

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

UNILOC 2017 LLC,
Patent Owner.

Case IPR2018-00523
Patent 6,661,203 B2

Before MIRIAM L. QUINN, CHARLES J. BOUDREAU, and
JOHN F. HORVATH, *Administrative Patent Judges*.

QUINN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318

I. INTRODUCTION

We instituted *inter partes* review pursuant to 35 U.S.C. § 314 to review claims 1–10, 15–25, and 29 of U.S. Patent No. 6,661,203 B2 (Ex. 1001, “the ’203 patent”), owned by Uniloc 2017 LLC. Paper 8 (“Dec. on Inst.”). We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that claims 1–4, 7–10, 15–19, 22–25, and 29 of the ’203 patent are unpatentable, but Petitioner has not shown that claims 5, 6, 20, and 21 are unpatentable.

II. BACKGROUND

A. *Related Matters*

The Petition lists several district court matters that involve the ’203 patent. Paper 2, 3. However, Patent Owner indicates in its August 8, 2018 Updated Mandatory Notice that all district court proceedings involving the ’203 patent have been terminated. Paper 7, 2.

B. *The ’203 Patent*

The ’203 patent relates to charging, discharging, and recharging rechargeable batteries under adverse thermal conditions. Ex. 1001, 1:8–12. The ’203 patent states that when a battery is being charged or discharged, internal heat is generated as current flows through the battery. *Id.* at 2:13–16. The design tradeoffs when operating a battery near its maximum operating temperature are to maintain charge and discharge currents, which may compromise the battery life and reliability, or to set the charge and

discharge current to low levels consistent with the maximum operating temperature, which makes charge and discharge unacceptably slow. *Id.* at 2:40–51. The '203 patent utilizes a temperature sensor in combination with a battery charger, or a battery conditioner, to control charging and discharging current flow as a function of the battery temperature. *Id.* at 3:58–61. Figure 1 is reproduced below.

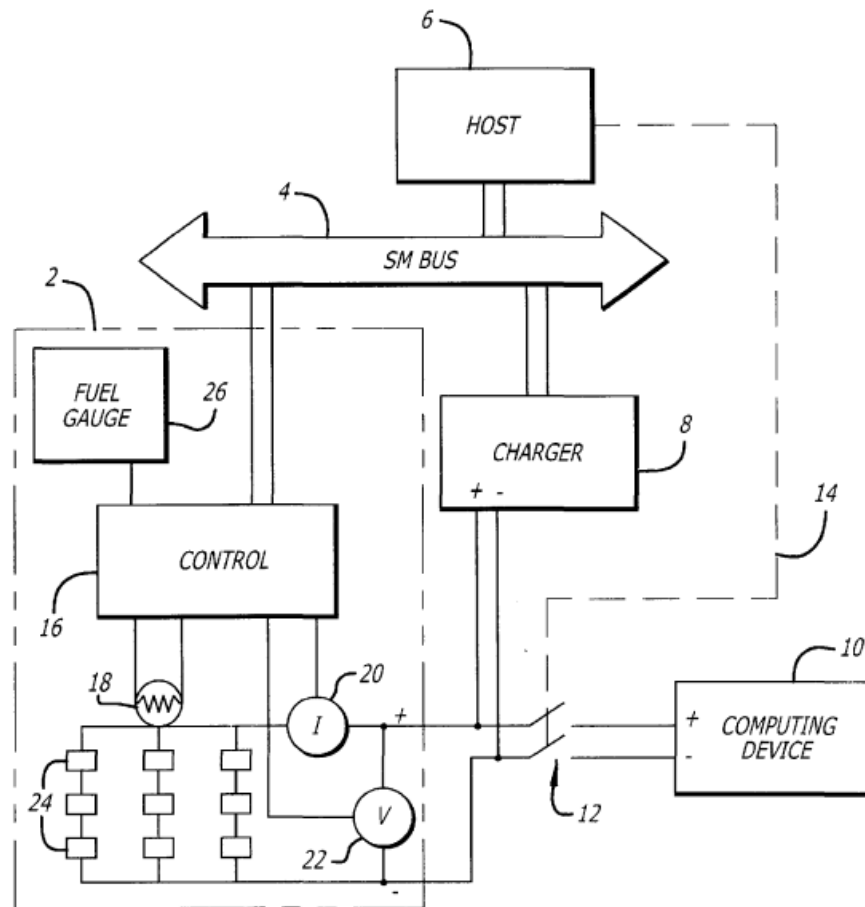


FIG. 1

Figure 1 illustrates a functional diagram of Smart Battery 2, which includes lithium cells 24, thermistor 18, controller 16, current sensor 20,

voltage sensor 22, and fuel gauge 26. *Id.* at 5:15–32. Figure 1 also depicts SMBus 4 coupled to controller 16 to communicate parameters such as the battery's terminal voltage, the rate of current flow into or out of the battery, the charge state, including whether the battery is fully charged or fully discharged, and the temperature of the battery according to the thermistor temperature sensor. *Id.* at 5:1–6, 34–36. Smart Battery 2 specification provides for a maximum charge current of 3 amps at 12.6 volts in the range of temperatures from 0°C to 45°C. *Id.* at 5:11–13. The discharge is rated at 3 amps from 0°C to 50°C. *Id.* at 5:12–13. Host controller 16 includes a memory with a look up table of charging and discharging currents related to temperatures. *Id.* at 5:61–63. Table 1 is reproduced below.

TABLE 1

Temperature	Current
Less than 45° C.	2.0 Amps
45° C. to 55° C.	1.0 Amps
55° C. to 60° C.	0.5 Amps
Greater then 60° C.	0.0 Amps

Table 1 shows illustrative charging current and temperature values. *Id.* at 5:65–6:9. Host controller 16 periodically requests the battery temperature from the smart battery and uses this value to access the memory look up table to select a charging current associated with that temperature. *Id.* at 6:10–13.

C. Illustrative Claims

Of the challenged claims, claims 1, 8, 16, and 23 are independent. Each of challenged claims 2–7, 9, 10, 15, 17–22, 24, 25, and 29 depends directly or indirectly from claims 1, 8, 16, or 23.

Claims 1 and 8 are illustrative:

1. An apparatus for charging a battery comprising:
 - a charging circuit for providing a charging current to the battery;
 - a temperature sensor positioned to sense a temperature of said battery; and
 - a controller coupled to said temperature sensor and said charging circuit and operable to control said charging circuit in accordance with said temperature, said controller operable to set said charging current to zero when said temperature is higher than a first predetermined threshold value.
8. An apparatus for exercising a battery, comprising:
 - a charging circuit having a charging current output coupled to the battery;
 - a temperature sensor positioned to sense a temperature related to the battery temperature;
 - a discharging circuit having a discharging current input coupled to the battery; and
 - a controller coupled to said temperature sensor, said charging circuit, and said discharging circuit, said controller operable to set said charging current in accordance with said temperature, and operable to set said discharging current in accordance with said temperature, said controller being operable to set said discharging current to zero when said temperature is higher than a first predetermined threshold value.

Ex. 1001, 7:34–45, 8:1–15.

D. Procedural History

Petitioner, Apple Inc., filed a Petition for *inter partes* review challenging claims 1–10, 15–25, and 29 of the ’203 patent. Paper 2 (“Pet.”). Patent Owner, Uniloc 2017 LLC, filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). We instituted trial on August 31, 2018. Dec. on Inst. During trial, Patent Owner filed a Patent Owner Response (Paper 10, “PO Resp.”), Petitioner filed a Reply (Paper 11, “Reply”), and Patent Owner filed a Sur-Reply (Paper 12, “Sur-Reply”). Both parties requested oral argument, which took place on May 29, 2019, the transcript of which is filed in the record as Paper 18 (“Tr.”).

E. Asserted Prior Art and Grounds of Unpatentability

This proceeding relies on the following prior art references:

- a) *Koenck*: U.S. Patent No. 4,709,202, issued November 24, 1987, filed in the record as Exhibit 1005;
- b) *Doi*: JP Patent App. No. H11-283677, published October 15, 1999, an English translation of which is filed in the record as Exhibit 1007; and
- c) *Sakakibara*: U.S. Patent No. 6,204,641 B1, issued March 20, 2001, filed in the record as Ex. 1006.

Petitioner asserts the following grounds of unpatentability (Pet. 12–13):

Challenged Claims	Basis	References
1, 5–8, 15, 16, 20–23, and 29	§ 103(a)	Koenck and Doi
2–4, 9, 10, 17–19, 24, and 25	§ 103(a)	Koenck, Doi, and Sakakibara

Petitioner also relies on a Declaration of Menahem Anderman, Ph.D., filed as Exhibit 1003 (“Anderman Decl.”), and a Supplemental Declaration of Menahem Anderman, Ph.D., filed as Exhibit 1009 (“Second Anderman Decl.”). Other than demonstratives for its oral argument, Patent Owner did not file any exhibits in the record.

III. ANALYSIS

A. Claim Construction

In our Decision on Institution we adopted Petitioner’s construction for one term recited in dependent claim 6: “maximum charging temperature.” Dec. on Inst. 7–8. That construction is “the highest battery temperature at which the maximum charging current can be used.” *Id.* (citing Pet. 9–12) (emphasis omitted). Patent Owner submits that the Board does not need to construe any claim term in this proceeding. PO Resp. 4.

The Board interprets claim terms of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent.” 37 C.F.R. § 42.100(b) (2018);¹ *see Cuozzo Speed Techs., LLC v. Lee*, 136 S.

¹ A recent amendment to this rule does not apply here because the Petition

Ct. 2131, 2144–46 (2016). We presume a claim term carries its “ordinary and customary meaning,” which is the meaning “the term would have to a person of ordinary skill in the art” at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (citation omitted).

Applying the plain and ordinary meaning to the term “maximum charging temperature,” we agree with Petitioner that term means “the highest battery temperature at which the maximum charging current can be used.” The specification provides support for this meaning by describing that the “Smart Battery specifications provide a maximum charge current to 3 amperes at 12.6 volts in the range of temperatures from 0° C. to 45° C.” Ex. 1001, 5:9–12. In Table 1, the specification correlates the charging current of 2.0 amps for the temperature range of “Less than 45° C.” *Id.* at 6:5. Thus, it flows from the specification that when the claim language refers to a predetermined threshold as the battery’s “maximum charging temperature,” it is referring to the upper limit of the range at which a maximum specified charging current can be applied, e.g., 45° C. Accordingly, we construe the term “maximum charging temperature” to mean “the highest battery temperature at which the maximum charging current can be used.”

The parties do not raise any other claim construction issue for us to decide. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868

was filed before November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018).

F.3d 1013, 1017 (Fed. Cir. 2017); *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

B. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (internal quotation and citation omitted). In that regard, Petitioner proffers that a person having ordinary skill in the art would have a Bachelor’s degree in Electrical Engineering, Chemistry (or similar), or Physics (or similar), or equivalent training, as well as approximately two to three years of experience working in designing and developing rechargeable battery systems. Pet. 9 (citing Ex. 1003, 6). On the current record, Patent Owner neither challenges Petitioner’s proffered level nor proposes a competing level of ordinary skill in the art. PO Resp. 3.

We find that Petitioner’s assessment is consistent with the level of ordinary skill in the art at the time of the invention as reflected in the prior art in the instant proceeding. For example, Koenck (Ex. 1005) describes a battery system capable of optimizing the performance of a rechargeable electrochemical storage medium while at the same time maximizing its useful life, which we find would be within the purview of a person having the background set forth by Petitioner. Ex. 1005, 1:14–18, Fig. 5.

Accordingly, we adopt the level of ordinary skill in the art proposed by Petitioner.

C. Obviousness over Koenck and Doi

Petitioner contends that Koenck discloses all the limitations of independent claims 1, 8, 16, and 23, except that for limitations reciting setting the charging/discharging current to zero, Petitioner also relies on Doi. Pet. 31–33. For dependent claims 5–7, 15, 20–23, and 29, Petitioner relies exclusively on Koenck as disclosing the further recited limitations. *Id.* at 33–40, 51–53, 55, 56, 60. In our Decision on Institution, we determined that for this ground, Petitioner had shown a reasonable likelihood of prevailing on its assertion that independent claims 1 and 16 and dependent claims 7, 15, 22, and 29 would have been obvious over Koenck alone or in combination with Doi. Dec. on Inst. 12–23. We determined, however, that Petitioner had not demonstrated a reasonable likelihood that claims 5, 6, 20, and 21 are unpatentable as asserted. After consideration of the full record before us, we determine that Petitioner has proven by a preponderance of the evidence that claims 1, 7, 8, 15, 16, 22, and 23 would have been obvious as asserted over Koenck alone. We also determine, as discussed below, that Petitioner failed to show by a preponderance of the evidence that claims 5, 6, 20, and 21 would have been obvious over Koenck and Doi.

1. Overview of Koenck (Ex. 1005)

Koenck is entitled “Battery Powered System,” and is directed to a battery system capable of optimizing the performance of a rechargeable electrochemical storage medium, while at the same time maximizing its useful life. Ex. 1005, [54], 1:15–18. Koenck describes that, “[f]or the sake

of recharging of a battery system as rapidly as possible without detriment to an optimum useful life span, battery parameters including battery temperature can be monitored during a charging cycle and the battery charging current can be adjusted accordingly.” *Id.* at 1:44–49. Figure 5, depicting Koenck’s battery system, is reproduced below.

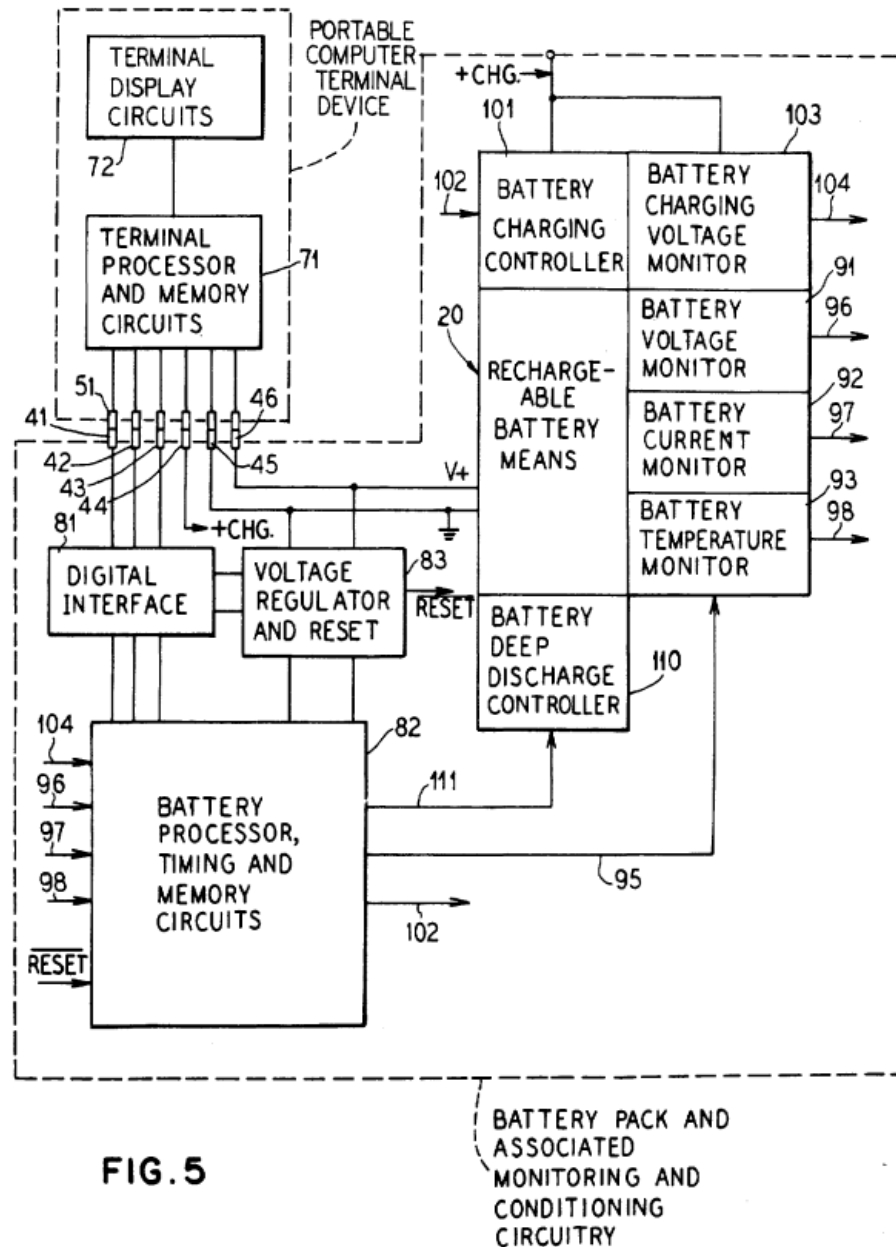


Figure 5 illustrates an exemplary circuit diagram of the battery pack and associated monitoring and conditioning circuitry in accordance with one embodiment. *Id.* at 6:11–12. In particular, the battery pack includes a battery processor (in component 82), voltage monitor 91, current monitor 92, and temperature monitor 93. *Id.* at Fig. 5. The battery processor sends digital signals over line 95 to each of monitors 91–93. *Id.* at 6:62–67. The digital signals are converted to analog values and compared to analog measurements made by monitors 91–93 (i.e., battery voltage, current, and temperature). *Id.* at 6:62–7:5. This allows the measured analog values to be digitally approximated. *Id.* at 14:1–60, Fig. 10. “The digital measurement values so determined may be utilized as a basis for updating battery condition information in the memory of component 82.” *Id.* at 7:9–12. In this way, during a battery charging cycle, the battery processor is supplied with battery operating information from which an optimum battery charging current can be selected. *Id.* at 7:43–46.

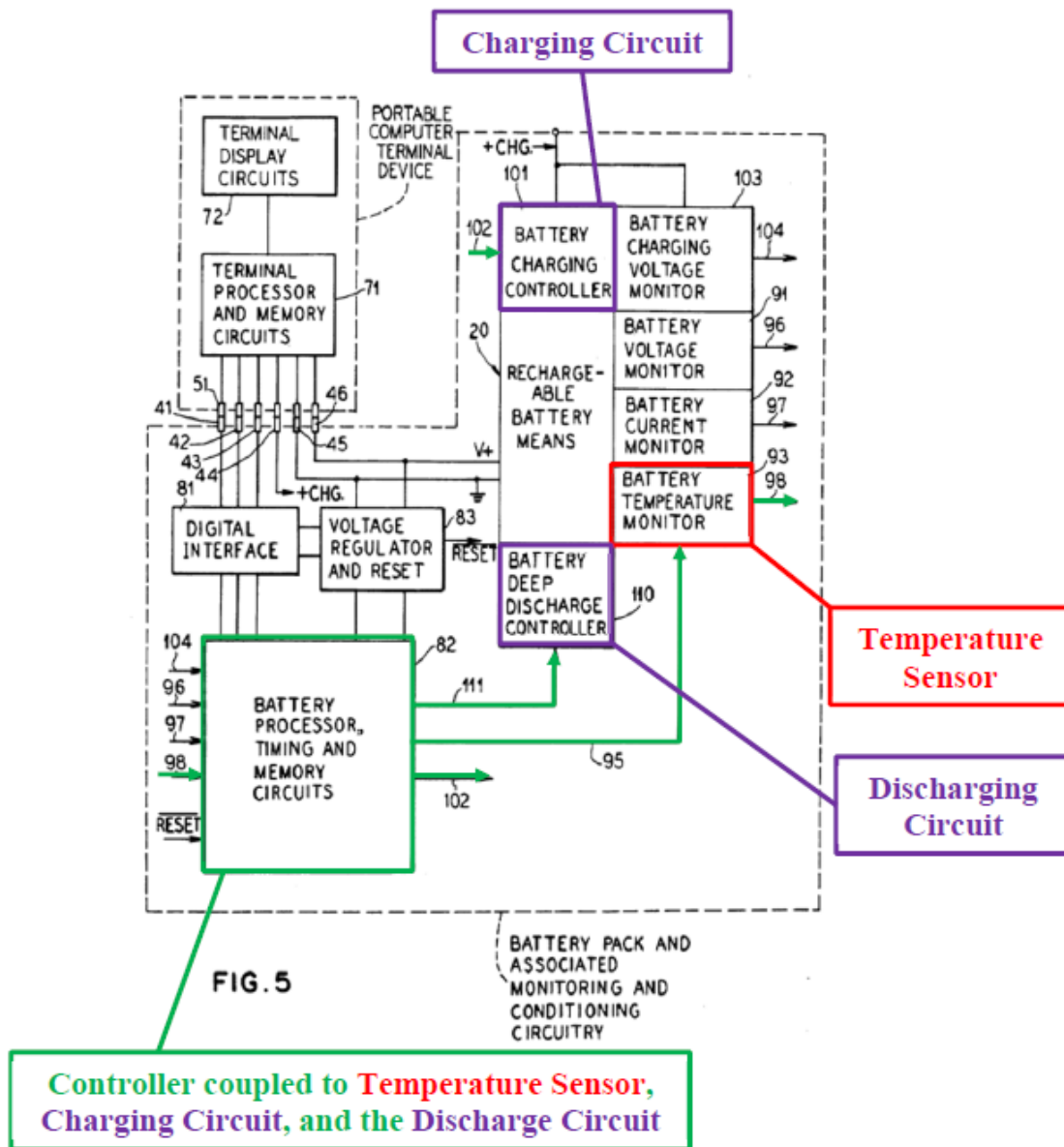
2. Overview of Doi (Ex. 1007)

Doi describes a battery pack with a switching circuit for stopping charging and discharging, and a circuit for monitoring the condition of a secondary battery. Ex. 1007, 2. Doi states that when discharging with an overcurrent exceeding the maximum permissible current, the temperature of lithium ion batteries rises excessively, the cycle characteristic deteriorates irrevocably, and the safety valve operates and the battery becomes unusable. *Id.* ¶ 4. When charging using an overcurrent, the battery temperature increases abnormally and battery life is shortened. *Id.* ¶ 5. Doi discloses a charge/discharge control circuit comprising a monitoring circuit for monitoring the condition of each lithium ion battery and the connection state

of the electronic devices, and a switching circuit receiving a signal from this monitoring circuit to turn the charge and discharge currents ON and OFF via charge and discharge field-effect transistors (“FETs”). *Id.* ¶ 8. In particular, the monitoring circuit includes a microcomputer and a measuring unit, which includes a temperature measuring circuit for measuring the heat generation temperature of the lithium ion battery. *Id.* ¶ 9. The microcomputer determines the heat generation condition, among other conditions, based on the measurement signal from the temperature measuring circuit. *Id.* ¶ 10. In the event abnormal conditions are generated during charging, the microcomputer turns the charging FET to OFF to stop charging, and when abnormal conditions occur during discharging, the discharge FET is turned to OFF to stop discharging. *Id.*

3. Independent Claims 1 and 8

Claims 1 and 8 are apparatus claims and recite similar structures, except that claim 1 focuses on the charging circuit, while claim 8 recites both charging and discharging circuits. The Petition alleges that Koenck’s Figure 5 discloses all the structural limitations recited in the independent claims, as shown in the annotated Figure 5 provided in the Petition and reproduced below:



The above figure is an annotated version of Koenck's Figure 5, provided by Petitioner at page 14 of the Petition. According to Petitioner, and we agree, Koenck's battery charging controller 101 discloses the "charging circuit" of claims 1 and 8 (Pet. 21–22, 42), Koenck's battery temperature monitor 93 discloses the "temperature sensor" of claims 1 and 8

(*id.* at 23–25, 42),² Koenck’s battery deep discharge controller 110 discloses the recited “discharging circuit” of claim 8 (*id.* at 42–43), and Koenck’s component 82 (battery processor, timing and memory circuits) discloses the “controller” of claims 1 and 8 (*id.* at 25–27, 44–45). Patent Owner does not dispute any of the structural disclosures of Koenck, but focuses on the recited configuration of the controller. We discuss the recited controller’s operation in turn.

i. Controlling Charging Circuit in Accordance with Temperature

Claim 1 recites that the controller is “operable to control said charging circuit in accordance with said temperature.” Ex. 1001, 7:41–42. Petitioner offers two arguments that Koenck teaches this limitation. Pet. 28–29. First, Petitioner points out Koenck’s disclosure of line 98, which the battery uses to send information about the battery to processor 82. *Id.* at 28 (citing Ex. 1005, 7:5–9). According to Petitioner, Koenck’s disclosure teaches a person of ordinary skill in the art that the battery temperature is supplied to the battery processor via line 98. *Id.* (citing Ex. 1003, 35). Second, Petitioner points out that the control mechanism in battery processor 82 allows the battery processor to select an optimum battery charging current based on the battery temperature. *Id.* at 28–30 (citing Ex. 1005, 7:17–19, 7:27–52, Fig. 5; Ex. 1003, 36). We agree with these arguments and the evidence provided in support that Koenck’s battery processor receives

² Petitioner relies on the temperature sensor of Koenck as teaching the “sensing a temperature” limitations recited in claims 16 and 23, discussed further below. Pet. 53, 57. We agree that Koenck’s temperature sensor teaches the limitations of claims 16 and 23 regarding the battery temperature sensor.

battery information that includes the battery temperature and selects the optimum battery charging current, using that information.

In our Decision on Institution, we did not rely on a further argument Petitioner made concerning Figure 6 of Koenck, reproduced below, because the significance of Figure 6 was unclear from the explanations provided in the Petition. Dec. on Inst. 15.

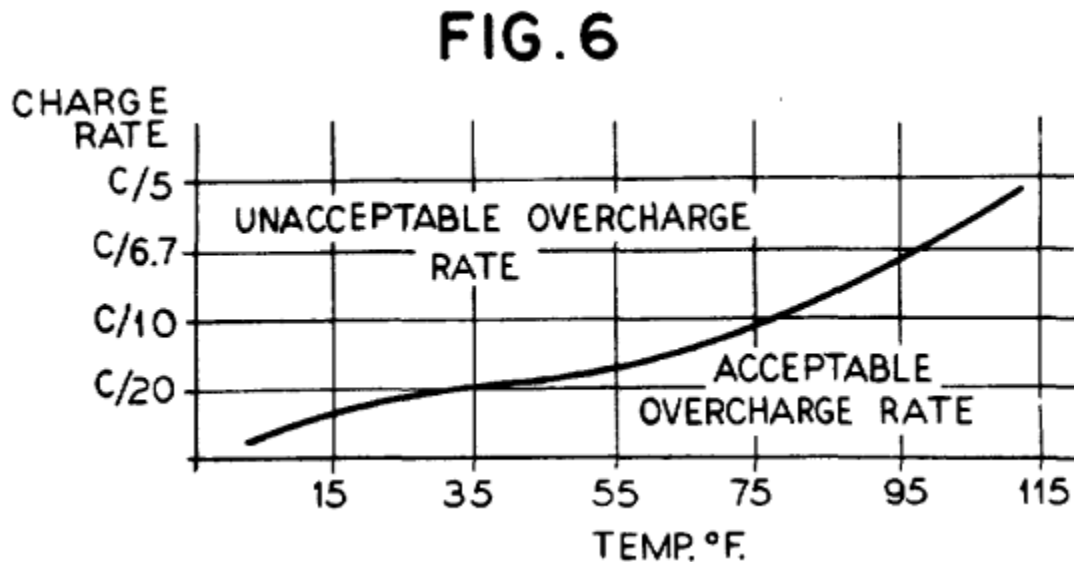


Figure 6, above, is described by Koenck as “a typical plot of permissible continuous overcharge rate as a function of temperature, for a particular type of rechargeable electrochemical energy storage cell.” Ex.1005, 3:36–39.

Petitioner, in the Reply, explains that Figure 6 offers an example showing the “maximum charge rate as a function of temperature.” Reply 15.

Petitioner further adds that Koenck explains Figure 6 as follows: “maximum charging rate is achieved when the charging rate can be adjusted according to quantitative measurement of battery temperature during the charging cycle.” *Id.* (citing Ex. 1005, 8:17–18, 8:22–25) (emphasis omitted); Pet. 30–31. According to Petitioner, by adjusting the charge rate according to temperature measurements, the charging current is set in accordance with

temperature. *Id.* This explanation highlights that Koenck teaches a relationship between charging rates and the battery temperature. The plot of Figure 6 shows how the maximum “overcharge” rate (which refers to the amount of charging current at which point the current is mostly generating oxygen rather than increasing the charge) increases with higher temperatures. Ex. 1005, 7:26–45, Fig. 6. For instance, Figure 6 shows that at 75° F, the plotted charge rate is C/10, but at 35° F, the plotted charge rate is C/20. *Id.* at Fig. 6. The C/10 charge rate (10 amps) is higher than the C/20 charge rate (5 amps), and thus, as temperature decreases from 75 to 35 degrees, the corresponding charge rate also decreases from 10 amps to 5 amps. *Id.* Thus, Koenck is explicit in teaching the technique of adjusting the charging rate in accordance with the temperature of the battery. We recognize that the ’203 patent specification shows a seemingly opposite relationship between temperature and charge: as the temperature decreases from 60° C to 45° C the charging current increases, from 0 to 2 amps. The claim, however, only requires controlling the charging circuit “in accordance with said temperature.” Therefore, we are persuaded that Figure 6 shows supporting evidence that Koenck teaches a corresponding relationship between a charging current value and the battery temperature.

Patent Owner did not present substantive argument regarding this limitation. See PO Resp. 11 (arguing that “Patent Owner should not be expected to anticipate what significance Figure 6 has to Petitioner’s theory, if any. Rather, the rules and controlling authority are clear that Petitioner must articulate its argument in the Petition itself with enough specificity to give Patent Owner the opportunity to respond. The Petitioner has [failed] to do [so].”). As stated above, we find that Petitioner’s explanation of Figure 6

supports the contention that Koenck teaches that the battery temperature influences the charging rate, and that Koenck's battery processor is programmed to select an optimal charge current depending on the battery temperature. Based on the full record, therefore, we find that Koenck teaches the limitation of controlling the charging circuit in accordance with the temperature.

ii. *Charging Current Set to Zero*

Claim 1 recites the controller being "operable to set said charging current to zero when said temperature is higher than a first predetermined threshold value." Ex. 1001, 7:42–45 ("charging current to zero" limitation). For context, the '203 patent describes the controller as being programmed with a "look up table" of charging and discharging currents. Ex. 1001, 5:62–64. As an example of such a table, the '203 patent specification provides Table 1, reproduced below.

TABLE 1

Temperature	Current
Less than 45° C.	2.0 Amps
45° C. to 55° C.	1.0 Amps
55° C. to 60° C.	0.5 Amps
Greater then 60° C.	0.0 Amps

Table 1 shows illustrative charging current and temperature values. *Id.* at 5:65–6:9. In operation, the '203 patent describes the controller as periodically requesting the battery temperature from the smart battery and using the temperature value to access the look up table "to select a charging current associated with that temperature." *Id.* at 6:10–13. For instance, if

the temperature value is greater than 60° C (the recited “first predetermined threshold value”), the controller selects a charging current of 0.0 amps.

Petitioner argues that Koenck alone teaches setting the “charging current to zero” because Koenck describes “Over-Under Temperature Protection,” where “the unit at high temperature (seventy degrees centigrade) will cut off charging.” Pet. 32 (quoting Ex. 1005, 55:40–46) (emphasis omitted). The Anderman Declaration further provides that to a person of ordinary skill in the art, Koenck’s system sets the charging current to zero because it teaches to “cut off charging.” *Id.* (citing Ex. 1003, 40) (emphasis omitted). We agree with Petitioner that Koenck’s disclosures and the Anderman Declaration, as cited above, show that Koenck teaches the controller “operable to set said charging current to zero when said temperature is higher than a first predetermined threshold value” as recited in claim 1.

We stated in our Decision on Institution that Petitioner had met the institution burden of showing that Koenck alone teaches the limitation. Dec. on Inst. 16–17. We noted that Petitioner’s arguments showed Koenck sets the charging current to zero by “cutting off” charging at 70° C, and that the Anderman Declaration supports Petitioner’s reading of Koenck. *Id.* Patent Owner’s Response focuses most of its arguments regarding this limitation on the combination of Koenck with Doi. PO Resp. 5–8. According to Patent Owner, “[t]he Petition appears to recognize that Koenck does not expressly or inherently disclose” the limitation. *Id.* at 7 (citing Pet. 32). We do not agree with Patent Owner’s characterization of the Petition. The Petition asserts that Koenck teaches the limitation and then offers an alternative argument “to the extent that Patent Owner may argue that Koenck does not

show setting the charging current to zero.” Pet. 32. We recognized the alternative arguments in our Decision on Institution and determined that Koenck alone “reasonably maps to the limitation” so we did not need to determine whether Koenck in combination with Doi also teaches the limitation. Dec. on Inst. 17; *see also* Reply 9 (Petitioner stating that it “believes that Koenck alone is sufficient to render this limitation obvious”).

In response to Petitioner’s arguments based on Koenck alone, Patent Owner argues Koenck’s statement of “cutting off” the charging of the battery is an ambiguous line and that the Anderman Declaration is conclusory and lacks “reasoned analysis or technical explanation apart from the conclusion.” PO Resp. 11–12. Instead, according to Patent Owner, Doi refutes the Anderman Declaration on this point because although Doi is designed to turn off charging, a measurable current is nevertheless still provided to the battery. *Id.* at 11. We are not persuaded by Patent Owner’s arguments.

First, we do not find Koenck’s disclosure ambiguous. Koenck discloses protecting the battery system from damage or degradation by cutting off the charge to the battery at high temperatures and low temperatures (“[o]ver-[u]nder [t]emperature [p]rotection”). Ex. 1005, 55:40–46. Koenck describes that at 70° C, which corresponds to the recited “first predetermined threshold value,” the “unit . . . will cut off charging” and that at a temperatures of -10° C, the “temperature charging stops.” *Id.* The description is unmistakably disclosing that Koenck is programmed to stop charging at the two extreme thresholds of 70° C and -10° C. Koenck describes this operation as “cut off charging,” in the same vein it describes “temperature charging stops.” *Id.* From this disclosure we draw only one

inference: that Koenck intends for the unit not to send *any* current to charge the battery when the temperature exceeds either threshold. We find no ambiguity in Koenck's disclosure. Patent Owner's argument urges us to draw an inference contrary to the teaching of Koenck: that notwithstanding the teaching of "cut off charging," some measurable charge current may still flow. PO Resp. 11–12; Sur-Reply 8. But there is no teaching in Koenck that it is designed to allow for a charge current to flow during cut-off or that Koenck's charge current flows despite its design to "cut off charging." We have no disclosure in Koenck from which we can draw the inference that Patent Owner asserts. To the contrary, Koenck is internally consistent that no charge, however marginal, is expected to flow to the battery because it discloses that at above 70° C the charge duty cycle is specified to be at 0%. See Ex. 1005, 57, Table D; Tr. 27:5–21 (discussing that the pseudo code of Koenck shown in Table D shows that, at temperatures greater than 70 degrees, Koenck cuts off the charge). This disclosure of Koenck confirms our understanding and Petitioner's characterization of Koenck, and refutes Patent Owner's contention that some current may still flow. With a 0% charge duty cycle at above 70°C, the disclosure of over temperature protection to "cut off charging" (and, therefore, zero current generated for the battery charge) is confirmed, because the charging circuitry would be off.

Second, the Anderman Declaration confirms this plain reading of Koenck by stating that a person of ordinary skill in the art would understand that Koenck's system effectively sets the charging current to zero. Ex. 1003, 40. We agree. And we do not see this testimony as deserving less weight as Patent Owner argues. We have been presented with credible testimony that

to a person of ordinary skill in the art, the words “cut off” charging mean that Koenck is setting the charging current to zero. We have no basis by which to discredit or disallow this testimony. Although it is true that the testimony is succinct on this point, we are not sure that more is needed, especially in light of Koenck’s consistent and direct disclosure.

Third, we are not persuaded that Doi’s teachings override the teaching of Koenck. Even if we were to agree with Patent Owner that Doi is designed to allow a measurable charging current to flow to the battery while alleging to “turn off” charging (PO Resp. 11), Koenck has not been shown to be designed to do the same thing. Essentially, Patent Owner urges that we view Doi as evidencing a general understanding of a person of ordinary skill in the art that “cut off” charging does not mean setting a current to zero. Patent Owner’s argument is unpersuasive because, although Doi may allegedly be designed to allow a charging current at cut-off,³ Koenck may not have been designed to work in the same manner. Again, absent factual evidence that Koenck is designed to operate as Doi operates, we cannot say that Koenck would operate just as Doi discloses. To the contrary, Doi’s evidentiary value in this case is as a prior art reference with teachings Petitioner must show would have been combined with Koenck. Unless

³ We express doubt about the technical soundness of Patent Owner’s argument in this regard. Petitioner has explained, with support from its technical expert, that the leakage or parasitic current in Doi is a charging current that occurs while the charging circuit is designed to be “on.” Reply 13 (citing Ex. 1009 ¶ 6). This characterization of Doi appears to be reasonable and supported by Doi (Ex. 1007 ¶ 137). Thus, even though we have entertained Patent Owner’s arguments on the matter, the evidence of record does not appear to support Patent Owner’s characterization of Doi as allowing a charging current while the charging circuit has been turned “off.”

Koenck's and Doi's teachings have been shown to be combined as required by the law of obviousness, we may not assume that Koenck would have been modified to work as Doi teaches. We find instead that on a full record, even considering Patent Owner's arguments concerning Doi, Koenck's cut-off charge would have been understood by a person of ordinary skill in the art as setting the charge current to zero. Doi's alleged teachings to the contrary do not alter the clear teachings of Koenck concerning "cutting off" the charging current, and, thus, setting the current to zero.

Finally, as stated in our Decision on Institution, Patent Owner focuses on unrecited features concerning actual current flow, rather than merely "setting" the charging current to zero, which is what the claim requires. Dec. on Inst. 18. Thus, even if a leakage current, or other small charging current, could occur, a proposition for which we find no evidence anywhere in Koenck, the claim is directed to the controller's operability to "set" the current to a zero value and control the charging circuit accordingly, which Koenck does. The claim does not prevent or preclude any and all parasitic leakage of charging circuits such as those alleged to occur in Doi. See PO Resp. 6 (arguing that "Doi purports to advantageously use this 'well-known' principle [of current flowing through a parasitic diode] to *slowly* provide a non-zero current to the battery while it is switched off from its 'chargeable state' due to reaching an over-discharged condition."). Nevertheless, Koenck has no disclosure of either allowing or preventing leakage currents. Thus, for this additional reason, we determine that Petitioner has shown sufficiently that Koenck's battery processor programming "sets" the charging current to zero at 70° C.

iii. Discharging Current Set to Zero

Claim 8 recites the controller “operable to set said discharging current to zero when said temperature is higher than a first predetermined threshold value.” Ex. 1001, 8:13–15 (“set said discharging current to zero” limitation). We stated in our Decision on Institution that Petitioner’s argument regarding Koenck’s disclosure was sufficient to meet the limitation notwithstanding Petitioner’s reliance also on the combination of Koenck and Doi. Dec. on Inst. 18. The Petition relies on Koenck’s disclosure of software control that sets the battery discharge to OFF when the temperature exceeds 70°C. Pet. 50 (referring to the “discharging current” arguments at Pet. 46–47) (citing Ex. 1003, 60 (Appendix A)). We agree with Petitioner that Koenck teaches the limitation.

Koenck discloses pseudo code for battery maintenance. Ex. 1005, 62:16–50. That pseudo code states that if the temperature is over 70 degrees, then “BATTERY DISCHARGE = OFF.” *Id.*; *see also* Pet. 47 (providing annotated portion of the pseudo code). The testimony of Dr. Anderman, which we credit, states that a person of ordinary skill in the art would understand Koenck’s pseudo code as teaching that the software for the battery processor controls the discharge circuit to turn off if the battery is over 70° C (“[the] first predetermined threshold value”), and this would include “setting the discharging current to zero in accordance with [the] temperature sensor detecting the overheat condition.” Ex. 1003, 57, 60–61.

Patent Owner argues that Koenck does not disclose setting the “discharging current to zero” because Koenck neither mentions a “current” nor teaches the discharging current set to zero. PO Resp. 19. According to Patent Owner, Koenck “does not disclose anything regarding the discharging

current.” *Id.* at 19. Further, according to Patent Owner, Petitioner relies on conclusory speculation of its declarant, which Patent Owner contends is insufficient for Petitioner to carry its burden. *Id.* We are not persuaded by Patent Owner’s arguments. Koenck unambiguously discloses setting the battery discharge operation to OFF when the battery temperature exceeds a certain threshold (i.e., 70° C). The question for us to determine is whether this software control of turning off the battery discharge circuitry would be understood by a person of ordinary skill in the art as setting the discharging current to zero. The Anderman Declaration provides evidence that a person of ordinary skill in the art would, indeed, understand that shutting off the discharge circuit means that the discharge current is set to zero. This testimony is supported by Koenck’s straightforward disclosure. The alleged omission in Koenck of the word “current” to describe this discharge control does not persuade us that somehow Koenck could be teaching that the discharge current would be some other value when the discharge circuit is turned off. To the contrary, as Dr. Anderman testifies, shutting off the discharge circuit is intended to stop the discharge process, which means that the circuit will not draw any more current from the battery. Ex. 1003, 55 (explaining the discharge circuit operation to draw current from the battery by software control), 56 (explaining that the discharge process is discontinued if the battery temperature exceeds 70 degrees). Accordingly, we determine that Koenck teaches the “set said discharging current to zero” limitation.

Petitioner further relies on Koenck in combination with Doi as an alternative argument. Pet. 47 (arguing that “to the extent . . . Patent Owner argues that Koenck does not set the discharge[ing] current in response to

battery temperature, Doi also discloses it”), 50 (relying on the arguments made at page 47 of the petition). We do not address these additional contentions as we have relied on Koenck alone in our analysis.

iv. Set Said Discharging Current in Accordance with Said Temperature

Claim 8 requires that the controller set the discharging current in accordance with said temperature and that the controller set the discharging current to zero, as discussed above. For this limitation, Petitioner relies on Koenck’s disclosure of discontinuing the discharge when the temperature sensor detects that the temperature is over 70°C. Pet. 46 (citing Ex. 1003, 55). We agree with Petitioner’s arguments and evidence that Koenck teaches the limitation. As described above with respect to the “set discharge current to zero” limitation, Koenck monitors the temperature of the battery to control the discharge current process in accordance with that temperature.

4. Independent Claim 16

Claim 16 is a method claim and tracks closely functions recited in claim 1. In particular, claim 16 requires setting the charging current in accordance with temperature and setting the current to zero if it exceeds a first predetermined threshold value. Ex. 1001, 8:44–49. Petitioner relies on the evidence and arguments discussed above with respect to claim 1. Pet. 53–55. For the reasons stated with respect to claims 1 and 8, we determine that Petitioner has shown that Koenck teaches all the limitations of claim 16.

5. Independent Claim 23

Claim 23 is a method claim and tracks closely functions recited in claim 8. In particular, claim 23 requires setting the charging current and

discharging current in accordance with the temperature, and setting the discharging current to zero when the temperature is higher than a first predetermined threshold value. Ex. 1001, 9:7–8, 13–17. Petitioner relies on the same arguments and evidence presented for claim 8 with respect to these limitations. Pet. 56–57, 59. For the reasons set forth in our discussion of these limitations above (sections 3.i–iv), we determine that Petitioner has met the burden of showing that Koenck alone teaches these limitations.

Claim 23 recites a further limitation, “discharging the battery at said discharging current.” Ex. 1001, 9:8–9. According to Petitioner, Koenck teaches this limitation because of its disclosure of setting the discharge operation to “OFF” based on the battery temperature. Pet. 57 (citing Ex. 1003, 68). Petitioner argues that setting the discharge operation to either on or off based on the battery’s temperature includes setting the discharge current to zero when the discharge circuit is deactivated to satisfy the “OFF” command. *Id.* Patent Owner does not address this further limitation of claim 23. We agree with Petitioner’s explanation and evidence and determine that Koenck teaches this limitation.

Claim 23 also recites “discontinuing said discharging step when a predetermined battery voltage is reached.” Ex. 1001, 9:11–12. Petitioner relies on Koenck as teaching this limitation. Pet. 58–59. In particular, Koenck discloses the discharge operation proceeds “at a predetermined rate until such time as the battery means 20 exhibits a battery output voltage of a predetermined value, for example, four volts where components 71 and 72 of the terminal device require a minimum operating voltage of say 4.5 volts.” Ex. 1005, 8:1–6. We agree with Petitioner that Koenck teaches the

limitation because it discloses that the discharge operation will proceed until the battery voltage measures four volts.

6. Conclusion Regarding the Challenged Independent Claims

Based on the foregoing, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 8, 16, and 23 would have been obvious over Koenck. We recognize that Petitioner has relied on a combination of Koenck and Doi in the alternative, particularly with respect to the zero-current limitations. However, because we have found that Petitioner met its burden of showing unpatentability with regard to Koenck alone, we do not address Petitioner's reliance on Doi.⁴

7. Dependent Claims 5 and 20

Claims 5 and 20 recite setting said charging current to a “maximum value” when said temperature is lower than a second predetermined threshold. Petitioner points to Koenck as teaching this further limitation. Pet. 34. For instance, Petitioner points out that Koenck's units will “taper back charge rate at low temperature below 10[°] C. and cut back to trickle rates at high battery temperature above 55° C.” *Id.* (emphasis omitted) (quoting Ex. 1005, 40:40–47). Petitioner concludes that a person of ordinary skill in the art would find it obvious that for “Koenck's battery to charge at maximum rate when at or below 55° C, the battery processor would apply a maximum charge current in order to achieve the maximum charge rate.” *Id.* at 35 (citing Ex. 1003, 42). We stated in our Decision on

⁴ We address Doi (in section C.3.ii) only insofar as Patent Owner relied on Doi's teachings to support the contention that Koenck's teachings and the Anderman Declaration are insufficient proof of obviousness.

Institution that we were not persuaded by Petitioner's arguments and evidence because Petitioner did not show any disclosure in which Koenck discloses a maximum rate or a maximum charging current. Dec. on Inst. 21–22.

In Reply, Petitioner explains that claims 5 and 20 “simply require[] that the highest value of charging current for a particular battery be selected when the temperature falls below a chosen threshold.” Reply 18 (citing Ex. 1009 ¶ 10). Petitioner cites Koenck's disclosure of a “maximum charging rate.” *Id.* (citing Ex. 1005, 8:22–25). And Koenck also states that when reaching above 55° C, the rate charge will be cut back to trickle rates. *Id.* at 19 (citing Ex. 1005, 40:40–57; Ex. 1009 ¶ 10). Therefore, according to Petitioner, Koenck applies the maximum charge rate when the battery temperature is below 55° C. *Id.* (citing Ex. 1003, 42–43). Recognizing that in our Decision on Institution we found Petitioner's assertion lacking, at least in part, because Petitioner did not show setting a charging current to a “maximum *value*,” Petitioner replies that Koenck teaches using a constant current rate at the charge rate C/8.3 for a normal recharge. Reply 20 (citing Ex. 1005, 39:55–58; Ex. 1009 ¶ 12). Petitioner argues that the claims, however, do not require any particular value. Reply 19 (citing Ex. 1009 ¶ 11).

Patent Owner challenges Petitioner's reply contentions. Sur-Reply 20–21. In particular, Patent Owner argues that the claims do require a value, and that Petitioner's reply contentions otherwise are conclusory. *Id.* at 20. Patent Owner also argues that regardless of Petitioner's position on this issue, the claim language requires setting a charging rate to a value that is identified as the maximum value. *Id.* According to Patent Owner, Koenck's

disclosure of C/8.3 as the charging rate in normal recharge mode is not identified as being a “maximum value” of charging current, and Dr. Anderman does not expand on Petitioner’s conclusory assertion. *Id.* at 21.

At oral argument, Petitioner clarified further that when the battery is operating between 10 and 55 degrees, “Koenck would seek to apply the maximum charging rate for that temperature range.” Tr. 23:13–16. Petitioner further argued that within that range (one of the four temperature ranges that Koenck discloses), a recharge rate of C/8.3 would be applied, as the temperature of the battery would be in the normal range. *Id.* at 23:22–24, 25:7–12. Patent Owner objected to these Petitioner arguments as new arguments presented for the first time in Reply. *Id.* at 47:9–24.

We do not find that Petitioner has demonstrated that Koenck teaches setting a charging current to a maximum value when the temperature is lower than a second predetermined threshold value. The Petition asserts that 55° C is the second predetermined threshold value. Pet. 35. Koenck discloses using a “trickle charge rate” if the temperature is above 55° C. Ex. 1005, 40:40–47. But none of the citations *in the Petition* or relied on by the Anderman Declaration describe what charge rate is applied at a temperature below 55° C, much less that the charge rate would correspond to a maximum value. Accordingly we give the Anderman Declaration little weight in this regard.

Petitioner relies on contradictory evidence in the Reply, and, therefore, we find Petitioner’s arguments based on that evidence unpersuasive. First, Petitioner relies on evidence presented for claim 1 for the proposition that Koenck’s Figure 6 discloses a plot illustrating

“maximum charge rate as a function of temperature.” Reply 18–19 (citing Pet. 31, which describes claim 1 limitations). The arguments concerning claim 5 in the Petition did not rely on the Figure 6 disclosure, nor did the expert rely on the Figure 6 disclosure (and corresponding explanation) to opine on the claim 5 limitation of a “maximum value” of a charging current. Thus, the Petition offers little to no explanation as to how Figure 6 supports Petitioner’s contentions regarding claim 5.

Nevertheless, we address Petitioner’s reply evidence by noting that the Figure 6 “plot” presents a curving line, showing potential charge rates and corresponding temperatures in Fahrenheit scale, illustrating 115° F (about 46° C) as the highest temperature. *See* Ex. 1001, Fig. 6. Figure 6 does not demonstrate that a person of ordinary skill in the art would understand that Koenck discloses a maximum charge rate up to 55° C (131° F), which Petitioner equates with the recited “second predetermined threshold value.” Moreover, to the extent the plot of Figure 6 shows potential “maximum” charging rates according to temperature, the plotted rates continuously change as the temperature increases over the temperature range shown. *Id.* Thus, for temperatures lower than 115° F, the alleged “maximum” charge rate is a constantly changing function of temperature, ranging from C/5 at 115° F down to C/20 at 35° F. *Id.* The claim requires setting the charging current to a maximum value when the temperature is lower than the threshold. When Koenck’s battery temperature is lower than the highest plotted temperature (which is not the temperature Petitioner identified as the “second predetermined threshold”), Figure 6 does not show (nor does Koenck describe) that the battery processor sets the maximum value of the charging current to any one of the *plotted* charging currents, all

of which could be considered “maximum” charging currents at their respective temperatures, but none of which has been shown to be the maximum value to which Koenck’s charging current is set.

Instead, we find that Figure 6 teaches a range of “acceptable” charging rates, where the plotted line shows the maximum “acceptable” charge rate. *Id.* (labeling the area below the plotted line as “acceptable overcharge rate” and the area above as “unacceptable overcharge rate”). Thus, although Figure 6 may be evidence that Koenck recognizes that charge rates can be controlled in accordance with temperature, Figure 6 does not show that Koenck utilizes the plotted values *to set the charging current* to the “maximum value,” as recited in claim 5.

Second, Petitioner also argues that Koenck charges the battery at C/8.3 charge rate during a normal recharge, which corresponds to the condition of the battery having temperatures below 55° C (but no lower than 10° C). Koenck describes the recharge as providing a constant current rate at C/8.3. Reply 20 (citing Ex. 1005, 39:55–58). There is no disclosure identified by Petitioner in which the C/8.3 or “recharge” rate is a maximum value of the charging current. Indeed, Koenck appears to disclose that the charge current could be as high as 0.66 amps for a constant charge (Ex. 1005, 41:38–40), yet, Koenck’s charge rate at C/8 is only .275 amps (*id.* at 49:37–39). Furthermore, if C/8.3 were a maximum value for recharge over the temperature range between 10°C and 55° C, as Petitioner argues, Figure 6 does not show this. *Id.* at Fig. 6 (showing that C/8.3 is the maximum “acceptable” charge rate only at a temperature of approximately 80° F (about 26° C)). Even if we assumed that Figure 6 erroneously labeled the temperatures in Fahrenheit scale rather than Celsius, at the 55 degree mark,

the plot shows a “maximum” charge rate of approximately C/15, which is well below C/8.3 charge rate that Petitioner alleges constitutes the “maximum value.”

Petitioner’s evidence and arguments, as discussed above, show such significant internal inconsistency that we are not persuaded by them. Figure 6, although showing the capabilities of Koenck to program any number of charge rates in accordance with temperature, does not show that Koenck utilizes the plotted charge rates *to set* the charging current at the corresponding temperatures. We note that Koenck does describe that it could be programmed with variable recharge rates, and even a “fast” charge rate. Ex. 1005, 40:11–15, 43:46–51; *see* Sur-Reply 21–22. It is Petitioner’s burden, however, to show that it would have been obvious for Koenck to set the charging current to a maximum value when the temperature is below 55° C. None of Figure 6, the C/8.3 recharge rate, or the description of a “maximum charge rate” teaches setting the charging current to a maximum value as recited in claim 5.

Petitioner relies on Koenck alone to teach the limitations of claims 5 and 20, and does not rely on any disclosure in Doi. Therefore, we are not persuaded that Petitioner has shown by a preponderance of the evidence that claims 5 and 20 would have been obvious over Koenck and Doi.

8. Dependent Claims 6 and 21

Claims 6 and 21 depend from claims 5 and 20, respectively, and recite that the “maximum value” is the “battery’s maximum specified charging current” and that the “second predetermined threshold value” is the “battery’s maximum charging temperature.” Ex. 1001, 7:61–64, 8:64–67. We construed the term “maximum specified charging current” as “the

highest battery temperature at which the maximum charging current can be used.” *See supra*, Section A.

i. “battery’s maximum specified charging current”

The Petition relies on Koenck’s disclosure that “utilizing a maximum charging rate is achieved when the charging rate can be adjusted according to quantitative measurement of battery temperature.” Pet. 35–36 (emphasis omitted). Petitioner posits that a person of ordinary skill in the art “would use the battery’s maximum specified charging current in order to achieve the maximum charging rate when the battery temperature is at or below 55°C.” *Id.* at 36 (relying on Ex. 1003, 43–44). The Petition concludes that Koenck’s disclosure of achieving the maximum charge rate and applying the maximum charging current when below 55° C renders obvious the recited “maximum value” that is the “battery’s maximum specified charging current.”

We stated in our Decision on Institution that the argument and evidence presented by Petitioner (including the Anderman Declaration) was not sufficient to show that Koenck teaches the limitation. Dec. on Inst. 22.

In the Reply, Petitioner argues that maximum charging currents for batteries were well known in the field and that a person of ordinary skill in the art would readily have known to look to this metric in selecting a “maximum charging rate.” Reply 21 (citing Second Anderman Decl. ¶ 14). Petitioner states that “[t]o the extent that the Board requires a showing of a particular ‘maximum specified charging current as a maximum value,’ Koenck, as discussed above, teaches that for a normal recharge, ‘a constant current rate at C/8.3’ will charge the battery in 12 hours.” *Id.* at 22 (citing

Ex. 1005, 39:55–58). Patent Owner does not address the limitations recited in claims 6 and 21.

We are not persuaded that Petitioner has met its burden of showing that Koenck teaches the recited limitation by a preponderance of the evidence. The claim requires setting the charging current to the battery's maximum specified charging current. Petitioner asserts the same evidence that it proffered for claims 5 and 20, which we found lacking. Neither the plotted “maximum charge rate” nor the recharge rate of C/8.3 is sufficient to meet the recited limitation for the reasons stated with respect to claims 5 and 20. To summarize, we have determined that Koenck discloses a selectable charge rate anywhere between C/8 and C/100. *See* Ex. 1005, 53:34–35). Although C/8 is a disclosed *programmable* charging rate, Petitioner cites nothing in Koenck that demonstrates C/8 is the battery's maximum *specified* charging current. At most, Koenck states that its battery pack comprises four main nickel-cadmium cells rated at 2.2 ampere-hours. Ex. 1005, 4:41–46; *see also id.* at 49:57–58 (identifying the backup battery as having a different rating, of only 225 milliamperes hours). Koenck provides no other battery specification and omits discussion as to whether the cells in the battery pack have a maximum specified charging current. Thus, we are not persuaded by Petitioner's arguments that Koenck teaches the limitation.

Furthermore, we are not persuaded by the arguments and evidence proffered in the Reply that it would have been well-known to select the battery's maximum charging current as the “maximum value.” Reply 21. First, this contention was not presented in the Petition. The Petition offered a conclusory statement that it would have been obvious to use the battery's maximum specified charging current in order to achieve the maximum

charging rate. Pet. 36. We found this assertion lacking in factual support, in Koenck or elsewhere. Dec. on Inst. 22. And we also found that the supporting expert testimony was an improper attempt to supply a missing limitation through knowledge of a person of ordinary skill in the art. *Id.* (citing *K/S Himpp v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365 (Fed. Cir. 2014)). Our opinion in this regard has not changed. The contention in the Petition alleging that it would have been obvious to select the battery's maximum specified charging current as a maximum value in Koenck is conclusory and lacks factual support. The Petition does not explain this alleged "well-known technique" to assert that Koenck either implements that technique or would have been modified to select such a maximum charging current according to the battery specification when charging in the 10–55° C range.

ii. "battery's maximum charging temperature"

For the limitation of "battery's maximum charging temperature," the Petition alleges that Koenck discloses using a "maximum charging current when the battery is below a second predetermined threshold of" 55° C. Pet. 36–37 (citing Ex. 1003, 44). Petitioner argues that the highest temperature at which the highest charging rate can be achieved is 55° C. *Id.* at 37. We agree with the logic that if Koenck's upper temperature threshold for applying the recharge mode is 55° C, then this temperature could be the highest temperature at which the highest charging rate could be achieved. However, that is not all that the claims require. Claims 6 and 21 require that the second predetermined threshold is the "battery's maximum charging temperature." There is no evidence that 55° C coincides with the battery's

maximum charging temperature. Again, Koenck is silent as to any battery specification other than the 2.2 ampere-hour rating for the main batteries.

Petitioner relies on Koenck alone to teach the limitations of claims 5 and 20, and does not rely on any disclosure in Doi. Therefore, based on the foregoing, we are not persuaded that Petitioner has demonstrated by a preponderance of the evidence that claims 6 and 21 would have been obvious over Koenck and Doi.

9. Dependent claims 7, 15, 22, and 29

Petitioner maps the further limitations recited in claims 7, 15, 22, and 29 to disclosures in Koenck. Pet. 39, 51–53, 56, 60. Claim 7 depends from claim 1, and further recites “wherein the battery is coupled to a load, and wherein said temperature sensor senses that [sic] temperature of the battery and the load.” Ex. 1001, 7:65–67. Claim 15 depends from claim 8, and further recites “wherein said temperature sensor senses the temperature of the battery and said discharging circuit.” *Id.* at 8:39–41. Claims 22 and 29 depend from claims 16 and 23, respectively, and recite similar limitations. *Id.* at 9:1–3, 9:37–39. Petitioner points us to Koenck’s discharge controller as the recited “load,” which is coupled to battery 20. Pet. 38 (citing Ex. 1005, Fig. 5). Petitioner further points out that Koenck’s temperature sensor 93 is physically disposed in heat transfer relation to the battery pack. *Id.* at 40 (citing Ex. 1005, 9:19–22). Thus, the Petition concludes that a person of ordinary skill in the art would understand that the temperature sensor would provide the temperature information of the battery pack, which includes the battery and the load. *Id.* (citing Ex. 1003, 48). We agree and are persuaded by these arguments and evidence. Patent Owner does not argue these claims separately.

We determine that Petitioner has shown by a preponderance of the evidence that claims 7, 15, 22, and 29 would have been obvious over Koenck.

D. Obviousness over Koenck, Doi, and Sakakibara

The remaining unpatentability ground, for claims 2–4, 9, 10, 17–19, 24, and 25, relies on the combination of Koenck and Doi with Sakakibara.

1. Overview of Sakakibara (Ex. 1006)

Sakakibara is directed to a battery charger and a method suitable for charging a battery that accumulates a large amount of heat during charging. Ex. 1006, 1:10–15. In particular, Sakakibara describes a battery charger with a control circuit that detects temperature of a battery and includes a memory that stores a controlling map. *Id.* at 4:54–60. A control circuit uses the controlling map to obtain an allowable current value using the detected temperature and the temperature rise so the battery can be charged while suppressing the rise of battery temperature. *Id.* at 4:60–65. The battery is, thus, charged while changing current value to suppress the temperature rise. *Id.* at 5:13–15. In one embodiment, if the temperature is high, relatively low charging current is applied, and if the temperature is low, relatively high charging current is applied. *Id.* at 5:24–26. Sakakibara also discloses that “the battery charger 10 constantly changes charging current in accordance with the battery temperature and temperature rise.” *Id.* at 7:32–34. The “[s]pecific processing of the battery charger” is explained further in that “after charging starts, a control section 36 of the battery charger . . . adjusts charging current and determines whether battery charging is completed in a predetermined cycle (here, at 100 seconds’ intervals for the convenience of

description, but actually far shorter intervals of 10 seconds or less).” *Id.* at 7:65–8:6.

2. Dependent Claims 2, 9, 17, and 24

Claim 2 depends from claim 1 and further recites “wherein said controller continuously sets said charging current in accordance with said temperature.” Claim 9 depends from claim 8, and further recites “wherein said controller continuously sets said discharging current in accordance with said temperature.” Claim 17 depends from claim 16 and recites that the “sensing and setting steps are repeated continuously during said charging step.” Claim 24 depends from claim 23 and further recites that the “sensing and setting a discharge current steps are repeated continuously during said discharging step.”

Petitioner relies on Sakakibara as teaching the limitations of claims 2 and 17 because Sakakibara describes that the “battery charger 10 constantly changes charging current in accordance with the battery temperature and temperature rise.” Pet. 66 (citing Ex. 1006, 7:32–34) (emphasis omitted), 78. Petitioner proffers evidence that a person of ordinary skill in the art would understand “constantly” changing the charging current in accordance with the battery’s temperature means that the temperature-checking and current-setting process would be carried out in a continuous manner. Ex. 1003, 77–78. We agree with Petitioner that Sakakibara’s disclosure teaches the limitations recited in claims 2 and 17.

For claims 9 and 24, Petitioner first relies on Koenck as teaching a battery maintenance process in which a system capsule code is executed every five seconds during idle periods, which a person of ordinary skill in the art would understand as being performed iteratively during the

discharging operation. Pet. 74 (citing Ex. 1005, 61:55–62:3; Ex. 1003, 88). Petitioner further relies on Sakakibara as teaching the limitations of claims 9 and 24 because of the “constantly” changing disclosure discussed above with respect to claims 2 and 17. *Id.* (citing Ex. 1006, 7:32–34). According to Petitioner, a person of ordinary skill in the art would, notwithstanding Sakakibara’s description of constantly checking temperature and setting the *charging* current, implement a similar “constant” checking process while the battery is discharging. Pet. 75 (citing Ex. 1003, 89). Petitioner reasons that it is known, as taught in Doi, that overheating of the battery can occur in both charging and discharging. *Id.* (citing Ex. 1003, 89). Consequently, a person of ordinary skill in the art would find it beneficial to constantly check the battery temperature both during charging and discharging. *Id.*

We agree with Petitioner’s arguments and evidence that Sakakibara teaches a continuous process of sensing and setting the charge current and that it would have been obvious to apply the same process during discharge for setting the discharge current. *Id.* We are also persuaded by Petitioner’s argument and evidence that it would have been obvious to combine Sakakibara’s teachings with those of Koenck, because Koenck’s charging method would be improved by Sakakibara’s teachings as the combination consists in “merely removing the time delay” of Koenck, and the result would have made Koenck’s method more accurate. *Id.* at 64 (citing Ex. 1003, 76). Furthermore, we are persuaded by Petitioner’s argument and evidence that applying Sakakibara’s teachings to the discharge process of Koenck would provide better accuracy. *Id.* at 75 (citing Ex. 1003, 89). Patent Owner did not present argument concerning the Sakakibara grounds.

We determine that Petitioner has shown by a preponderance of the evidence that claims 2, 9, 17, and 24 would have been obvious over Koenck, Doi, and Sakakibara.

3. Dependent Claims 3, 10, 18, and 25

Claim 3 depends from claim 1 and further recites “wherein said controller periodically sets said charging current in accordance with said temperature.” Claim 10 depends from claim 8 and further recites “wherein said controller periodically sets said discharging current in accordance with said temperature.” Claim 18 depends from claim 16 and further recites “wherein said sensing and setting steps are repeated periodically during said charging step.” Claim 25 depends from claim 23 and further recites “wherein said sensing and setting a discharge current steps are repeated periodically during said discharging step.”

For claims 3 and 18, Petitioner relies on Sakakibara’s teachings of adjusting charging current and determining whether battery charging is completed in a predetermined cycle (i.e., in 100-second intervals). Pet. 68 (citing Ex. 1006, 8:1–6). Petitioner argues that a person of ordinary skill in the art would understand that Sakakibara’s adjusting the charging current in accordance with the battery’s temperature every 100 seconds, 10 seconds, or less, is a periodic action. *Id.* (citing Ex. 1003, 79).

For claims 10 and 25, which address discharging current, Petitioner argues that although Sakakibara discloses adjusting the charging current periodically, as stated above with regard to claims 3 and 18, a person of ordinary skill in the art would have implemented a similar “periodic” checking process while the battery is discharging. *Id.* at 77 (citing Ex. 1003, 93), 80. Relying on Doi’s teachings of overheating during both charging

and discharging, Petitioner reasons that a person of ordinary skill in the art would have found it equally beneficial to check periodically for an overheating condition when discharging the battery. *Id.* at 77–78.

We agree with Petitioner’s arguments and evidence that Sakakibara teaches periodically sensing and setting the charge current, and that it would have been obvious to apply the same periodic process during discharge for setting the discharge current. We are also persuaded by Petitioner’s argument and evidence that it would have been obvious to combine Sakakibara’s teachings with those of Koenck, because the combination would have been nothing more than using Sakakibara’s time delay method to check and set the charging current in Koenck’s battery charging system in the same way. *Id.* at 68 (citing Ex. 1003, 90); *see also KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”). We are also persuaded by Petitioner’s argument and evidence that it would have been obvious to combine Sakakibara’s teachings with those of Koenck and Doi, because Koenck’s method would be improved by Sakakibara’s teachings to provide better accuracy for determining if the discharge processes should be terminated. *Id.* at 77–78 (citing Ex. 1003, 88).

We determine that Petitioner has demonstrated by a preponderance of the evidence that claims 3, 10, 18, and 25 would have been obvious over Koenck, Doi, and Sakakibara.

4. Dependent Claims 4 and 19

Claim 4 depends from claim 1 and further recites “a memory coupled to said controller having a temperature and charging current look up table

stored therein, and wherein said controller accesses said look up table to set said charging current.” Claim 19 depends from claim 16 and further recites that “said setting step further comprises the step of recalling a charging current corresponding to said sensed temperature from a look up table.”

Petitioner argues and we agree that Koenck teaches a controller and coupled memory. Pet. 69–70 (citing Ex. 1005, 6:47–50, 7:9-12, Fig. 5). Petitioner further argues that Sakakibara discloses a memory for storing “a current controlling map.” *Id.* at 70 (citing Ex. 1006, 4:58–59). The controlling map of Sakakibara is a look-up table, shown in Figure 5, reproduced below.

Fig. 5

		T				
		$\sim T_1$	$T_1 \sim T_2$	$T_2 \sim T_3$	$T_3 \sim T_4$	$T_4 \sim$
dT/dt	$\sim X_1$	I 11	I 12 <1><3>	I 13 <4>	I 14 <9>	I 15 <10><12>
	$X_1 \sim X_2$	I 21	I 22 <2>	I 23 <5><7>	I 24 <8>	I 25 <11><13>
	$X_2 \sim$	I 31	I 32	I 33 <6>	I 34	I 35 <14><15>

Figure 5 of Sakakibara is “an explanatory view showing the content of a map held in the charging circuit.” Ex. 1006, 3:66–67. Petitioner argues, and we agree, that it would have been obvious to combine Koenck’s charging system with the teachings of Sakakibara’s current control map to set the charging current of a battery based on the battery’s temperature. Pet. 71–72 (citing Ex. 1003, 84–85). According to Petitioner, a person of

ordinary skill in the art would have understood that such a map would improve Koenck's charging apparatus as such an implementation would have been a faster, more efficient way to correlate battery temperature with charging current. *Id.* at 72 (citing Ex. 1003, 85). We are persuaded by Petitioner's argument and evidence that Sakakibara teaches the recited look-up table and that it would have been obvious to combine that teaching with Koenck's charging system for the reasons stated in the Petition and summarized above.

We determine that Petitioner has shown by a preponderance of the evidence that claims 4 and 19 would have been obvious over Koenck, Doi, and Sakakibara.

IV. CONCLUSION

For the foregoing reasons, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 7, 8, 15, 16, 22, 23, and 29 are unpatentable over Koenck and that claims 2–4, 9, 10, 17–19, 24, and 25 are unpatentable over Koenck, Doi, and Sakakibara. We determine that Petitioner has not demonstrated by a preponderance of the evidence that claims 5, 6, 20, and 21 are unpatentable.

V. ORDER

Accordingly, it is

ORDERED that claims 1–4, 7–10, 15–19, 22–25, and 29 of the '203 patent have been shown to be unpatentable; and

FURTHER ORDERED that claims 5, 6, 20, and 21 of the '203 patent have not been shown to be unpatentable;

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FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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