UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MARIE A. SCHNITZER, ARNE W. BALLANTINE,
SCOTT K. LOBDELL, and SEAN S. LYONS

Appeal 2008-3287
Application 10/209,747
Technology Center 1700

Decided: August 5, 2008

Before BRADLEY R. GARRIS, CHUNG K. PAK, and
THOMAS A. WALTZ, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 1 through 12, 15, and 23 through 27, all of the claims pending in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. § 6.

We AFFIRM.

STATEMENT OF THE CASE

The subject matter on appeal is directed to a reactant delivery apparatus comprising at least the following three components: (1) a fuel cell comprising an anode 40 having an anode chamber 54, a cathode 42 having a cathode chamber 56, and a a proton exchange membrane (PEM); (2) an injection device (valves 522 and 524 and inlet conduit 510) for passing oxidant (e.g., O_2) and fuel (e.g., H_2) to an anode reactant supply stream; and (3) a controller to humidify the anode reactant supply stream in order to prevent the PEM from drying out by regulating the humidity (i.e., the level of water vapor) of the anode reactant supply stream via the injection device based on the fuel cell's voltage. (Spec. 5, Figs. 4-6). The oxidant introduced into the injection device may be supplied from a cathode reactant supply stream. *Id*.

Further details of the appealed subject matter are recited in representative claims 1 and 23, which are reproduced below:

1. A reactant delivery system, comprising:

a fuel cell comprising an anode chamber to receive a flow and having a cell voltage;

an injection device to combine a fuel with an oxidant to produce the flow; and

a controller to control the combination of the fuel and the oxidant to regulate a humidity of the flow based on the cell voltage.

23. A reactant delivery system for a PEM fuel cell, comprising:

> a fuel cell having an anode, a cathode, a hydrogen rich anode reactant supply stream, and an oxidant cathode reactant supply stream, the anode being in fluid communication with the hydrogen rich anode reactant supply stream, the cathode being in fluid communication with the oxidant cathode reactant supply stream;
>
> wherein the oxidant cathode reactant supply stream is also in fluid communication with the hydrogen rich anode reactant supply stream and is configured to flow an amount of oxidant into the hydrogen rich anode reactant supply stream sufficient to form water vapor; and
>
> a controller to control the flow of the amount of the oxidant into the hydrogen rich anode reactant supply stream to regulate a level of the water vapor based on the voltage of the fuel cell.

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following references:

Mathias	6,376,111 B1	Apr. 23, 2002
Fronk	6,497,970 B1	Dec 24, 2002
Chen	6,746,789 B1	Jun. 8, 2004

The Examiner has rejected the claims on appeal as follows:

1) Claims 1, 3-4, 6-7, 11-12, 23-24, and 26 under 35 U.S.C. § 102(e) as anticipated by the disclosure of Mathias;

2) Claims 1, 3-12, 15 and 23-27 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Chen and Mathias; and

3) Claims 1-4, 6-9, 11-12, and 23-26 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Fronk and Mathias.

The Appellants appeal from the Examiner's decision rejecting the claims on appeal under §§102(e) and 103(a) [1].

ISSUE

Have Appellants shown reversible error in the Examiner's finding that Mathias teaches a controller for regulating the humidity of an anode reactant supply stream based on the voltage of the fuel cell as required by claims 1 and 23?

FINDINGS OF FACT (FF)

1. Mathias teaches, *inter alia*, (col. 2, l. 15 through col. 3, l. 52) a proton exchange membrane (PEM fuel cell assembly 10 comprising, *inter alia*, an anode flow channel 28 to receive and direct humidified hydrogen (H_2) from a hydrogen stream to an anode diffusion medium 24 layered adjacent to an anode 18, a membrane 14, a cathode flow channel 26 to receive and direct oxygen (O_2) or air from an oxygen stream to a cathode diffusion medium 20 layered adjacent to a cathode 16, a DC/DC converter, and a controller 44.
2. Mathias teaches (col. 2, l. 54 through col. 3, l. 52) that the controller 44 determines the humidity of the fuel cell assembly 10 via a high frequency resistance of the fuel cell and controls a humidifier 46 in

[1] In each of the three grounds of rejection, Appellants base their arguments for patentability solely on the limitations of claims 1 and 23. Therefore, we select claims 1 and 23 as the representative claims for each ground of rejection consistent with 37 C.F.R. § 41.37(c)(1)(vii)(2007).

response to the determined humidity level by humidifying "one or both of the air stream supplied to the cathode flow channel 26 and the hydrogen supply stream to the anode flow channel 28 [which] are humidified by one of several ways known in the art….In yet another approach, an oxygen stream may be injected into the hydrogen stream upstream of the anode flow channel 28 to react a small amount of H_2 to produce H_2O."

3. Mathias teaches (col. 3, ll. 14-34) the fuel cell assembly produces a DC stack voltage and a DC stack current.
4. Mathias teaches (col. 3, ll. 12-67) the DC/DC converter generates, *inter alia*, a high frequency AC ripple, which has an AC stack ripple current component and an AC stack ripple voltage component, on the DC stack current and the DC stack voltage.
5. Mathias teaches (col. 3, ll. 53-67) this high frequency resistance is the measured amplitude of the high frequency AC stack ripple voltage divided by the measured amplitude of the high frequency AC stack ripple current.
6. Mathias teaches (col. 6, ll. 34-37) that each fuel cell has a "high frequency resistance range within which the fuel cell operates most optimally or efficiently."
7. Mathias states (col. 5, ll. 14-29) "FIGS. 3A-3C illustrate the relationship between the humidity level of a fuel c ell [sic], the high frequency resistance of the fuel cell, and the efficiency of the fuel cell respectively."

8. Mathias teaches (col. 5, ll. 10-21) the "voltage of a fuel cell is a measure of the efficiency of the cell."
9. Mathias teaches (col. 6, ll. 5-8) the "efficiency of a fuel cell is a function of the humidification of the fuel cell and that the high frequency resistance of a fuel cell is a measure of the humidity level of the fuel cell."
10. Chen teaches, *inter alia*, (col. 6, ll. 31-67 and col. 8, ll. 1-20) a PEM fuel cell comprising a fuel flow hydrogen channel 118 connected to main hydrogen supply line 72 containing humidified hydrogen, a gas diffusion media 114, a oxidant channel 116 connected to an air supply line 66 containing oxidant, and a catalytic reactor 50 for providing humidified hydrogen to the main hydrogen supply line 72 by reacting oxygen from an air supply line 80 with hydrogen from a secondary hydrogen supply line 74.
11. Fronk teaches, *inter alia*, (col. 6, l. 40 through col. 8, l. 31) humidifying the hydrogen rich reformate stream 3 for anode humidification of a fuel cell 22 by controlling the amount of air injected into the hydrogen rich reformate stream 3 via the electronic control module.

PRINCIPLES OF LAW

During prosecution of a patent application, "the PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art." *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir.

1997). "[T]he claims themselves provide substantial guidance as to the meaning of particular claim terms . . . the context in which a term is used in the asserted claim can be highly instructive." *Philips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005). It is, however, permissible to use dictionaries to help determine what a person of ordinary skill in the art would understand the claim terms to mean. *Phillips* at 1319. ”Absent an express definition in their specification, the fact that appellants can point to definitions or usages that conform to their interpretation does not make the PTO’s definition unreasonable when the PTO can point to other sources [i.e., dictionaries] that support its interpretation.” *Morris*, 127 F.3d at 1056.

Under 35 U.S.C. § 102, anticipation is established only when a single prior art reference describes, either expressly or under the principle of inherency, each and every element of a claimed invention. *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990).

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, if any. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966).

ANALYSIS

In each of the Examiner's three grounds of rejection, Appellants do not dispute the Examiner's finding that Mathias teaches a controller to control via the high frequency resistance the flow of oxidant into a hydrogen rich anode reactant supply in the anode flow channel of a proton exchange

membrane (PEM) fuel cell assembly. (*Compare* Ans. 3-12 with App. Br. 9-14 and Reply Br. 1-4; and *see also* FF 1-5). Appellants' only contention in each of the Examiner's three grounds of rejection is that Mathias does not teach a controller to regulate the humidity of the flow of hydrogen and oxygen into the hydrogen rich anode reactant supply stream in the injection device based on the fuel cell's voltage. (*Compare* Ans. 3-12 with App. Br. 9-14 and Reply Br. 1-4; *see also* FF 1-5 and 10-11).[2]

We begin by noting that claims 1 and 23 do not require that the controller regulate the humidity of the hydrogen rich anode reactant supply in a direct response to the fuel cell's voltage. Instead, we note claims 1 and 23 only require that the controller regulate the humidity of the hydrogen rich anode reactant supply "based on" the fuel cell's voltage. The phrase "based on" recited in claims 1 and 23 is not expressly defined in the Specification. According to page 155 of *Webster's II New Riverside University Dictionary* (The Riverside Publishing Company, 1994), however, the broadest reasonable meaning of this phrase in its ordinary usage includes "[a] supporting…part" or "a reference for computations or measurement."

Consistent with the claimed requirement, Mathias states that each fuel cell has a "high frequency resistance range within which the fuel cell operates most optimally or efficiently." (FF 6). In other words, the high frequency resistance range taught by Mathias is determined by the fuel cell efficiency, which is a measure of the voltage of the fuel cell. (FF 6-9).

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[2] Appellants do not dispute the Examiner's findings directed to Chen and Fronk. (*Compare* Ans. 3-12 with App. Br. 9-14 and Reply Br. 1-4). Nor do Appellants challenge the propriety of combining them with Mathias (*Compare* Ans. 3-12 with App. Br. 9-14 and Reply Br. 1-4.)

Thus, we find that Mathias' controller, which regulates the humidity of the hydrogen rich anode reactant supply in the injection device in a direct response to a high frequency resistance, is based on the fuel cell's efficiency, i.e., the fuel cell's voltage. (FF 6-9). Therefore, we concur with the Examiner that Mathias teaches a controller which regulates the humidity of the hydrogen rich anode reactant supply (hydrogen and oxygen) based on the fuel cell voltage.[3]

Accordingly, based on the factual findings set forth in the Answer and above, we affirm the Examiner's decision rejecting claims 1, 3-4, 6-7, 11-12, 23-24, and 26 under 35 U.S.C. § 102(e), claims 1, 3-12, 15 and 23-27 under 35 U.S.C. § 103(a), and claims 1-4, 6-9, 11-12, and 23-26 under 35 U.S.C. § 103(a).

ORDER

The decision of the Examiner is affirmed.

[3] To the extent that Mathias does not expressly teach that the humidity of the hydrogen rich anode reactant supply be controlled based on the fuel cell voltage, we are of view that Mathias would have at least suggested such an arrangement since Figures 3A and 3C show the relationship between the humidification level of the hydrogen and oxygen inlet streams and the fuel cell voltage. (FF 7-9).

TIME PERIOD

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).

AFFIRMED

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sld

TROP PRUNER & HU, PC
1616 S. VOSS ROAD, SUITE 750
HOUSTON, TX 77057-2631