UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte EVERETT ANDERSON, MARK E. DRISTY, TUSHAR GHUWALEWALA, LAWRENCE C. MOULTHROP. MICHAEL SPANER, ELENA STOCKTON, ERIC STYCHE, ALLAN TOMASCO and JOHN ZAGAJA

Appeal 2007-3914
Application 10/249,837
Technology Center 1700

Decided: February 29, 2008

Before BRADLEY R. GARRIS, CATHERINE Q. TIMM, and LINDA M. GAUDETTE, *Administrative Patent Judges*.

GAUDETTE, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 2, 4-8, and 12-20, the only claims pending in the application. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The invention relates to an electrochemical cell which is capable of high pressure operation. (Spec. ¶ [0002]). Claims 8, 13, and 16 are illustrative of the invention and are reproduced below:

8. A method of operating an electrochemical cell system, comprising:

flowing supply water to an anode electrode of an electrolysis cell solely with gravity water feed;

applying a first current density to the electrolysis cell;

electrolyzing the supply water at the anode electrode wherein hydrogen ions and a first portion water migrate to a cathode electrode of the electrolysis cell;

collecting the first portion of water in a chamber in fluid communication with the cathode electrode;

monitoring a water level in the chamber;

when the water level attains a first selected level, decreasing the supply water flow to the anode electrode a sufficient amount to draw the first portion water from the chamber to the anode electrode; and

electrolyzing the first portion water.

13. A method of operating an electrochemical cell system, comprising;

flowing supply water to an anode electrode of an electrolysis cell, wherein the electrolysis cell comprises the anode, a membrane, a cathode electrode, and a fluid accumulation chamber;

applying a first current density to the electrolysis cell;

electrolyzing the supply water at the anode electrode wherein hydrogen ions and a first portion water migrate to the cathode electrode;

collecting the first portion of water in the fluid accumulation chamber;

monitoring a water level in the fluid accumulation chamber, wherein monitoring the water level further comprises creating a short between probes of a level sensing unit, and wherein the probes are disposed into the fluid accumulation chamber; and

when the water level attains a first selected level, decreasing the supply water flow to the anode electrode a sufficient amount to draw water from the fluid accumulation chamber to the anode electrode.

16. A method of operating an electrochemical cell system, comprising:

flowing supply water to an anode electrode of an electrolysis cell, wherein the electrolysis cell comprises the anode, a membrane, a cathode electrode, and a fluid accumulation chamber;

applying a current density to the electrolysis cell;

electrolyzing the supply water at the anode electrode wherein hydrogen ions and a portion of the supply water migrate to the cathode electrode;

collecting the portion of water in the fluid accumulation chamber;

monitoring a water level in the fluid accumulation chamber;

when the water level attains a first selected level, decreasing the supply water flow to the anode electrode; and

decreasing the current density until a hydraulic flux plus a back diffusion are greater than or equal to an electro-osmotic flux plus water electrolysis.

The Examiner relies on the following prior art references to show unpatentability:

Dempsey	3,870,616	Mar. 11, 1975
Young	5,037,518	Aug. 6, 1991
Leonida	6,375,812	Apr. 23, 2002
Taniguchi	JP 64-000422 A	Jan. 5, 1989

The Examiner made the following rejections[1]:

1. Claim 8 under 35 U.S.C. § 103 as unpatentable over Dempsey with evidence from Leonida.

2. Claims 2, 4-7, 12, 14[2], 15-17, 19, and 20[3], under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young.

3. Claim 13 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Taniguchi.

4. Claim 18 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young and further in view of Taniguchi.

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[1] The Examiner has withdrawn the final rejection of claims 12, 13, 15, 17, and 18 under 35 U.S.C. §112, second paragraph, in view of Appellants' after-final amendment. (Ans. 2, ¶ (3)).

[2] Claim 14 is not among the claims listed in the statement of the rejection. However, the Examiner discusses claim 14, which depends from independent claim 15, under this rejection heading. (Ans. 8). In addition, Appellants list claim 14 among the claims on appeal. (Br. 2, ¶ III). Therefore, we view the omission of claim 14 from the statement of the rejection as a mere oversight and harmless error.

[3] The Examiner further relies on evidence from Leonida in rejecting claim 20. (Ans. 4).

Rejection of claim 8 under 35 U.S.C. § 103 as unpatentable over Dempsey with evidence from Leonida

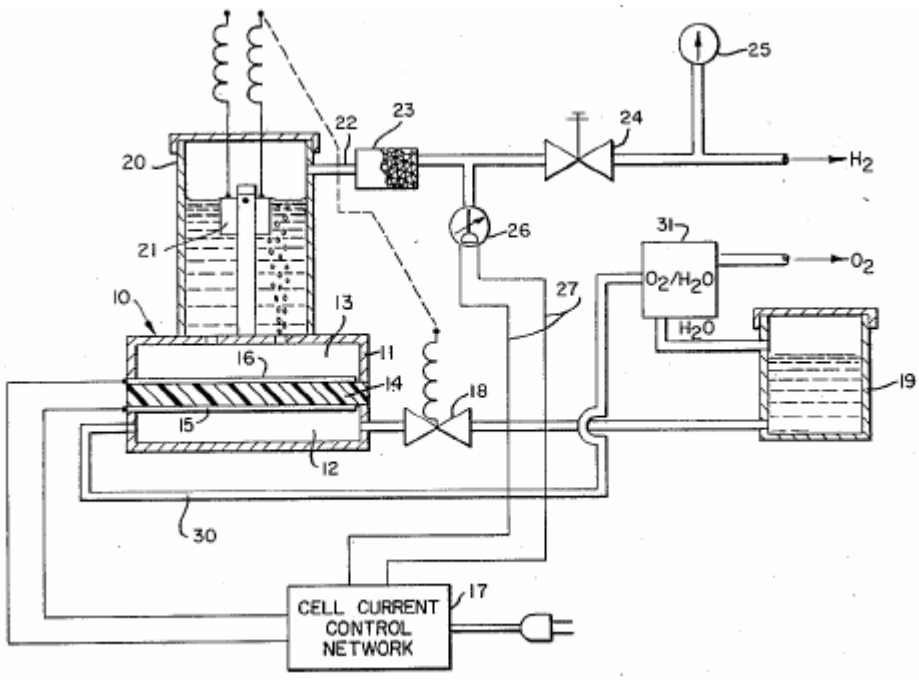
The Examiner finds that Dempsey discloses the invention as claimed with the exception of using gravity feed to flow supply water to the anode electrode of the electrolysis cell. (Ans. 4). The Examiner relies on Leonida as evidence that "[g]ravity feeding of water into a water electrolyzer is well known in the art of electrolysis for the purpose of reducing energy costs by removing the need for a pump to move the water into the electrolysis cell." (Ans. 4).

Appellants point out that Dempsey is silent as to how the supply water is impelled. (Br. 7). Therefore, Appellants contend that the Examiner's conclusion of obviousness is based on an improper "obvious to try" standard. (Br. 7).

Based on the contentions of the Examiner and the Appellants, the issue presented is: Are the facts and reasons relied on by the Examiner sufficient to establish that one of ordinary skill in the art at the time of the invention would have had a reasonable expectation of success in using a gravity feed to flow supply water to the anode electrode of Dempsey's electrolysis cell? We answer this question in the affirmative.

The following finding of fact is relevant to our consideration of this issue:

1) Dempsey discloses a method of operating a water electrolyzer. *See* Dempsey, Abstract. Figure 1 of Dempsey is shown below:



Dempsey Figure 1 shows a gas generator in which evolution of gas at the electrodes is controlled by sensing an operating parameter such as the outlet gas pressure and varying the current flow to the electrolysis cell in response thereto. Dempsey col. 1, ll. 4-9 and 46-51.

"When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product . . . of ordinary skill and common sense." *KSR Int'l Co. v. Teleflex Inc.,* 127 S. Ct. 1727, 1742 (2007). The Examiner finds, and Appellants do not dispute, that the ordinary artisan would have understood that the two options available for transferring water from the supply tank 19 to the anode chamber 15 in Dempsey's process are (1) a pump and (2) gravity feed. (Ans. 11). Likewise, Appellants do not dispute the Examiner's finding that

use of a gravity feed to flow supply water to a water electrolysis cell is well known in the art. (*See* Br. 8; *see also, infra,* Finding of Fact 13). Thus, contrary to Appellants' contention, the Examiner properly established that, given the limited number of known options available to flow supply water to the anode electrode in Dempsey's method, selection of one of those options, i.e., gravity water feed, would have been prima facie obvious. *See KSR*, 127 S. Ct. at 1739 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

A prima facie case of obviousness may be rebutted by evidence of unexpected results or a showing that the prior art teaches away from the claimed invention in any material respect. *In re Geisler*, 116 F.3d 1465, 1469-70 (Fed. Cir. 1997). Appellants maintain that Dempsey "Figure 1 actually teaches away from employing a gravity feed since a gravity feed would require redesigning the system as disclosed and illustrated by Dempsey et al. For example, the positioning of the water supply tank and/or pipes would need to be changed." (Br. 7). While drawings are useful in understanding a disclosed invention[4], we do not agree with Appellants' unsupported assertion that one of ordinary skill in the art would have concluded that Dempsey's process is necessarily limited by the arrangement of process equipment depicted in Figure 1. (Ans. 11). *Cf. In re Bozek*, 416 F.2d 1385, 1390, (noting that a reference disclosure must be evaluated for all that it fairly teaches and not only for what is indicated as preferred).

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[4] *Cf. Autogiro Co. of Am. v. United States,* 384 F.2d 391, 398 (Ct. Cl. 1967) ("In those instances where a visual representation can flesh out words, drawings may be used in the same manner and with the same limitations as the specification.")

Appellants concede that Dempsey does not specify the manner in which supply water is impelled to the anode (Br. 6) and have not directed us to any disclosure in Dempsey which criticizes, discredits, or otherwise discourages flowing supply water by gravity feed. *See In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004)(discussing factors relevant in determining whether a reference teaches away).

Accordingly, we determine that a preponderance of the evidence favors the Examiner's conclusion of obviousness as to claim 8. The decision of the Examiner to reject claim 8 under 35 U.S.C. § 103 as unpatentable over Dempsey with evidence from Leonida is affirmed.

Rejection of claims 2, 4-7, 12, 14, 15-17, 19, and 20, under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young

The Examiner finds that Dempsey discloses the invention as claimed with the exception of a step of decreasing current density applied to the electrolysis cell when the water level attains a first selected level. (Ans. 4-5). The Examiner maintains that it would have been obvious to the ordinary artisan at the time of the invention to have included a step of reducing the amount of current flowing to Dempsey's cell when the flow of supply water was reduced/ceased. (Ans. 5). The Examiner contends that motivation for including this step in Dempsey's process is prevention of drying out of the membrane which, according to Young, occurs when water is consumed by electric current faster than it is supplied by back diffusion to the anode. (Ans. 5).

Appellants maintain that Young's solution to the problem of membrane dry out is a sensor for detecting inadequate water supply. (Br. 9). According to Appellants, neither Dempsey nor Young disclose "decreasing

the current density." (Br. 10). Rather, Young discloses detecting inadequate water supply with sensors and interrupting power supply to avoid drying out the membrane. (Br. 10). Appellants maintain that "combined, the references merely teach an artisan to not reduce the flow of water to the anode too much." (Br. 9). Thus, Appellants contend that the only motivation to modify Dempsey to achieve the claimed invention is based on improper hindsight reasoning. (Br. 10).

Based on the contentions of the Examiner and the Appellants, the issue presented is: Has the Examiner provided sufficient facts and reasons such that it is reasonable to conclude that one of ordinary skill in the art at the time of the invention would have been motivated to modify Dempsey's process such that a corresponding decrease in current supplied to the electrodes would occur responsive to a specified decrease in water supply to the anode? We answer this question in the affirmative.

The following additional findings of fact are relevant to our consideration of this issue:

2) Dempsey's gas generator (*see, supra,* Finding of Fact 1) includes an electrolysis cell assembly 10 having anode and cathode chambers 12 and 13 separated by a solid polymer ion-exchange-membrane electrolyte 14. Dempsey, col. 2, l. 65-col. 3, l. 3. Water supplied to anode electrode 15 is dissociated into positive hydrogen ions plus oxygen. The positive hydrogen ions move across ion-exchange-membrane 14 and are converted into molecular hydrogen at cathode electrode 16. Dempsey, col. 3, ll. 16-22. The anode electrode 15 and cathode electrode 16 are energized from current control network 17. Dempsey, col. 3,

ll. 7-9.

3) Hydrogen ions moving across the membrane 14 transport water molecules (referred to as "protonic pumping") from the anode electrode 15 to the cathode electrode 16 creating an accumulation of water in the cathode chamber 13. Dempsey, col. 5, ll. 8-15. The build-up of water in the cathode chamber 13 results in a pressure gradient which produces diffusion of water back across the ion-exchange membrane 14 to the anode chamber 12 by diffusion. Dempsey, col. 5, ll. ll. 17-21. This returned water acts as a first source of water supplied to anode 15 for dissociation. The second source of water supply to anode electrode 15 is from tank 19. Dempsey, col. 4, ll. 7-9.

4) Because the amount of water transported by protonic pumping exceeds the amount of water diffusing back to the anode chamber 12, an accumulator chamber 20 acts as a storage reservoir for both the hydrogen evolved at the cathode electrode 16 and excess water which accumulates in the cathode chamber 13. Dempsey, col. 3, ll. 24-28. A water level float 21 actuates a switch when the water in chamber 20 reaches a predetermined level. The switch, in turn, actuates water inlet solenoid valve 18 to shut off the water supply from tank 19 to the anode electrode 15. Dempsey, col. 3, ll. 31-35. When this occurs, only the aforementioned first source (*see* Finding of Fact 3) supplies water to the anode electrode 15. Once the water level in the accumulator chamber 20 has been reduced below a predetermined level, float 21 deenergizes solenoid valve 18 allowing the anode electrode 15 to

again receive water from the second source (*see* Finding of Fact 3). Dempsey, col. 4, ll. 29-37.

5) A pressure sensing element 26 senses the outlet hydrogen pressure in conduit 22. Pressure sensing element 26 is connected to cell current control network 17. Dempsey, col. 3, ll. 36-48. Current supplied to electrolysis cell assembly 10 may be controlled on an on-and-off basis or by a continuously varying the electrical signal responsive to the outlet hydrogen pressure variations. For example, a pressure strain gauge which produces an electrical analog output signal proportional to the pressure sensed by pressure switch 26, and which is continuously variable over a given pressure range, may be used to vary the current supplied to the electrolysis cell and, thus, the rate of hydrogen evolution at the electrodes. Dempsey, col. 3, l. 61-col. 4, l. 6.

6) Dempsey discloses a control circuitry (FIG. 3), in which "the current level in the cell is set by means of a potentiometer from zero to a maximum current with the signal from the potentiometer being summed with a feedback signal from the cell and an external signal responsive to outlet gas pressure. All these signals are integrated in a summing amplifier to produce an increasing or decreasing current output in response to an error input, thus resulting in a very closely controlled output current." Dempsey, col. 10, ll. 9-18.

7) Young discloses an apparatus comprising an electrolytic cell having a cathode and an anode separated by a solid electrolyte ion exchange membrane for generating hydrogen by the electrolysis of

water. Young, Abstract. According to Young, the disclosed apparatus "provide[s] an electrolytic hydrogen and oxygen generator which produces hydrogen and oxygen at rates greater than those attainable in presently available electrolytic hydrogen generators." Young, col. 2, ll. 46-49.

8) Young explains that current supplied to the electrolytic cell drives the dissociation of water at the anode. As the current is increased, the quantity of water dissociated is increased. Young, col. 2, ll. 5-8. Young notes that "drying out" or "breaking down" of the ion exchange membrane is a problem which can occur when the electrolytic cell's demand for water is greater than the supply. Young, col. 2, ll. 3-5. More specifically, if the supply of water at the anode is not great enough to satisfy the demand of the electrolytic cell, the water molecules which were incorporated into the structure of the membrane during the manufacturing process will become dissociated, irreversibly drying out the membrane. Young, col. 2, ll. 8-14.

9) According to Young , a conventional electrolytic cell gas generator, such as the one disclosed in Dempsey, would be especially prone to drying out during the time period when the water supply to Dempsey's anode chamber 12 is solely from the first source, i.e., from the diffusion of water from the cathode chamber 13 back across the ion-exchange membrane 14. Young, col. 1, ll. 60-67.

10) Young's apparatus is said to reduce the possibility of irreversible drying out of the ion exchange membrane because

water in the accumulator (hydrogen-water separator 21) is recycled back to the main water supply source (water reservoirs 1, 2), thereby eliminating the need to periodically shut off flow from the water supply source and rely on water supplied solely from diffusion of water from the cathode chamber back across the ion-exchange membrane. Young, col. 14, ll. 13-21.

11) According to Young, "[t]o generate hydrogen gas and to avoid permanent damage to the solid electrolyte in the hydrogen generator cell C, the solid electrolyte should always be immersed in water." Young, col. 8, ll. 52-55. Young thus employs various safety features to "protect the electrolytic cell from damage due to massive leaks, through the errant addition of impure water, or due to the absence of water from the supply system." Young, col. 2, ll. 54-59. Young discloses, for example that when hydrogen pressure fails to increase at a predetermined minimum rate or reach a desired pressure, a leak is suspected and a detector provides a signal to shut off current supply to the cell. Young, col. 8, l. 64-col. 9, l. 2 and col. 10, ll. 58-62.

12) Young controls the release of hydrogen gas using a shutoff valve 35 which connects tube 34 to a hydrogen output port 36. A pressure transducer 38 monitors the hydrogen pressure in the tube 34 and produces a corresponding electrical signal which is used to control the electrical power supplied to the electrolytic cell. Young, col. 6, ll. 13-22. To provide a selected pressure of hydrogen gas, the electrochemical cell is supplied with an amount of electrical current that is regulated in response to the difference

between the measured pressure and the desired pressure. Young, col. 8, ll. 3-8. Young notes that other parameters, such as hydrogen flow rate, may be used for controlling electrical power to the cell. Young, col. 8, ll. 15-17.

13) In Young's apparatus, water preferably flows into the electrolytic cell by gravity, i.e., by positioning the water reservoirs 1, 2 above the electrolytic cell C. Young, col. 4, ll. 47-49. Young utilizes a sensor in the water reservoir(s) which produces an electrical signal in response to a drop in the water level in the reservoir to a predetermined level, or in response to a predetermined change in the electrical conductivity of the water. Control circuitry responds to the electrical signal by interrupting the supply of electrical power to the cell. Young, col. 4, ll. 24-30. Young notes that various types of sensors, including electrodes, optical sensors, or float switches may be used to sense water level. Young, col. 10, ll. 14-17.

While the analysis in support of an obviousness determination should "identify a reason that would have prompted a person of ordinary skill in the art to combine the elements" in the manner claimed, the "analysis [of whether the subject matter of a claim is obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR,* 127 S. Ct. at 1740-41 (*quoting In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *see also DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006) ("The motivation need not be found in the

references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself."). When a second reference identifies the benefits of adding a feature to the primary reference, an obviousness rejection is proper. *See In re Thrift*, 298 F.3d 1357, 1365 (Fed. Cir. 2002).

In our view, the facts and reasons relied on by the Examiner properly conform to the Supreme Court's guidelines in *KSR* and are persuasive in establishing a prima facie showing of obviousness as to all of the appealed claims for the reasons well-stated in the Answer. (Ans. 4-8 and 12-13). We do not find Appellants' arguments persuasive because they narrowly focus on the explicit teachings of the references and fail to address the Examiner's findings with respect to the inferences and creative steps that a person of ordinary skill in the art at the time of the invention would have employed in attempting to improve upon known methods of electrolyzing water to produce hydrogen gas. (Ans. 12-13).

We note that Appellants' arguments are particularly inapposite to claim 16[5] in which the step of decreasing current density applied to the electrolysis cell is not linked to attaining a particular water level in the chamber. *See In re Am. Acad. Of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004) (During prosecution claims are given their broadest reasonable

[5] Appellants have presented arguments with respect to dependent claim 20. (Br. 11). Therefore, we separately consider patentability of claim 20 over the applied prior art. Appellants have not, however, presented arguments which are reasonably specific to any of the independent claims subject to this ground of rejection. Accordingly, the Board may properly decide the appeal as to this ground of rejection on the basis of independent claim 16. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2005).

construction "in light of the specification as it would be interpreted by one of ordinary skill in the art."). More specifically, Appellants argue that neither Dempsey nor Young discloses varying current in response to water level in the chamber. However, both Dempsey and Young do disclose varying current in accordance with a desired rate of hydrogen evolution at the electrodes. (Findings of Fact 5 and 12). Both Young and Dempsey monitor outlet hydrogen pressure variations as well as other feedback signals from the electrochemical cell. (Findings of Fact 2, 4-6, 12 and 13). Dempsey integrates these signals in a summing amplifier to produce an increasing or decreasing current output in response to an error input. (Finding of Fact 6). Young notes that the ion exchange membrane used in a conventional process such as Dempsey's is prone to damage when supply of water to the anode electrode 15 is solely by diffusion of water from the cathode chamber 13 back across the ion-exchange membrane 14. (Findings of Fact 8 and 9). To avoid damage to the electrochemical cell in their own process, Young monitors various process parameters such as hydrogen pressure and water level in the reservoirs. (Findings of Fact 10-13). Thus, contrary to Appellants' contention, we find ample support for the Examiner's conclusion that one of ordinary skill in the art would have been motivated to modify Dempsey's control system to provide a material balance of the water flow and the anode/membrane interface (i.e., include a step of "decreasing the current density until a hydraulic flux plus a back diffusion are greater than or equal to an electro-osmotic flux plus water electrolysis") responsive to an error input (e.g., variation in outlet hydrogen pressure or water level) of the type disclosed in Young as signaling the possibility of damage to the ion exchange membrane (Ans. 8).

With respect to claim 20, Appellants argue that "[t]here is also no motivation to redesign the system of Dempsey et al. to locate the water storage tank above the cell stack." We are not persuaded by this argument. Rather, we find that the Examiner properly established a prima facie showing of obviousness as to claim 20 for the same reasons discussed above in connection with the rejection of claim 8.

We affirm the Examiner's decision to reject claims 2, 4-7, 12, 14, 15-17, 19, and 20, under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young.

Rejection of claim 13 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Taniguchi

The Examiner finds that Dempsey discloses the invention as claimed with the exception of monitoring water level by creating a short between probes of a level sensing unit. (Ans. 9). The Examiner further finds that Taniguchi discloses a level sensing device in which water level is determined by relationships between current in various probes. (Ans. 9). The Examiner contends that it would have been obvious to have replaced Dempsey's level sensor with the level sensor of Taniguchi. (Ans. 9-10). Appellants maintain that the Examiner has not explained the motivation for substituting Taniguchi's multiple probe sensing device for Dempsey's sensing device. (Br. 12).

Contrary to Appellants' contention, we find that the Examiner's conclusion of obviousness is properly based on a finding that the level sensors of Dempsey and Taniguchi are functional equivalents (Ans. 10 and

13-14)[6]. *See KSR*, 127 S. Ct. at 1740 (In an obviousness determination, the question to be asked is "whether the improvement is more than the predictable use of prior-art elements according to their established functions."). Appellants have not refuted this finding. Accordingly, we affirm the decision of the Examiner to reject claim 13 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Taniguchi.

Rejection of claim 18 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young and further in view of Taniguchi

Appellants argue that claim 18 is patentable over the proposed combination because (1) it depends from claim 16 which is patentable and (2) there is no motivation to combine the teachings of Dempsey and Taniguchi. (Br. 13).

For the reasons discussed above, we determined that a preponderance of the evidence weighs in favor of the Examiner's conclusion of obviousness as to claim 16. We also determined that the Examiner provided a reasonable basis to conclude that one of ordinary skill in the art would have been motivated to modify Dempsey's process by employing Taniguchi's level sensing device. Therefore, we do not find Appellants' arguments persuasive in establishing nonobviousness as to claim 18.

Accordingly, we affirm the decision of the Examiner to reject claim 18 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young and further in view of Taniguchi.

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[6] We note that Young supports the Examiner's finding that various types of sensors may be used to determine water level in gas generation systems employing electrochemical cells. (Finding of Fact 13).

ORDER

The decision of the Examiner rejecting claim 8 under 35 U.S.C. § 103 as unpatentable over Dempsey with evidence from Leonida; claims 2, 4-7, 12, 14, 15-17, 19, and 20, under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young; claim 13 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Taniguchi; and claim 18 under 35 U.S.C. § 103 as unpatentable over Dempsey in view of Young and further in view of Taniguchi 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)(i)(iv).

AFFIRMED

tc/cam

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