The opinion in support of the decision being entered today is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte PETER MARDILOVICH, DAVID CHAMPION,
GREGORY S. HERMAN, and JAMES O'NEIL

Appeal 2007-3580
Application 10/359,976
Technology Center 1700

Decided: September 24, 2007

Before BRADLEY R. GARRIS, THOMAS A. WALTZ, and
PETER F. KRATZ, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 1-6, 8-11, 55, and 57-59. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

INTRODUCTION

Appellants claim a method of operating a fuel cell comprising, in relevant part, oscillating the oxidant and fuel streams, including reversing flow direction, wherein oscillating the streams comprises flowing the fuel stream and the oxidant stream in a same direction through the fuel cell during a majority of the time (claim 1).

Claims 1, 5, 8, 9, 10, and 55 are illustrative:

1. A method of operating a fuel cell, said method comprising:

supplying a fuel stream to said fuel cell;

supplying an oxidant stream to said fuel cell; and

oscillating said streams, including reversing flow direction;

wherein oscillating said streams comprises flowing said fuel stream and said oxidant stream in a same direction through said fuel cell during a majority of operating time.

5. The method of claim 1, wherein said fuel and oxidant streams are oscillated in phase with one another.

8. The method of claim 1, wherein said oscillation further comprises reversing a flow direction of said streams at irregular intervals.

9. The method of claim 1, whereto said oscillating further comprises varying a flow rate of said streams in a sinusoidal pattern.

10. The method of claim 1, wherein said oscillating further comprises varying a flow rate of said gas streams according to a rectangular-wave, square-wave, or other polygonal-wave pattern.

55. The method of claim 6, further comprising phase shifting said fuel or oxidant stream oscillations an amount that facilitates matching an

availability of fuel at an anode of said fuel cell with an availability of oxidant at a cathode of said fuel cell.

The Examiner relies on the following prior art references as evidence of unpatentability:

Carlstrom, Jr.	US 6,093,502	Jul. 25, 2000
Chow	US 6,753,106 B2	Jun. 22, 2004

The rejection as presented by the Examiner is as follows:

1. Claims 1-6, 8-11, 55, and 57-59 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Carlstrom, Jr. in view of Chow.

The Examiner finds that Carlstrom, Jr. discloses all that is in independent claim 1 except for reversing the flows of the oxidant and fuel (Answer 3). The Examiner concludes that it would have been obvious to combine Chow's disclosure to reverse flow of the fuel and oxidant streams in Carlstrom, Jr.'s fuel cell to improve water management within the fuel cell, which Chow discloses as a benefit resulting from reversing the flows of the oxidant and fuel (Answer 4).

Appellants separately argue independent claim 1, and dependent claims 5, 8, 9, 10, and 55. Accordingly, non-argued dependent claims 2-4, 6, 11, and 57-59, which directly depend on claim 1, stand or fall with claim 1.

OPINION

INDEPENDENT CLAIM 1

Appellants argue that the claim features "reversing the flow direction" and "oscillating said streams comprises flowing said fuel stream and said oxidant stream in a same direction through said fuel cell during a majority of

operating time" would not have been taught or suggested by the combination of Chow's reversing the flow direction of the fuel and oxidant in a fuel cell with Carlstrom, Jr.'s fuel cell (Br. 6-7). Appellants argue that Chow discloses that the flow directions of the fuel and oxidant streams are reversed simultaneously, which means that the fuel and oxidant streams always flow in opposite directions such that the claim recitation of flowing the oxidant fuel streams "in the same direction . . . during a majority of operating time" would not be met by the combination (Br. 5-6). Appellants argue that because Chow's streams always run in opposite directions, Chow teaches away from "flowing the fuel and oxidant in the same direction a majority of operating time" (Br. 7).

We have considered all of Appellants' arguments and are unpersuaded for the reasons below.

Carlstrom, Jr. discloses a method for removing water and controlling concentration gradients in a fuel cell (Carlstrom, Jr., col. 2, ll. 25-37, 49-56). Carlstrom, Jr. discloses that the pressure oscillations help to control the concentration gradients in the fuel cell by wringing or removing the water that blocks the diffusion paths for the fuel and oxidant (Carlstrom, Jr., col. 7, ll. 1-17; col. 8, ll. 5-36). Carlstrom, Jr. further states that by oscillating the pressure of the fuel and oxidant streams the power density of the fuel cell may be improved (Carlstrom, Jr., col. 7, ll. 15-17). Appellants concede that Carlstrom, Jr. discloses flowing the fuel and oxidant streams in the same direction a majority of operating time (i.e., all the time) (Br. 5, ll. 7-8).

Chow discloses a method for managing water in fuel cells by reversing the flow direction of the fuel and/or the oxidant stream(s) (Chow, col. 1, ll. 27-30). Chow further discloses that the ionic membrane in the fuel

cell must be kept moist and that reversing the flow directions of the fuel and oxidant streams enhances the ability to maintain the proper moisture level for the ionic membrane (Chow, col. 1, ll. 20-30). Chow discloses that "in a preferred embodiment . . . the method further comprises periodically reversing the flow direction of a fuel stream substantially simultaneously with the flow direction reversals of the oxidant stream" (Chow, col. 5, ll. 8-12). Chow further discloses that "in this [preferred] embodiment, the fuel stream is preferably directed to flow in a direction substantially opposite to the oxidant stream flow direction" (Chow, col. 5, ll. 23-25).

Based on these disclosures, we find no convincing merit in Appellants' argument that Chow only discloses having the oxidant and fuel streams flow in the opposite direction of one another. Rather, Chow clearly discloses that the embodiment where the oxidant and fuel streams run in an opposite direction of one another is a "preferred" embodiment (Chow, col. 5, ll. 8-25). By necessary inference, Chow's non-preferred embodiment must include having the fuel and oxidant streams run in the same direction. All of the disclosures in a reference must be evaluated for what they fairly teach one of ordinary skill in the art. *In re Boe*, 355 F.2d 961, 965, 148 USPQ 507, 510 (CCPA 1966).

Accordingly, we find that Chow inferentially discloses to one of ordinary skill in the art to reverse the flow directions of oxidant and fuel streams flowing in the same direction, albeit this is a non-preferred embodiment. Therefore, we are unpersuaded by Appellants' argument that Chow teaches away from Appellants' claim recitation that the fuel and oxidant streams flow in the same direction for a majority of operating time.

Rather, as noted above, Chow inferentially discloses the fuel and oxidant streams flow in the same direction.

Moreover, Appellants concede that Carlstrom, Jr. discloses that the fuel and oxidant streams flow in the same direction a majority of operating time (i.e., all the time) (Br. 5, ll. 7-8). Therefore, the combination of Chow's method of managing water in a fuel cell by reversing the flow directions of the fuel and oxidant streams with Carlstrom, Jr.'s method for removing water from a fuel cell and controlling concentration gradients in a fuel cell using pressure oscillations of the fuel and oxidant streams, would satisfy Appellants' argued claim 1 features of "reversing the flow" and "oscillating said streams comprises flowing said fuel stream and said oxidant stream in a same direction through said fuel cell during a majority of operating time."

For the foregoing reasons, we affirm the Examiner's § 103(a) rejection of independent claim 1 and dependent claims 2-4, 6, 11, and 57-59.

DEPENDENT CLAIMS 5 AND 8-10

Appellants argue that Carlstrom, Jr. does not disclose reversing the directions of the fuel and oxidant flow streams, and Chow does not disclose oscillating the flow streams in phase with one another (claim 5), reversing the flow direction at irregular intervals (claim 8), varying the flow rate of said streams in a sinusoidal pattern (claim 9), or varying the flow rate of said gas streams according to a rectangular-wave, square-wave, or other polygonal-wave pattern (claim 10) (Br. 8-9). Appellants further argue that Carlstrom, Jr.'s disclosure regarding the oscillation patterns is solely with regard to pressure variations, not flow reversals (Reply Br. 4-6).

We have considered all of Appellants' arguments and find them unpersuasive for the reasons below.

Carlstrom, Jr. discloses that it is known to control pressure oscillations of the fuel and oxidant streams in either an "in-phase" or an "out-of-phase" pattern with one another (Carlstrom, Jr., col. 10, ll. 50-61; Figures 13-15). Carlstrom, Jr. further discloses that oscillation of the fuel and oxidant streams may be in a sinusoidal pattern, a "sporadic" or "non-repeating" pattern (i.e., irregular) or a periodic, intermittent, spiked, and/or random pattern (Carlstrom, Jr., col. 11, ll. 5-15).

Chow discloses that reversing the direction of the fuel and oxidant streams are done periodically (Chow, col. 3, ll. 54-56; col. 4, ll. 16).

Plainly, Carlstrom discloses that oscillations of the fuel and oxidant streams in a fuel cell may be controlled with the patterns as claimed in Appellants' claims 5 and 8-9. Regarding claim 10, we agree with the Examiner that Carlstrom, Jr.'s disclosure at column 11, lines 5-15 noted above would reasonably have suggested a polygonal-wave pattern (Answer 11-12).

We are unpersuaded by Appellants' arguments that Carlstrom, Jr.'s disclosure regarding the control of the fuel cell is only applicable to pressure oscillations (Reply Br. 4-6). Rather, Carlstrom, Jr.'s and Chow's disclosures, as a whole, would have suggested to one of ordinary skill in the art that Carlstrom, Jr.,'s various oscillation patterns would apply to any oscillations of the fuel and oxidant streams including oscillation of the flow direction (i.e., flow reversals). Chow's disclosure to "periodically" oscillate the flow reversal pattern (Chow, col. 3, ll. 54-56; col. 4, ll. 16), one of the patterns disclosed by Carlstrom, Jr., further supports such a determination.

Moreover, we add that with regard to claims 1, 5 and 8-10, the oscillations of the fuel and oxidant streams recited in the claims can include oscillations other than reversals of the flow direction. Claim 1 recites "oscillating said streams, including reversing flow direction." The plain meaning of that claim phrase includes other forms of oscillation (e.g., pressure or flow rate oscillation) in addition to the required "reversing flow direction." In fact, such a construction of the claim phrase is supported by Appellants' Specification which indicates that "oscillating" is to be construed as "any variation in the flow of fuel or oxidant in a fuel cell . . ." (Specification ¶ [0019]). Therefore, the "oscillated," "oscillations" and "oscillating" language of claim 5, claim 8, and claims 9 and 10, respectively, may refer to other forms of oscillation (e.g., pressure) encompassed by the language of claim 1. Accordingly, Carlstrom, Jr.'s disclosures regarding the oscillation patterns for pressure would satisfy the features of claims 5 and 8-10.

For the above reasons, we affirm the Examiner's § 103(a) rejection of claims 5 and 8-10 over Carlstrom, Jr. in view of Chow.

DEPENDENT CLAIM 55

Appellants argue that the amount of fuel or oxidant in a fuel cell may be greater than would be required by the fuel cell, such that the Examiner's position that the amount of fuel would necessarily have to match the amount of oxidant during normal operation of the fuel cell is not correct (Br. 9-10). Appellants further argue that the "phase shifting" to facilitate matching has not been shown to be present in the art by the Examiner (Br. 10).

We have considered all of Appellants' arguments and find them unpersuasive for the reasons below.

Claim 55 recites "phase shifting said fuel or oxidant stream oscillations an amount that facilitates matching" the availability of fuel at the anode of the fuel cell with the availability of oxidant at the cathode of the fuel cell. Such claim language, "facilitates matching," does not require that the amount of fuel and oxidant be matched exactly. The language requires only that the matching be facilitated. In other words, an excess of fuel or oxidant may be present and the claim phrase "facilitates matching" would still be satisfied.

In view of our claim construction, we determine that the "facilitates matching" claim language encompasses having an excess of oxidant or fuel and therefore would be satisfied even if the amount of fuel or oxidant in the fuel cell is greater than required as argued by Appellants. Moreover, the Examiner's position is reasonable that "the amount of fuel would necessarily have to match the amount of oxidant during normal operation of the fuel cell" (Answer 5). Additionally, Carlstrom, Jr. discloses that the purpose of his pressure oscillation is to increase the amount of reactants (i.e., fuel and oxidant) that permeate through the diffusion layer (i.e., facilitate matching) so as to achieve high current densities (Carlstrom, col. 7, ll. 15-17; col. 8, ll. 5-36). Accordingly, Carlstrom, Jr. teaches or would have suggested the argued "facilitates matching" claim feature.

Regarding the "phase shifting" claim feature, as noted above, Carlstrom, Jr. discloses phase shifting (i.e., out-of-phase control) with regard to pressure oscillations (Carlstrom, Jr., Figure 14). As noted above with claims 1, 5 and 8-10, the "oscillations" of claim 55 are not limited to solely

reversing the flow direction. Rather, "oscillations" may be construed to include "any variation in the flow of fuel or oxidant in a fuel cell . . ." (Specification ¶ [0019]) in addition to reversing the flow direction of the fuel and oxidant streams recited in claim 1. Accordingly, claim 55 and claim 1 from which it depends, are not limited to reversing the flow directions of the fuel and oxidant streams as the only form of oscillation. Rather, claims 1 and 55 may include other forms of oscillation in addition to reversing the flow directions of the fuel and oxidant streams.

Since the Examiner's proposed combination includes adding Chow's reversal of the flow directions of the fuel and oxidant streams to Carlstrom, Jr.'s method of controlling water and concentration gradients in a fuel cell using pressure oscillations, the combination would include both reversing the flow direction as required by claim 1 and pressure oscillations of the fuel and oxidant streams.[1] In light of our claim construction regarding claim 55, the "phase shifting . . . oscillations" feature of claim 55 is construed as encompassing the pressure oscillations of Carlstrom, Jr., which Carlstrom, Jr. discloses may be controlled with an out-of-phase pattern (i.e., phase shifting).

For the above reasons, we affirm the Examiner's § 103(a) rejection of claim 55 over Carlstrom, Jr. in view of Chow.

DECISION

For the above reasons, we AFFIRM the Examiner's § 103(a) rejection of claims 1-6, 8-11, 55, and 57-59 over Carlstrom, Jr. in view of Chow.

[1] Appellants do not dispute that the combination of Carlstrom, Jr. in view of Chow would have included both pressure oscillations and reversing the flow directions of the fuel and oxidant streams (Br. 5-6).

The 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).

AFFIRMED

clj

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