ll. 10-16 and 40-46, col. 3, l. 55 to col. 4, l. 12, col. 10, ll. 5-59, col. 11, l. 15 to col. 12, l. 39, and col. 14, ll. 26-66. "Difficulties to be overcome [in industrial purification of 1,3-propanediol] include removal of cell matter form [sic, from] the broth (clarification), concentration of 1,3-propanediol either by extraction or water removal and separation of residual impurities from the partially purified" 1,3-propanediol. Burch col. 12, ll. 54-60.

"Water reduction of the clarified broth is complicated by the high solubility of 1,3-propanediol in water," and extraction from the clarified broth can be accomplished by, among other things, evaporation/distillation, membrane technology, extraction by organic solvent and adsorption. Burch col. 13, ll. 6-11. "Rotary evaporators may be used to initially reduce water volume in the clarified broth." Burch col. 13, 12-16. The alternatives afforded by membrane technology include allowing passage of water and 1,3-propanediol and retaining "other molecules." Burch col. 13, ll. 17-25. "Following evaporation and membrane concentration, partially purified 1,3-propanediol" can be extracted with a suitable solvent such as, among other things, propanol. Burch, col. 13, ll. 28-35. After extraction, refining

methods can include distillation, wherein the order of evaporation is, among other things, "water, diols including 1,3-propanediol and finally heavier materials such as glycerol." Burch col. 13, ll. 48-54. Burch further discloses that the syrup from evaporation of clarified broth was distilled, and distillate cuts containing 1,3-propanediol diluted with water for recovery of the 1,3-propanediol by anion exchange column and subsequent microdistillation. Burch col. 23, ll. 29-40.

We find Matsuyama would have disclosed to one of ordinary skill in this art a process for recovering optically active 3-phenyl-1,3-propanediol obtained in a fermentation broth from a mixture of enantiomers in the presence of an energy source such as glucose. Matsuyama, e.g., Abstract and col. 8, ll. 40-57. The optically active 3-phenyl-1,3-propanediol can be purified from the broth directly or after broth clarification by conventional procedures such as extraction with an organic solvent, distillation, or column chromatography. Matsuyama col. 9, ll. 33-45. In the illustrative Examples, clarified broth is extracted with ethyl acetate, the extract is dehydrated, and the resulting syrup dissolved in hexaneisopropyl alcohol. Matsuyama, e.g., col. 10, ll. 22-32, and col. 12, ll. 43-53.

A discussion of Ames, Eyal, and Herold is not necessary to our decision. *See In re Kronig*, 539 F.2d 1300, 1302-04 (CCPA 1976).

We find that Appellants acknowledge it was known in the prior art to produce 1,3-propanediol by fermentation and purify this product from the broth by targeting the impurities, which can be glycerol, 1,2,4-butanetriol, and glucose, that are chemically similar to 1,3-propanediol. A common method of purifying 1,3-propanediol is by distillation. Spec. 1:9-24.

We determine the combined teachings of Burch and Matsuyama, the scope of which we determined above, provide convincing evidence supporting the Examiner's case that the claimed invention encompassed by claim 3, as we interpreted this claim above, would have been prima facie obviousness to one of ordinary skill in the fermentation arts familiar with processes for separating 1,3-propanediol from fermentation broths.

There is no dispute that the combined teachings of Burch and Matsuyama would have disclosed to one of ordinary skill in this art methods for separating 1,3-propanediol from fermentations broths, including either the fermentation broth per se or from fermentation broths that have been clarified and the amount of water therein reduced, wherein the separation steps include a solvent extraction step. *See* Br. 4-5 and 8.

Appellants contend that "[a]lthough Burch may be read to imply that residual glucose or glycerol may be present in the fermentation product . . . it does not suggest that extraction can be used to separate 1,3-propanediol from these impurities." Br. 4-5. Appellants further point out that Burch discloses that following solvent extraction, the partially purified 1,3-propanediol can be purified by, among other things, distillation. Br. 5. Thus, Appellants submit that one of ordinary skill in this art would understand that "extraction can be used to separate the 1,3-propanediol from the water that is present in the fermentation broth," but "there is nothing in Burch that suggests that extraction can be used to separate 1.3-propanediol from impurities such as glucose . . . [and] glycerol." Br. 5. In this respect, Appellants further submit that Burch's statement regarding distillation

would suggest to this person "that extraction could not be relied on to separate the desired product, 1,3-propanediol, from the impurities glucose . . . [and] glycerol." Br. 5 (original emphasis omitted), citing Burch col. 13, ll. 41-49.

Appellants' contentions do not successfully rebut the prima facie case. Burch does teach that after extraction, 1,3-propanediol can be separated from at least glycerol by distillation. However, such disclosure does not establish that no glycerol or glucose as well as 1,3-propanediol remained with the separated extracting solvent. Indeed, as we interpreted claim 3 above, all that is required is some amount, however small, of the 1,3-propanediol remaining in the first phase and the weight ratio of this product to any contaminant, including glycerol or glucose, can be greater to any extent, however small, than in the fermentation broth. There further is no requirement for a change in this ratio upon further purification steps involving the second mixture.

Thus, on this record, there is no claim limitation supporting Appellants' contention that the claimed process reliably separates all of the glycerol and/or glucose from the 1,3-propanediol. To the extent that a separation of 1,3-propanediol from these impurities to some extent, however small, is required by claim 3, as we interpreted this claim above, we are of the opinion that Appellants have done no more than recognize an additional benefit not disclosed in the prior art. In this respect, it is well settled that Appellants' elucidation of the mechanism of an old process or discovery of a new benefit of that process does not render the old process again patentable simply because those practicing the process may not have appreciated the

mechanism or the results produced thereby. *See, e.g., In re Spada*, 911 F.2d 705, 707 (Fed. Cir. 1990); *In re Woodruff*, 919 F.2d 1575, 1577 (Fed. Cir. 1990); *W.L. Gore & Assocs. Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1548 (Fed. Cir. 1983) ("[I]t is . . . irrelevant that those using the invention may not have appreciated the results[,] . . . [otherwise] it would be possible to obtain a patent for an old and unchanged process." (citations omitted)).

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in Burch, Ames, Matsuyama, Eyal, and Herold with Appellants' countervailing evidence of and argument for nonobviousness and conclude that the claimed invention encompassed by appealed claims 3 through 10, 16 through 24, and 27 through 32 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

The Primary Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv) (2007).

AFFIRMED

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