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OLIFF PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JAN VAN KRIEKEN,
ANDRÉ BANIER DE HAAN, and JAN VAN BREUGEL

Appeal 2018-006911
Application 14/767,004
Technology Center 1600

Before ERIC B. GRIMES, JEFFREY N. FREDMAN, and ULRIKE W. JENKS, *Administrative Patent Judges*.

FREDMAN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal[1,2] under 35 U.S.C. § 134 involving claims to a process for preparing methyl lactate. The Examiner rejected the claims as obvious. We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the Real Party in Interest as PURAC BIOCHEM B.V. (*see* App. Br. 1).

[2] We have considered and refer to the Specification of Aug. 11, 2015 ("Spec."); Non-Final Action of Nov. 2, 2017 ("Non-Final Act."); Appeal Brief of Mar. 30, 2018 ("App. Br."); Examiner's Answer of May 2, 2018 ("Ans."); and Reply Brief of June 25, 2018 ("Reply Br.").

Statement of the Case

Background

"Methyl lactate is a compound with many uses" including as "a starting material for acrylic acid and other esters" (Spec. 1:4–15). "Methyl lactate can be manufactured from lactic acid, which is obtained through fermentation. In view of the various uses of methyl lactate, there is need in the art for a method for manufacturing methyl lactate, which is efficient and which provides methyl lactate in high yield" (*id.* 1:17–21).

The Claims

Claims 1–4, 6, and 8–20 are on appeal.[3] Claim 1 is representative and reads as follows:

> 1. Process for preparing methyl lactate comprising the steps of
>
> - providing an aqueous liquid comprising lactic acid, methanol, and at least 5 wt.% of a dissolved chloride salt selected from magnesium chloride, calcium chloride, and zinc chloride,
>
> - subjecting the aqueous liquid to an esterification step by bringing the aqueous liquid to reaction conditions, thereby obtaining methyl lactate, wherein
>
> an extractant is provided to the reaction mixture before, during, and/or after formation of methyl lactate, and
>
> the extractant is selected from the group of C5+ ketones, C3-C10 ethers, and C6-C10 aromatic compounds,
>
> - subjecting the reaction mixture to a liquid-liquid separation step wherein an organic phase comprising methyl lactate and extractant is separated from an aqueous phase comprising dissolved chloride salt.

[3] Claims 5 and 7 were allowed (*see* Ans. 67).

The Issues

A. The Examiner rejected claims 1–4, 14, and 17–19 under 35 U.S.C. § 103(a) as obvious over El Paso[4] and Poma[5] (Ans. 3–6).

B. The Examiner rejected claims 1–4, 8–12, 14, and 17–19 under 35 U.S.C. § 103(a) as obvious over El Paso, Poma, and Van Krieken[6] (Ans. 6–9).

C. The Examiner rejected claims 1–4, 6, and 14–20 under 35 U.S.C. § 103(a) as obvious over El Paso, Poma, and Polarity Index (2016)[7] (Ans. 9–10).

D. The Examiner rejected claims 1–4, 13, 14, and 17–19 under 35 U.S.C. § 103(a) as obvious over El Paso, Poma, and Hagemayer[8] (Ans. 10–11).

A. 35 U.S.C. § 103(a) over El Paso and Poma

The Examiner finds:

> El Paso Products teaches a method of preparing methyl lactate (lactic acid methyl ester) wherein lactic acid is mixed with a water miscible alcohol (methanol) in a esterification step then extracted under mild heating with a water immiscible organic solvent wherein lactic acid in the aqueous phase is transformed into the ester of lactic acid (methyl lactate) in the organic phase which is distilled (liquid-liquid separation step) to recover the

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[4] El Paso, GB 1,282,926, published July 26, 1972.
[5] Poma et al; *The action of neutral salts on the constants of chemical equilibrium*, in 24(1) PROCEEDINGS OF THE NATIONAL ACADEMY OF LINCEI, CLASS OF PHYSICS, MATHEMATICS AND NATURAL REPORTS 747–754 (1915) (English Translation).
[6] Van Krieken et al., WO 2005/123647 A1, published Dec. 29, 2005.
[7] Polarity Index, http://www.maro.lsu.edu/howto/solvents/Polarity%20index.htm (2016).
[8] Hagemeyer, Jr., US 2,417,748, issued Mar. 18, 1947.

> immiscible solvent and the residue distilled to yield the methyl lactate.

(Ans. 4). The Examiner finds El Paso teaches "salts may be used as catalysts" (*id.*). The Examiner acknowledges that El Paso does not teach "a method wherein lactic acid and methanol are combined with a dissolved chloride salt (magnesium chloride)" (*id.* 5).

The Examiner finds Poma teaches "the use of neutral salts (such as magnesium chloride) in esterification reactions involving methyl alcohol (methanol)" (Ans. 5).

The Examiner finds it obvious to use neutral salts including magnesium chloride in the method of El Paso because "El Paso Products teaches that any salt may be used as an esterification catalyst and Poma et at. [sic] teaches that magnesium chloride is known to be suitable as an esterification catalyst" (Ans. 5).

The issue with respect to this rejection is: Does a preponderance of the evidence of record support the Examiner's conclusion that El Paso and Poma render the claims obvious?

Findings of Fact

1. El Paso teaches "a process for the conversion of lactic acid to an ester of a low molecular weight alcohol. These esters have chemical and physical properties conducive to easy recovery, purification, handling, storage, and further processing" (El Paso 5:32–38).

2. El Paso teaches:

> An acidified aqueous solution containing lactic acid . . . is mixed with a water miscible alcohol. The resulting solution is then extracted under mild heating with a water immiscible organic solvent. As a result of these operations, lactic acid in

> the aqueous phase is transformed into the ester of lactic acid in the organic phase. The organic phase is distilled to recover the immiscible solvent. The residue from this process is then distilled to yield the ester of lactic acid in pure form.

(El Paso 5:40–52).

3. El Paso teaches, in Example 8, that:

> Technical grade lactic acid mixture, as a 44% aqueous solution (500 grams) was mixed with ethanol (500 grams) and sulfuric acid (96%, 50 grams) . . . and then placed in a vessel heated to 50°C. This heated solution was fed into a continuous counter-current extractor near the top and benzene was fed into the extractor at the bottom . . . The benzene, after entering the extractor, flowed upward as small droplets passing through the continuous aqueous phase which flowed slowly downward. The aqueous phase left the extractor at the bottom. . . . The benzene extract left the extractor from the top. . . . Water-white ethyl lactate (92.4% pure) was obtained in about 50% yield.

(El Paso 11:128–12:39).

4. El Paso teaches, in Example 11, that the "experiment of Example VIII was repeated using chloroform instead of benzene and using methanol instead of ethanol. About 50% of the lactic acid was extracted as methyl lactate. Distillation of the extract yielded water-white methyl lactate (98.8% pure)" (El Paso 12:62–67).

5. El Paso teaches that "it is highly preferable that a small amount of a catalyst such as an acidic or metallic catalyst be present during the esterification reaction to enable the reaction to reach equilibrium as soon as possible" (El Paso 6:35–40).

6. El Paso teaches regarding the catalyst that "[g]enerally 2% to 15% by weight of the total amount of the solution is sufficient" (El Paso 6:40–42).

7. El Paso teaches that in "specialized instances, such as with solutions of amino acids, non-acidic catalysts such as salts of copper or other other [sic] metals may be used" (El Paso 6:59–62).

8. Poma teaches that in "order to complete the study of the action of neutral salts on the stability of homogeneous systems containing methyl alcohol or ethyl alcohol and different absolute amounts of water, we have made the following experiments, in which, as usual, the acid was from etherification of the acetic acid" (Poma 2).

9. Table 5a of Poma is reproduced below (original quality is poor)

Table 5a.
[H2O]:[CH3OH] = 5
neutral salt: MgCl, 2 norm. eq.

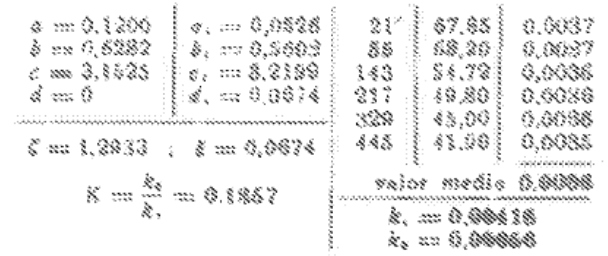

Table 5a shows a formulation with water, methanol, and magnesium chloride in an acetic acid etherification reaction (*see* Poma 2–3).

10. Poma teaches "that the action exerted by the accelerator neutral salts on individual speed etherification and hydrolysis, as may be inferred from the changes of the corresponding reaction constants k1 and k2, it is, generally, the greater the higher the affinity for the water of neutral salts used" (Poma 9).

Principles of Law

A prima facie case for obviousness "requires a suggestion of all limitations in a claim," *CFMT, Inc. v. Yieldup Int'l Corp.*, 349 F.3d 1333,

1342 (Fed. Cir. 2003) and "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 418 (2007).

Analysis

Appellant contends that

> the Examiner has not met his burden of presenting a *prima facie* case of obviousness at least because (1) the Examiner's assertions that El Paso teaches that any salt may be used as a catalyst (specifically an esterification catalyst) overstates El Paso's teaching and/or is based on mere speculation that is not supported by the evidence of record, and (ii) one skilled in the art would not have interpreted Poma as disclosing or suggesting that the neutral salts (such as magnesium chloride) described therein are "catalysts" (i.e., effective to enable the equilibrium to be reached as soon as possible).

(App. Br. 11). Appellant also contends "the art does not suggest that neutral salts selected from magnesium chloride, calcium chloride, and zinc chloride are materials known to be suitable for an intended use as a catalyst for an esterification reaction and thus proposed modification lacks a rational underpinning to support the legal conclusion of obviousness" (*id.*).

The Examiner responds that El Paso teaches "<u>any catalyst</u> may be used during the esterification reaction to enable the reaction to reach equilibrium as soon as possible, <u>wherein salts may be used as catalysts</u>" (Ans. 13). The Examiner also contends that the "Poma reference clearly performs an experiment involving the presence and absence of the neutral salt $MgCl_2$" (*id.*).

We agree with Appellant because the Examiner overstates the teachings of both El Paso and Poma. El Paso does teach the use of metallic

catalysts during esterification reactions (FF 5) but only teaches the use of metal salts in the context of amino acid solutions (FF 7). Thus, El Paso provides no generic suggestion of metal salts as catalysts of esterification reactions, including esterification of lactic acid into methyl lactate.

Poma has a table that includes magnesium chloride (FF 9) and discusses neutral salts and etherification of acetic acid (FF 8) as well as "accelerator neutral salts" (FF 10). However, the evidence in Poma does not persuasively suggest any reason why magnesium chloride, calcium chloride, or zinc chloride should be included in a reaction involving the esterification of lactic acid into methyl lactate.

While the Examiner is correct that non-preferred embodiments may be used to support obviousness, and that preferred embodiments do not teach away (*see* Ans. 16), the Examiner has provided no persuasive reason to select the salt of Poma for use in the esterification reaction of El Paso. "We must still be careful not to allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention." *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008).

Conclusion of Law

A preponderance of the evidence of record does not support the Examiner's conclusion that El Paso and Poma render the claims obvious.

B.-D. 35 U.S.C. § 103(a)

Having reversed the obviousness rejection of claim 1 over El Paso and Poma for the reasons given above, we also find that the further combinations with Van Krieken, Polarity Index (2016), and Hagemeyer do not suggest the

use of the recited metal chloride salts and therefore do not render the rejected claims obvious for the same reasons.

CONCLUSION

In summary:

Claim(s) Rejected	Basis	Affirmed	Reversed
1–4, 14, 17–19	§ 103(a) El Paso, Poma		1–4, 14, 17–19
1–4, 8–12, 14, 17–19	§ 103(a) El Paso, Poma, Van Krieken		1–4, 8–12, 14, 17–19
1–4, 6, 14–20	§ 103(a) El Paso, Poma, Polarity Index (2016)		1–4, 6, 14–20
1–4, 13, 14, 17–19	§ 103(a) El Paso, Poma, Hagemayer		1–4, 13, 14, 17–19
Overall Outcome			1–4, 6, 8–20

REVERSED