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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

*Ex parte* JOSEPH D. ROCCI and MICHAEL L. QUELLY

Appeal 2018–000560[1]
Application 12/888,181
Technology Center 2800

Before ST. JOHN COURTENAY III, THU A. DANG, and
JOHN A. EVANS, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's final rejection of claims 2–6, 8–11, 13, 14, 16, 20–22 and 24–39, which are all of the pending claims. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

A. INVENTION

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies Phoenix Broadband Technologies, LLC as the real party in interest. Appeal Br. 1.

According to Appellant, the invention relates to "system and method of equalizing and monitoring the amount of charge of individual batteries connected in a string of batteries managed by a string-level charging system," the system and method utilizing "battery monitoring sensors or equivalent circuitry in order to reduce the charge on overcharged batteries." Spec. ¶ 19.

## B. REPRESENTATIVE CLAIM

Claim 24 is representative of the subject matter on appeal:

> 24. A method for monitoring the health of, and adjusting the charge of, a battery in a string of batteries, wherein there is a sensor associated with each battery, each sensor being in communication with a controller, the method comprising:
>
> via each sensor and at each battery, obtaining an indication of the battery voltage, and also applying a pulse width modulated (PWM) excitation signal, and based on a battery response to the application of the excitation signal, determining at least one non-voltage health characteristic of each battery and providing an indication of the health of the battery;
>
> at the controller, receiving from each sensor the health indications and the indication of battery voltage;
>
> calculating, according to an algorithm carried out by the controller, a target battery voltage for each battery in the string based on the battery voltage indications;
>
> based on the calculation, sending, from the controller to one or more selected ones of the sensors, one or more discharge instructions; and
>
> at each selected sensor, generating a variable digital signal having pulse widths that are based on the discharge

> instruction and applying the variable digital signal to a current switching device operatively coupled across the battery so as to discharge the battery until the target battery voltage has been attained.

## C. REJECTIONS

Claims 4, 5, 10, 11, 20–22, 24, 25, 27, 28, and 31–39 stand rejected under 35 U.S.C. § 103(a) over Loncarevic (US 2010/0052615 A1; published Mar. 4, 2010), Windebank (US 4,433,294; issued Feb. 21, 1984), and Lim (US 8,054,034 B2; issued Nov. 8,2011).

Claims 2, 3, 13, and 14 stand rejected under 35 U.S.C. § 103(a) over Loncarevic, Windebank, Lim, and Stocker (US 2010/0237702 A1; published Sep. 23, 2010).

Claims 6, 8, 16, and 29 stand rejected under 35 U.S.C. § 103(a) over Loncarevic, Windebank, Lim, and Sufrin-Disler (US 2008/0252257 A1; published Oct. 16, 2008).

Claims 9 and 30 stand rejected under 35 U.S.C. § 103(a) over Loncarevic, Windebank, Lim, Sufrin-Disler and Dunn (US 6,239,579 B1; issued May 29, 2001).

# II. ISSUES

The principal issues before us are whether the Examiner erred in finding the *combination* of Loncarevic, Windebank, and Lim teaches *or suggests* a method comprising the steps of:

"at each battery, obtaining an indication of the battery voltage," "applying a pulse width modulated (PWM) excitation signal," and "based on a battery response to the application of the excitation signal, determining at least one non-voltage health characteristic of each battery;"

"calculating, according to an algorithm carried out by the controller, a target battery voltage for each battery in the string based on the battery voltage indication;" and

"based on the calculation, sending . . . one or more discharge instructions."

*See* Appeal Br., Claims App. 2.

## III. FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

*Loncarevic*

1. Loncarevic discloses a Battery Management System (BMS) for controlling the charging and discharging of a plurality of batteries, each battery having an associated plurality of control circuits which monitor and control the charging of the individual battery. Loncarevic, Abstract. These units are controlled by a central controller which shunts current around the battery if it is fully charged, and stops discharge if the battery is fully discharged, to prevent damage to the batteries. *Id.*

In the BMS, circuits/functions common to all cells are provided centrally, whereas individual cells are provided with corresponding control systems comprising cell balancing means and/or slave sensor means. *Id.*
¶ 11. Figure 1 is reproduced below:

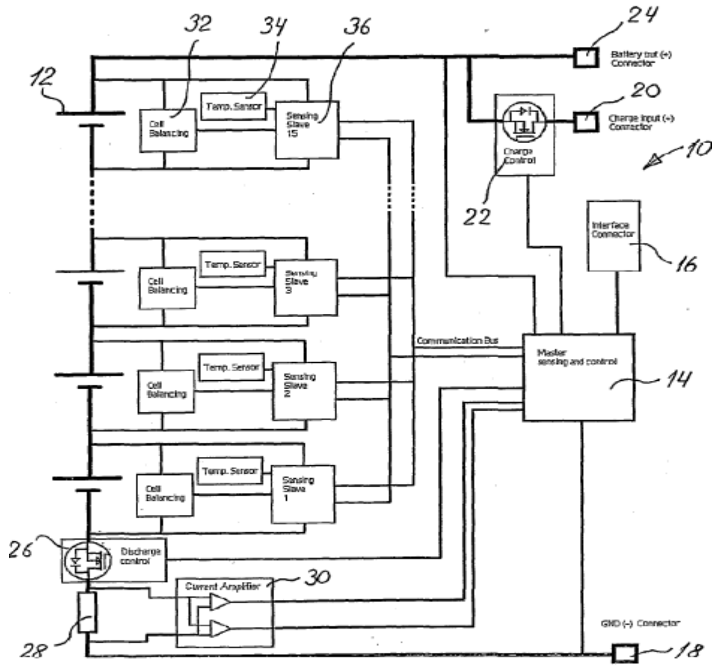


*Fig. 1*

Figure 1 shows battery management system (BMS) 10 connected to a plurality of lithium ion cells 12. *Id.* ¶ 25. As shown in Figure 1, each lithium ion cell 12 is connected to a separate monitoring and controlling circuit, the monitoring and controlling circuit including cell balancing circuit 32, temperature sensor 34, and communication/sensing slave circuit 36 establishing communication from cell balancing circuit 32 and temperature sensor 34 to and from central master microcontroller 14. *Id.* ¶¶ 28, 36.

*Lim*

2. Lim discloses a battery management system (BMS) to manage a battery wtih a plurality of cells, the BMS including a sensing unit, a microcontroller unit (MCU) and a cell balancing unit. Lim, Abstract. Lim recognizes using a BMS with cell balancing control to manage a plurality of battery cells connected to each other. *Id.* at 1:43–48. Accordingly, Lim provides a sensing unit to measure a cell voltage of each of the plurality of

cells, wherein the MCU detects cells requiring cell balancing and generates a plurality of cell voltage signals to control the cell balancing. *Id.* at 2:8–12.

The MCU calculates an average voltage of all the cells and then compares the calculated average voltage with a voltage of each cell in the battery, wherein, if the absolute value of the difference is greater than a predetermined set-point voltage, the MCU transfers a control signal to the cell balancing unit to balance the charge states of cells. *Id*. at 5:7–19. The cell balancing unit balances the charge state of each cell, discharging a cell having a comparatively high charge state and charges a cell having a comparatively low charge state. *Id.* at 5:2–6.

*Windebank*

3. Windebank discloses testing the operating condition and/or characteristics of a battery. Windebank, Abstract. When a test cycle is initiated, the power output circuit supplies a controllable varying test charging current ("test current") to the battery. *Id.* at 7:41–50. Dynamic voltage current characteristic is obtained for the battery under test to determine the actual charge capacity of the battery. *Id.* at 9:12–19. Figure 4 is reproduced below:

FIG. 4

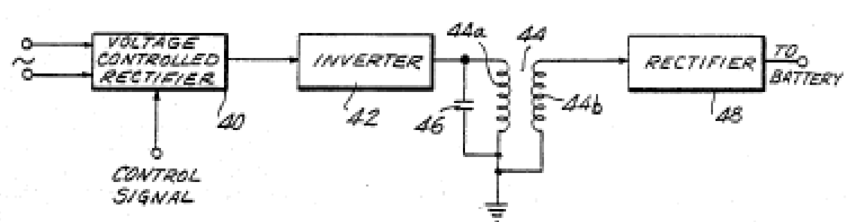


Figure 4 shows a power output circuit comprising a voltage-controlled rectifier 40, an inverter 42, a transformer 44 and an output rectifier 48, wherein the DC currents produced by voltage-controlled rectifier 40 are supplied to inverter 42 which in turn produces an AC signal which, when rectified, corresponds to the test current or a charging voltage. *Id.* at 18:35–53. Inverter 42 may include a pulse width modulator which generates pulse width modulated (PWM) signals corresponding to the test current and the charging voltage supplied to the battery. *Id.* at 18: 53–57.

## IV. ANALYSIS

We have reviewed the Examiner's rejection in light of Appellant's arguments presented in this appeal. Arguments which Appellant could have made, but did not make in the Brief are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2016). On the record before us, we are unpersuaded the Examiner erred.

Appellant contends that "Loncarevic does not teach the battery voltage equalization features of the claims." App. Br. 14. In particular, Appellant contends that "Loncarevic does not teach the claimed features of calculating a target voltage for discharge purposes, much less doing so based on the voltages of other batteries (cells) in a string of batteries (cells)," as claimed. *Id.* at 15.

Further, according to Appellant, "Lim et al. do not teach or suggest measuring the voltage of each battery in a string of batteries, much less a sensor associated with each battery in the string of batteries," as claimed. *Id.* In particular, Appellant contends that "Lim et al. expressly teach that a goal of his system is to provide *fewer* sensors." *Id.* Appellant contends that "the claims provide that there is a discharge instruction associated with each battery, as contrasted to Lim et al., which teaches fewer discharge signals than there are batteries (cells)." *Id.* at 16.

Appellant then contends Lim "teach[es] away from the use of variable digital signals for selectively discharging cells." *Id.* Thus, according to Appellant, Lim "expressly teach[es] away from both (i) sensing each battery in the string of batteries and (ii) any ability to adjust the voltage of individual batteries in the string of batteries." *Id.* at 15.

Although Appellant acknowledges that the Examiner relies on Windebank for teaching and suggesting "applying a PWM signal to battery (cell) and monitoring its response thereto to obtain [the battery's non-voltage health] charactertics" (*id.* at 16), Appellant contends that "Windebanks applies a ramped signal, i.e., an analog signal, not a PWM or even a digital signal, to each battery." *Id.* at 16–17. In particular, Windebanks' PWM signal "are applied to an inverter 42 that creates an analog AC, signal that is applied [to] the battery," wherein "Windebank does so for the purpose of determining a voltage characteristic of the battery, rather than a non-voltage characteristic." *Id.* at 17.

Appellant then contends that the ordinarily skilled artisan "would not combine [the references] in a manner that arrives at the claimed invention [when the references are ] viewed as a whole," but instead, "would be led away from the claimed invention [when] viewed as a whole." *Id.* at 17. According to Appellant, "all of the references are directed to either battery voltage equalization or measure of battery characteristic, but none is directed to both and none suggest both in a single system." *Id.* at 18.

We have considered all of Appellant's arguments and evidence presented. However, we agree with the Examiner's findings, and find no error with the Examiner's conclusion that claim 24 would have been obvious over the *combination* of the teachings *and suggestions* of Loncarevic, Lim, and Windebank.

Although Appellant contends that "Loncarevic does not teach the battery voltage equalization features of the claims," and that Lim "[does] not teach or suggest measuring the voltage of each battery in a string of batteries" (App. Br. 14–15), the Examiner rejects the claim as obvious over the combination of Loncarevic, Lim, and Windebank. The test for obviousness is what the combination of Loncarevic, Lim, and Windebank teaches or would have suggested to one of ordinary skill in the art. *See In re Merck & Co*., 800 F.2d 1091, 1097 (Fed. Cir. 1986). As the Examiner points out, "one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references." Ans. 2 (citing *In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *Merck*, 800 F.2d at 1097).

Thus, although Appellant contends that Lim "[does] not teach or suggest measuring the voltage of each battery in a string of batteries" (App. Br. 15), the Examiner relies on Loncarevic for teaching and suggesting the claimed measuring of voltage of "each battery in a string of batteries." Ans. 4. Loncarevic discloses a Battery Management System (BMS) for controlling the charging and discharging of a string of batteries, wherein each battery monitors and controls its own charging. FF 1. In particular, in Loncarevic's BMS, each battery cell is connected to a separate monitoring and controlling circuit which includes cell balancing circuit, temperature sensor and communication/sensing slave circuit. *Id.*

Here, the Examiner finds that "Loncarevic teaches one or more batteries (12) in a string of batteries (Par.25) comprising a controller (14)(Par. 26) and a plurality of battery sensors (monitoring and control circuit)(Par. 26), each a sensor (monitoring and controlling circuit) associated with each battery (12)." Final Act. 3. We find no error with the Examiner's reliance on Loncarevic to teach and suggest a method for "adjusting the charge of . . . a battery in a string of batteries, wherein there is a sensor associated with each battery, each sensor being in communication with a controller," the method comprising the step of: "via each sensor and at each battery, obtaining an indication of the battery voltage." *See* Appeal Br., Claims App. 2.

Similarly, although Appellant contends that "Loncarevic does not teach the claimed features of calculating a target voltage for discharge purposes" (App. Br. 15), the Examiner relies on Lim, instead, for teaching and suggesting the claimed "calculating a target voltage" step. *See* Ans. 3.

Lim discloses a BMS for managing a battery including a plurality of cells, wherein the BMS uses balancing control to manage the plurality of battery cells connected to each other. FF 2. In Lim, a sensing unit measures a cell voltage of each of the plurality of cells, and an MCU detects cells requiring cell balancing, wherein the MCU calculates an average voltage of all the cells and then compares the calculated average voltage with a voltage of each cell in the battery. *Id.* If the absolute value of the difference is greater than a predetermined set-point voltage, the MCU transfers a control signal to a cell balancing unit to balance the charge states of cells, and the cell balancing unit discharges a cell having a comparatively high charge state and charges a cell having a comparatively low charge state. *Id.*

As the Examiner finds, “Lim teaches calculating a target voltage (average voltage) of each battery (CELL1-CELL40) in a string of batteries based on battery voltage indications,” and “discharging a battery until the target battery voltage has been attained.” Ans. 3. Accordingly, we find no error with the Examiner’s reliance on Lim to teach and suggest the steps of “calculating, according to an algorithm carried out by the controller, a target battery voltage for each battery . . . based on the battery voltage indications,” and “based on the calculations, sending from the controller to one or more selected ones of the sensors, one or more discharge instructions.” Appeal Br., Claims App. 2.

We also do not find any error with the Examiner’s reliance on Windebank to teach and suggest a method “for monitoring the health of . . . a battery,” comprising the step of “applying a pulse width modulated (PWM) excitation signal, and based on a battery response signal, determining at least one non-voltage health characteristic of each battery.” Appeal Br., Claims App. 2. In particular, the Examiner finds that “Windebank teaches determining a non-voltage characteristic [(]charge capacity) of the battery (10).” Ans. 6.

We are unpersuaded by Appellant’s contention that Windebank’s PWM signals are not applied to the battery. App. Br. 17. As shown in Figure 4 of Windebank, an excitation signal (test current) is applied to the battery wherein the excitation signal may comprise a PWM signal as modulated at the inverter 42. FF 3.

We are also unpersuaded by Appellant’s contention that Windebank’s excitation signals are applied “for the purpose of determining a voltage characteristic of the battery, rather than a non-voltage characteristic such as admittance." App. Br. 17. As an initial matter of claim construction, we note that the claims and the specification do not provide any specific definition for "non-voltage characteristic" of claim 24. We are unconvinced that the Examiner's interpretation of "non-voltage characteristic" as encompassing Windebank's "charge capacity" of battery 10 is unreasonable or overly broad. *See* Ans. 6; *see also* FF 3. That is, a "charge capacity" is not a voltage and thus, given the broadest, reasonable interpretation, we find no error with the Examiner's broad but reasonable interpretation of "non-voltage" characteristic as encompassing a "charge capacity" that is not a voltage characteristic. *See In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

Based on the record before us, we agree with the Examiner's finding that the combination of Loncarevic, Lim and Windebank teaches or at least suggests the contested limitations.

Furthermore, we are unpersuaded by Appellant's contention that the ordinarily skilled artisan "would not combine [the references] in a manner that arrives at the claimed invention [when the references are ] viewed as a whole," but instead, "would be led away from the claimed invention [when] viewed as a whole." App. Br. 17.

A prior art teaches away from the claimed invention if "a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the [A]pplicant." *In re Gurley*, 27 F.3d 551,553 (Fed Cir. 1994). Merely discussing a preferred embodiment, "does not teach away [as] it merely expresses a general preference for an alternative invention but does not 'criticize, discredit, or otherwise discourage' investigation into the invention claimed." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)).

Here, both Loncarevic and Lim are directed to the same field of endeavor of using a BMS for cell balancing. FF 1–2. We find no error with the Examiner's combination of Lim's calculation of a "target voltage for each battery" (FF 2) with Loncarevic's BMS for controlling each battery in a string of batteries (FF 1) to "effectively manage [Loncarevic's] plurality of batteries . . . by balancing the charge in the batteries thereby preventing damage due to overcharging or over-discharging." *See* Ans. 4. That is, the Examiner has provided an "articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

We are also unpersuaded by Appellant's contention that "none [of the cited references] is directed to both [battery voltage equalization and measure of battery characteristic] and none suggest both in a single system." App. Br. 18. Since the Examiner rejects the claim as obvious over the combination of the references, the test is what the combination of Loncarevic, Lim, and Windebank teaches or suggests to one of ordinary skill in the art. *See Merck*, 800 F.2d at 1097. The Supreme Court guides that the conclusion of obviousness can be based on the background knowledge possessed by a person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). The skilled artisan is "a person of ordinary creativity, not an automaton." *Id.* at 421.

Here, we agree with the Examiner that one of ordinary skill in the art, upon reading Windebank's method of monitoring the health of a battery ("measur[ing] the battery characteristic") (FF 3), would have found it obvious to add a step of battery health monitoring to Loncarevic's and Lim's method of adjusting the battery charge (FF 1–2) to "determine[] the operating condition of the battery and establish if the battery needs replacement." Final Act. 4.

Appellant also argues the Examiner has relied upon impermissible hindsight in combining the cited references. App. Br. 19. However, Appellant does not provide any evidence sufficient to demonstrate that combining the teachings in the manner proffered by the Examiner would have been "uniquely challenging or difficult for one of ordinary skill in the art," *Leapfrog Enters., Inc. v. FisherPrice, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007), nor has Appellant provided any objective evidence of secondary considerations, which our reviewing court guides "operates as a beneficial check on hindsight." *See Cheese Sys., Inc. v. Tetra Pak Cheese and Powder Sys., Inc.*, 725 F.3d 1341, 1352 (Fed. Cir. 2013).

Accordingly, Appellant has not shown the Examiner erred in rejecting claim 24, and claims 4, 5, 10, 11, 20–22, 25, 27, 28, and 31–38 , which are not separately argued and thus falling therewith, over Loncarevic, Lim and Windebank. Appellant does not provide substantive arguments for claims 2, 3, 6, 8, 9, 13, 14, 16, 29, and 30 separate from those for claim 24. Accordingly, we also affirm the Examiner's rejections of: claims 2, 3, 13, and 14 over Loncarevic, Windebank, Lim, and Stocker; claims 6, 8, 16, and 29 over Loncarevic, Windebank, Lim, and Sufrin-Disler; and claims 9 and 30 over Loncarevic, Windebank, Lim, Sufrin-Disler and Dunn.

CONCLUSION

In summary:

| **Claims Rejected** | **Basis** | **Affirmed** | **Reversed** |
|---|---|---|---|
| 4, 5, 10, 11, 20–22, 24, 25, 27, 28, and 31–39 | § 103(a) Loncarevic, Windebank, Lim | 4, 5, 10, 11, 20–22, 24, 25, 27, 28, and 31–39 | |
| 2, 3, 13, and 14 | § 103(a) Loncarevic, Windebank, Lim, and Stocker | 2, 3, 13, and 14 | |
| 6, 8, 16, and 29 | § 103(a) Loncarevic, Windebank, Lim, and Sufrin-Disler | 6, 8, 16, and 29 | |
| 9 and 30 | § 103(a) Loncarevic, Windebank, Lim, Sufrin-Disler and Dunn | 9 and 30 | |
| | | | |
| **Overall Outcome** | | 2–6, 8–11, 13, 14, 16, 20–22 and 24–39 | |

V. DECISION

We affirm the Examiner’s rejections of claims 2–6, 8–11, 13, 14, 16, 20–22 and 24–39 under 35 U.S.C. § 103(a).

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).

<u>AFFIRMED</u>