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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MANAL AHMED GASMELSEED AWAD,
AWATIF AHMED HENDI, and
KHALID MUSTAFA OSMAN ORTASHI¹

Appeal 2019-005866
Application 15/098,242
Technology Center 1700

Before ERIC B. GRIMES, LINDA M. GAUDETTE, and LILAN REN,
Administrative Patent Judges.

GRIMES, *Administrative Patent Judge.*

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134(a) involving claims to a flexible solar panel, which have been rejected as obvious. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

¹ Appellant identifies the real party in interest as “KING SAUD UNIVERSITY, RIYADH, SAUDI ARABIA.” Appeal Br. 3. We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42(a).

STATEMENT OF THE CASE

The “invention relates to solar cells, solar panels and the like, and particularly to a flexible solar panel including an extract of chard (*B. vulgaris subsp. cicla*).” Spec. ¶ 1. In a working example, the Specification describes making an extract of *B. vulgaris subsp. cicla* leaves by blending the leaves with water and centrifuging “to produce [a] green colored *B. vulgaris subsp. cicla* extract.” *Id.* ¶ 9. “Solar panels produced” with the *B. vulgaris subsp. cicla* extract were “exposed to light” and “tested for current generation.” *Id.* ¶ 11. The results showed that the “current generation and induced potential difference of the green flexible solar film is due to the presence of chloroplasts in the *B. vulgaris subsp. cicla* extract.” *Id.* ¶ 12.

Claims 1–3 are on appeal. Claim 1, reproduced below, is illustrative:

1. A flexible solar panel, comprising a polymer matrix and a plant extract completely incorporated in the polymer matrix, the plant extract being a green-colored extract of *B. vulgaris subsp. cicla*, wherein the extract includes chloroplasts.

OPINION

Claims 1 and 2 stand rejected under 35 U.S.C. § 103 as obvious based on Ochiai,² Pavoković,³ and Yang⁴ (Final Action⁵ 7). Claim 3 stands rejected under 35 U.S.C. § 103 as obvious based on Ochiai, Pavoković,

² Hideo Ochiai et al., *Photocurrent by Immobilized Chloroplast Film Electrode*, *Agric. Biol. Chem.* 43(4):881–883 (1979).

³ Dubravko Pavoković et al., *Complex Biochemistry and Biotechnological Production of Betalains*, *Food Technol. Biotechnol.* 49(2):145–155 (2011).

⁴ Yujie Yang et al., *Preparation of Photostable Chlorophyll/PVA Film*, *Advanced Materials Research*, Vols. 239–242:2707–2710 (2011).

⁵ Office Action mailed October 10, 2018.

Yang, and Wong⁶ (Final Action 9). The same issue is dispositive for both rejections.

The Examiner finds that Ochiai teaches a solar panel comprising a polymer matrix of polyvinyl alcohol (PVA) and “a plant extract completely incorporated in the polymer matrix wherein the extract includes green-colored chloroplasts.” Final Action 7. The Examiner acknowledges that Ochiai does not disclose that “the plant extract is a green-colored extract of *B vulgaris subsp. cicla*,” but finds that “PAVOKOVIC teaches that betalains, such as those from *B. vulgaris subsp. cicla* (Swiss chard), are useful as ‘natural pigments’ in solar cells.” *Id.*

The Examiner finds that Yang teaches that incorporating chlorophyll-containing plant extracts in a PVA polymer matrix stabilizes the extracts against light- and oxygen-induced damage. *Id.* at 7–8. The Examiner finds that Yang also teaches that “extracts may be produced by cleaning the plant leaf material and grinding the material together with a solvent.” *Id.* at 8.

The Examiner concludes that it would have been obvious “to modify OCHIAI and add to the photosensitive plant-derived composition betalains from plants such as *B. vulgaris subsp. cicla* as taught by PAVOKOVIC because betalain extracts from this cultivar are known to have relatively high photoactive conversion efficiencies.” *Id.* at 8. The Examiner also concludes that it would have been obvious “to further modify OCHIAI and prepare the chloroplast/PVA film according to the methods taught by YANG to produce

⁶ D. Wong et al., *Excitation Energy Transfer among Chlorophyll a Molecules in Polystyrene: Concentration Dependence of Quantum Yield, Polarization and Lifetime of Fluorescence*, *Z. Naturforsch* 33c:863–869 (1978).

a green-colored extract containing chlorophyll because this method allows for effective isolation of the chlorophyll components from the harvested plant material.” *Id.*

Appellant argues that “[t]he Pavokovic article is directed to the biochemistry and biotechnology of betalains . . . [which] **are classified in two groups: red-violet betacyanins and yellow betaxanthins.**” Appeal Br. 10–11. Appellant argues that “although Pavokovic may suggest the usage of betalains in solar panel construction, it does not teach the usage of a green, chloroplast-containing extract of *B. vulgaris subsp. [cicla]* used in a DSSC [dye-sensitized solar cell].” *Id.* at 11.

We agree with Appellant that the Examiner has not adequately shown that the claimed invention would have been obvious based on the cited references. We begin with “a key legal question—*what is the invention claimed?*” *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1567 (Fed. Cir. 1987). “Claim interpretation . . . will normally control the remainder of the decisional process.” *Id.* at 1567–68. “[T]he PTO must give claims their broadest reasonable construction consistent with the specification.” *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007).

Claim 1 recites “a plant extract . . . , the plant extract being a green-colored extract of *B. vulgaris subsp. cicla*, wherein the extract includes chloroplasts.”

As we understand it, the Examiner interprets this limitation to encompass any combination of plant extracts, as long as the final combination (a) is green-colored, (b) includes a *B. vulgaris subsp. cicla* extract, and (c) includes chloroplasts. For example, the Examiner states that

the rejection of record does not rely on Pavokovic for teaching the entirety of the claimed plant extract. . . . Ochiai teaches a plant extract that is green and includes chloroplasts. . . . The Examiner relies on the Pavokovic reference only to teach that betalain extracts of *B. vulgaris subsp. cicla* are useful as natural pigments in solar cells to convert radiant energy into electric energy.

Ans. 5. *See also id.* at 6: “[E]ven if the betalains of *B. vulgaris subsp. cicla* are colors other than green, the final product created from the combination of the prior art references still contains a plant extract comprising the green-colored chlorophyll chloroplasts taught by Ochiai because these betalains are added to Ochiai’s plant-extract composition.”

We conclude that this interpretation is broader than is reasonable, when the claim language is read in light of the Specification. The Specification states that the Field of the Invention relates “particularly to a flexible solar panel including an extract of chard (*B. vulgaris subsp. cicla*).” Spec. ¶ 1. At no point does the Specification discuss extracts from any plant other than *B. vulgaris subsp. cicla*. *See id.* ¶¶ 3, 5–7. The Specification states that “[i]n order to make the flexible solar panel, a green colored extract of *B. vulgaris subsp. cicla* is first prepared,” and then mixed with a polystyrene solution. *Id.* ¶ 6. “Alternatively, polyvinyl alcohol (PVA) . . . may be added to a first amount of *B. vulgaris subsp. cicla* extract until completely dissolved to form a first mixture. Then, a second amount of the *B. vulgaris subsp. cicla* extract is added.” *Id.* ¶ 7. Each of the working examples uses an extract from *B. vulgaris subsp. cicla*, not from any other plant and not mixed with any other plant extract. *See id.* ¶¶ 9–17.

Thus, when we interpret the claim language in light of the Specification, we conclude that the broadest reasonable interpretation of the

limitation “the plant extract being a green-colored extract of *B. vulgaris subsp. cicla*, wherein the extract includes chloroplasts” requires an extract from *B. vulgaris subsp. cicla* that itself is green-colored and also contains chloroplasts; i.e., the chloroplasts are derived from *B. vulgaris subsp. cicla*. In other words, “being” in the quoted limitation is construed to mean “consisting of”: the plant extract *consists of* a green-colored extract of *B. vulgaris subsp. cicla*, wherein the extract includes chloroplasts. To interpret the quoted limitation to encompass a mixture of plant extracts would be inconsistent with the Specification’s disclosure.

The Examiner has not pointed to any disclosure in the cited references of a green-colored extract from *B. vulgaris subsp. cicla* that includes chloroplasts, and no such disclosure is apparent to us. Ochiai appears to state that its chloroplasts were isolated from spinach, and suggests that a thermophilic alga may also be a suitable source of chloroplasts. *See* Ochiai 883, left col. (“[T]he chloroplasts isolated from spinach are not always the best source. . . . [A] strain of thermophylic [sic] alga . . . is a suitable replacement for spinach.”). Pavoković discloses that *B. vulgaris subsp. cicla* produces betaxanthins and betacyanins but does not discuss chloroplast-containing extracts from *B. vulgaris subsp. cicla*. *See* Pavoković 148, Table 1. Yang discusses chlorophyll, not chloroplasts, and extracted its chlorophyll from spinach, not *B. vulgaris subsp. cicla*. *See* Yang 2708 (“Chlorophyll extraction”).

Thus, the Examiner has not shown that the plant extract required by the claims—a green-colored, chloroplast-containing extract from *B. vulgaris subsp. cicla*—would have been obvious based on the cited references, or that the prior art would have provided a reason to use such an extract in the

claimed flexible solar panel. We therefore reverse the rejection of claims 1 and 2 under 35 U.S.C. § 103 based on Ochiai, Pavoković, and Yang. The Examiner has not pointed to any disclosure in Wong that makes up for the deficiency discussed above. *See* Final Action 9. We therefore reverse the rejection of claim 3 under 35 U.S.C. § 103 based on Ochiai, Pavoković, Yang, and Wong for the same reason.

DECISION SUMMARY

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2	103	Ochiai, Pavoković, Yang		1, 2
3	103	Ochiai, Pavoković, Yang, Wong		3
Overall Outcome				1–3

REVERSED