

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PRO-DEX, INC.,
Petitioner,

v.

INTELLIGENT AUTOMATION DESIGN LLC,
Patent Owner.

Case IPR2023-00218
Patent 7,091,683 B1

Before KRISTEN L. DROESCH, SCOTT A. DANIELS, and
IFTIKHAR AHMED, *Administrative Patent Judges*.

DROESCH, *Administrative Patent Judge*.

DECISION

Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Pro-Dex, Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–8 of U.S. Patent No. 7,091,683 B1 (Ex. 1001, “the ’683 Patent”). Paper 1 (“Pet.”). Petitioner filed a Declaration of Richard Klopp Ph.D., with its Petition. Ex. 1002. Intelligent Automation Design, LLC (“Patent Owner”) timely filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). Patent Owner filed a Declaration of Anthony Bellezza, Ph.D., with its Preliminary Response. Ex. 2001.

We have authority to determine whether to institute review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. After considering the Petition and the Preliminary Response, for the reasons provided below, we do not institute *inter partes* review.

B. Related Matters

The parties indicate that Patent Owner asserted the ’683 Patent in *Intelligent Automation Design, LLC v. Zimmer Biomet CMF and Thoracic, LLC, DBA Biomet Microfixation*, Case No. 5:16-cv-00011-CMC (E.D. Tex.) which was transferred to the Middle District of Florida, Case No. 3:16-cv-01044-BJD-MCR (M.D. Fla.) (“Biomet Litigation”). *See* Pet. 1; Prelim. Resp. 7–8. The parties indicate that the district court entered judgment that the ’683 Patent was invalid based on indefiniteness and, upon appeal, the Federal Circuit reversed the district court holding in *Intelligent Automation Design, LLC v. Zimmer Biomet CMF & Thoracic, LLC*, 799 F. App’x 847 (Fed. Cir. 2020). *See* Pet. 1–2 (citing Exs. 1015, 1016, 1017); Prelim. Resp. 8. Petitioner further asserts that the parties settled and the district court action was dismissed with prejudice. *See* Pet. 2 (citing Ex. 1018).

Petitioner also indicates that the '683 Patent was the subject of *Zimmer Biomet CMF v. Intelligent Automation Design, LLC*, IPR2017-00727 (institution denied). *See* Pet. 1 (citing Ex. 1014); Prelim. Resp. 7–8.

Petitioner points out that Patent Owner also asserted the '683 Patent in *Intelligent Automation Design, LLC v. OsteoMed LLC*, Case No. 4:21-cv-00614-SDJ (E.D. Tex.) (“OsteoMed Litigation”), which was dismissed with prejudice. Pet. 2 (citing Ex. 1019).

C. The '683 Patent (Ex. 1001)

The '683 Patent discloses a controller and method for controlling a screwdriver motor. *See* Ex. 1001, code (57), 2:3–9.

Figure 5 of the '683 Patent is reproduced below:

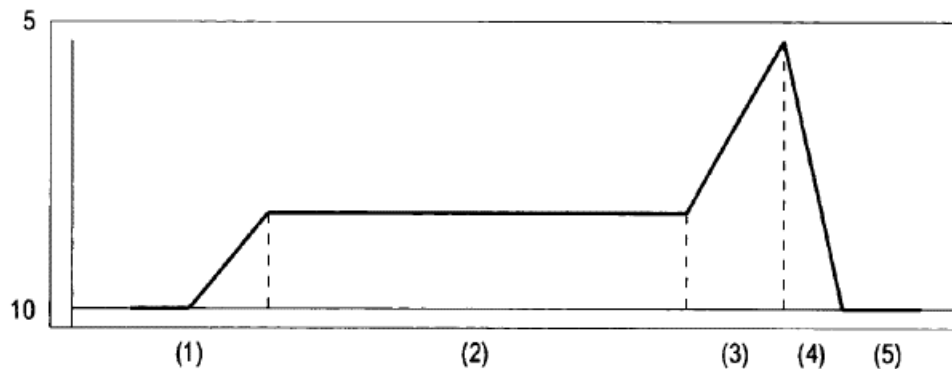


Figure 5 depicts a screw seating torque profile including zones 1 through 5. *See* Ex. 1001, 2:37–3:2. In zone 1, a screw tip makes contact with the material to be engaged and the torque level ramps up until the barrel of the screw is reached. *See id.* at 2:47–49. In zone 2, the barrel of the screw requires a constant torque to continue to drive the screw into the material. *See id.* at 2:50–52. In zone 3, once the barrel of the screw is seated into the material, the torque required to continue driving the screw rises as the head of the screw comes in contact with the material until the optimum point of grip is reached at the transition point from zone 3 to zone 4. *See id.*

at 2:53–59. In zone 4, the torque required to continue turning the screw drops significantly as the threads created in the material begin to strip. *See id.* at 2:60–64. In zone 5, the threads created in the material are completely stripped after one full revolution, and the torque required to turn the screw is minimal. *See id.* at 2:65–3:2.

The amount of current flowing through the screwdriver motor coils is proportional to the amount of torque the motor is producing. *See* Ex. 1001, 3:6–16. Motor current is measured as voltage produced across a precision resistor in series with the motor coils. *See id.* at 3:16–18. A capacitor with a resistor and/or diode is used to average the analog signal that is measured by the microprocessor. *See id.* at 3:20–23. The microprocessor further filters the analog signal using an averaging formula to produce a stable value corresponding to motor torque/current. *See id.* at 3:23–26, 3:36–38. Averaging the analog signal prevents random peaks and valleys from creating false triggers. *See id.* at 3:42–43. The '683 Patent provides following sample averaging formula: $(\text{Current value} \times 9.9 + \text{New Value} \times 0.1) / 10 = \text{New Current Value}$. *See id.* at 3:39–41. When a decrease in current, corresponding to a drop in torque, is detected at the optimum point of grip, the controller stops the motor. *See id.* at 3:26–28.

D. Illustrative Claims

Claims 1 and 6 are independent and claims 2–5, 7, and 8 depend ultimately therefrom, respectively. Claims 1 and 6 are illustrative and reproduced below:

1. A method of controlling a motor (106) used to drive a screwdriver bit (105) such that screws (107) are seated to the optimum point of grip between the screw (107) and the work piece material, the method comprising:
 - (a) detecting a torque of the motor;
 - (b) determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip; and
 - (c) stopping the motor at the optimum point of grip.

6. A speed/torque controller (100) for controlling the rotation speed and output torque of the motor (106) with either sensor feedback or back EMF used to monitor motor (106) speed and current used to monitor motor (106) torque, the controller comprising:
 - a detector for detecting the output torque of the motor; and
 - a control circuit for determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip, and stopping the motor at the optimum point of grip.

Ex. 1001, 4:11–20, 4:33–44.

E. Asserted Challenges to Patentability and Asserted Prior Art

Petitioner asserts that claims 1–8 would have been unpatentable based on the following grounds on the following grounds and (Pet. 11, 16–68):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–7	§ 102 ¹	Hosokawa ^{2,3}
1–7	§ 103	Hosokawa
1–7	§ 103	Hosokawa and Minogue ⁴
1–7	§ 103	Hartung ^{5,6} and Minogue
1–7	§ 103	Ishii, ⁷ Minogue, and either Hosokawa or Hartung
8	§ 103	Any of Hosokawa, Hartung, or Ishii in combination with Minogue, and either of Germanton ⁸ or Koselke ⁹

II. ANALYSIS

A. Claim Construction

In an *inter partes* review proceeding, the Board applies the same claim construction standard as that applied in federal courts in a civil action

¹ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 103 effective March 16, 2013. Because the '683 Patent has a filing date prior to the effective date of the applicable AIA amendment, we refer to the pre-AIA version of §§ 102, 103, and 112.

² Ex. 1004, Japan Patent Application JP 2002-283248 A, published Oct. 3, 2016 (“Hosokawa”).

³ Ex. 1005, English Translation of Hosokawa.

⁴ Ex. 1007, US Patent 4,684,922, issued Aug. 4, 1987 (“Minogue”).

⁵ Ex. 1008, German Patent Application DE 198 45 871 A1, published April, 15, 1999 (“Hartung”).

⁶ Ex. 1009, English Translation of Hartung.

⁷ Ex. 1011 US Patent 5,831,404, issued Nov. 3, 1998 (“Ishii”).

⁸ Ex. 1012, US Patent 5,014,793, issued May 14, 1991 (“Germanton”).

⁹ Ex. 1013, US Patent 6,084,366, issued July 4, 2000 (“Koselke”).

under 35 U.S.C. § 282(b), which is generally referred to as the *Phillips* standard. *See* 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Under the *Phillips* standard, “words of a claim ‘are generally given their ordinary and customary meaning.’” *Phillips*, 415 F.3d at 1312.

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

35 U.S.C. § 112 ¶ 6. Construing a means-plus-function claim term is a two-step process. First, the claimed function must be identified, followed by a determination of what structure, if any, disclosed in the specification corresponds to the claimed function. *See Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1351 (Fed. Cir. 2015) (en banc) (citing *Noah Sys. Inc. v. Intuit Inc.*, 675 F.3d 1302, 1311 (Fed. Cir. 2012)).

Petitioner asserts that all terms should be given their plain and ordinary meaning, except “‘determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip,’ which requires construction.” Pet. 13; *see* Ex. 1001, 4:16–19 (claim 1), 4:39–44 (claim 6). Petitioner asserts that this term invokes 35 U.S.C. § 112 ¶ 6 and “recites two functions (or one function with two functional parts): (1) ‘determining a time when the torque reaches a maximum’ and an average means for (2) ‘determining an average value as a function of a current and a new value.’” Pet. 13–14 (quoting Ex. 1001, 4:16–19). Petitioner points out that “[t]he Federal Circuit held that the

corresponding structure for ‘determining a time when the torque reaches a maximum’ is ‘a microprocessor to detect a decrease in torque.’” Pet. 14 (citing *Intelligent Automation Design*, 779 F. App’x. at 853). Petitioner notes that “[t]he Federal Circuit’s holding did not specifically address the corresponding ‘average means’ structure for ‘determining an average value as a function of a current value and a new value.’” *Id.* Petitioner asserts that in the OsteoMed Litigation, Patent Owner acknowledged that § 112 ¶ 6 applied and

contended that the corresponding structure for performing both parts of the function is a microprocessor that performs the following steps:

- averages the torque signal in the microprocessor using the formula: $(\text{Current Value} \times 9.9 + \text{New Value} \times 0.1) / 10 = \text{New Current Value}$;
- monitors the average torque/current using the microprocessor;
- determines when a decrease in current, corresponding to a drop in torque, is detected.

Pet. 14 (citing Ex. 1020, 4–5 (Ex. A)). According to Petitioner,

the Board should interpret “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip” as governed by § 112 ¶ 6 and to encompass the corresponding structure identified in [Patent Owner]’s construction in the OsteoMed Litigation (and equivalents thereof).

Pet. 14–15 (citing Ex. 1020, 4–5 (Ex. A)).

“Patent Owner stipulates the application of § 112 ¶6 as described in by the Federal Circuit . . . and further stipulates to the construction of ‘average means’ offered in the Biomet Litigation . . . and OsteoMed Litigation.” Prelim. Resp. 8–9 (citing *Intelligent Automation Design*, 799 F.

App'x at 851; Ex. 1015, 14; Ex. 1020, 4–5 (Ex. A)). Patent Owner further asserts, in a footnote, that the construction of “average means” is “a microprocessor executing the averaging formula, monitoring the average torque/current, and detecting a decrease in current corresponding to a drop of torque (as well as any equivalents).” Prelim. Resp. 9 n.1.

For the purpose of determining whether to institute trial, we agree with the parties that “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip” is governed by § 112 ¶ 6. Consistent with Petitioner's asserted construction and Patent Owner's proposed construction in the OsteoMed Litigation, we construe “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip” as an algorithm that causes a microprocessor to perform the following steps: averages the torque signal in the microprocessor using the formula: $(\text{Current Value} \times 9.9 + \text{New Value} \times 0.1) / 10 = \text{New Current Value}$; monitors the average torque/current using the microprocessor; and determines when a decrease in current, corresponding to a drop in torque, is detected, as well as equivalents thereof. *See* Pet. 14–15; Prelim. Resp. 8–9, Ex. 1020, 4–5 (Ex. A).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art “would have had: (1) a four-year degree in electrical or mechanical engineering or equivalent technical background, (2) familiarity with powered tools and torqued threaded fasteners, screw threads, joint members, and their

mechanical behavior, and (3) familiarity with dynamic signal measurement, processing, and feedback control.” Pet. 15 (citing Ex. 1002 ¶¶ 13–18).

Petitioner further contends that “[a]dditional work experience could serve as a substitute for a formal degree and vice versa.” *Id.* Patent Owner does not offer a description of a person of ordinary skill in the art. *See* Prelim. Resp.

For the purpose of determining whether to institute trial, we adopt Petitioner’s definition of a person of ordinary skill in the art because it is consistent with the level of skill reflected by the ’683 Patent Specification and the asserted prior art.

C. Principles of Law

“Under 35 U.S.C. § 102 a claim is anticipated ‘if each and every limitation is found either expressly or inherently in a single prior art reference.’” *King Pharm., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1274 (Fed. Cir. 2010) (quoting *Celeritas Techs. Ltd. v. Rockwell Int’l Corp.*, 150 F.3d 1354, 1360 (Fed. Cir. 1998)). “Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim.” *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed. Cir. 2010) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)).

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any

differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) if in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).¹⁰

D. Challenges to Claims 1–7 as anticipated by Hosokawa, Unpatentable as Obvious over Hosokawa, and over Hosokawa and Minogue

1. Overview of Hosokawa (Exs. 1004 and 1005)

Hosokawa is directed to tightening tools, such as drill/drivers, and wrenches which are used to tighten screws, bolts, etc. *See* Ex. 1005 ¶ 1. The tightening tool includes a torque estimation part which estimates how much tightening torque has been generated by the tightening tool motor and a tightening assessment part. *See id.* ¶¶ 4, 14–15, 27, 34–42. With Hosokawa’s disclosed tightening tool, it is possible to obtain the optimal tightening condition, without damaging the fastening members by discontinuing tightening on the basis of when the torque fluctuation amount T_q reaches 0 (zero) or when the torque fluctuation rate T_v reaches 0 (zero), depending on whether the fastening member is resin-based or metal. *See id.* ¶¶ 13–15, 17, 22, 26, 41–42 (equations 12, 15), 94–95 (equations 17, 18). The torque fluctuation amount and torque fluctuation rate are calculated based on moving averages. *See id.* ¶¶ 41–42, 94–95.

2. Overview of Minogue (Ex. 1007)

Minogue discloses an invention directed to adaptive digital filtering, specifically noise filtering by temporal averaging. *See* Ex. 1007, 1:9–11. In the background of the invention, Minogue explains that “[d]igital signal

¹⁰ At this stage, the parties do not present evidence or arguments regarding secondary considerations.

processing is a broad field encompassing those operations which are done by and with digital logic circuitry and computers to condition or extract meaning from signals acquired from physical sensors or sources.” *Id.* at 1:14–18. Minogue explains that one class of digital signal processing circuits are digital filters that are used to pass signals in certain frequency bands and attenuate signals in other frequency bands. *See id.* at 1:20–24. Minogue explains that one well-known application of digital filtering techniques is temporal averaging. *See id.* at 1:29–30.

Minogue discloses,

Temporal averaging is a scheme for reducing noise in a signal by implementing a special first order difference equation:

$$\hat{x}_t = \alpha x_t + (1 - \alpha) \hat{x}_{t-1}$$

where x_t is the current noisy input sample, $\hat{x}_{t-1}$ is the smoothed output sample for the immediately preceding noisy input sample, $\hat{x}_t$ is the smoothed output sample for the present noisy input sample and α and $(1 - \alpha)$ are weighting coefficients which determine the noise reduction factor.

Ex. 1007, 3:44–55. Minogue discloses a voltage mode digital-to-analog converter (DAC) takes on the same form as the first order difference equation:

$V_{OUT} = D \cdot V_{REF} + (1 - D) \cdot Agnd$, where V_{REF} is the voltage at the reference terminal of the DAC, $Agnd$ is the voltage at the analog ground terminal of the DAC, V_{OUT} is the output voltage of the DAC and D is the fractional representation of the digital code (i.e., the gain of the DAC).

Ex. 1007, 3:66–4:6. “Due to this identity of form of transfer functions, temporal averages and other digitally programmable infinite impulse response filters can be implemented using voltage mode DAC’s.” *Id.* at 4:6–9.

Figure 3 of Minogue is reproduced below.

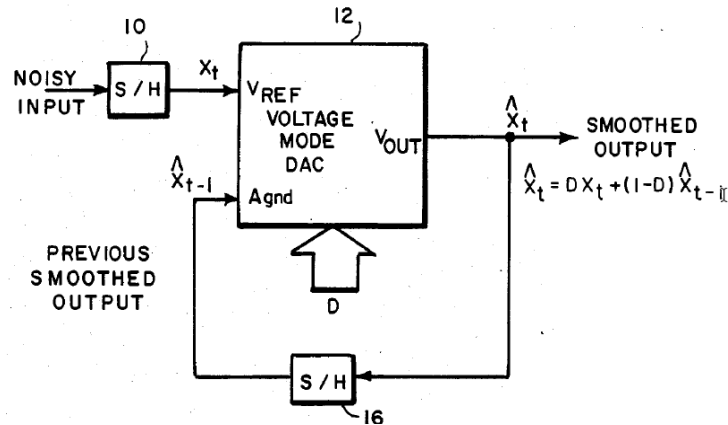


Figure 3 depicts a block diagram of a temporal averager. *See* Ex. 1007, 2:32–33. A noisy input signal is applied to first sample and hold circuit 10, the output of which is connected to the V_{REF} input of DAC 12. *See id.* at 4:15–18. The V_{OUT} terminal of DAC 12 supplies the smoothed output signal and also is connected to the input of second sample and hold circuit 16. *See id.* at 4:18–20. The output of second sample and hold circuit 16 is provided to the Agnd input terminal of DAC 12. *See id.* at 4:20–22.

3. Analysis

Petitioner asserts that Hosokawa discloses “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip,” as recited in claim 1. *See* Pet. 21 (citing Ex. 1002 ¶ 148); *see also* Pet. 21–25. More specifically, Petitioner asserts that the corresponding structure for “determining a time when the torque reaches a maximum, and thus the optimum point of grip” is a “microprocessor to detect a decrease in torque.” *See* Pet. 21 (citing Ex. 1002 ¶ 149). According to Petitioner, “Hosokawa discloses a tightening assessment part 9 that executes computations regarding the torque and

determines when to issue a shut off command to the motor” and “the tightening assessment part represents a microprocessor.” Pet. 22 (citing Ex. 1005 ¶¶ 5, 27, 29, Fig. 1; Ex. 1002 ¶ 150). Petitioner contends that Hosokawa further discloses that the tightening assessment part executes a “computation . . . based on the estimated tightening torque obtained in the torque estimation part 8 so as to thereby automatically determine the completion of tightening.” *Id.* (citing Ex. 1005 ¶ 27). According to Petitioner, “[i]n this computation, the tightening assessment part determines the ‘torque fluctuation amount T_q ,’ which is the ratio of the variation in tightening torque T to the variation in rotation angle θ or time t , as shown in Equation 17.” *Id.* (reproducing Ex. 1005, Eq. 17; citing Ex. 1005 ¶¶ 15, 17, 41, 42, 94, claims 1, 2, 4, 9; Ex. 1002 ¶ 151). Petitioner contends “that the torque fluctuation amount T_q represents the rate of change of the tightening torque T compared to screw rotation angle θ or screw drive time t .” *Id.* (citing Ex. 1005 ¶ 94; Ex. 1002 ¶ 151). According to Petitioner, “[a]lternately the torque fluctuation amount T_q can be described as the derivative of the torque or the slope of the torque curve.” *Id.* (citing Ex. 1002 ¶ 151). Petitioner further asserts that Hosokawa discloses detecting when the torque fluctuation amount T_q becomes zero or lower for metal-based fasteners, and thus discloses when the torque is unchanging or decreasing. *See* Pet. 23 (citing Ex. 1005 ¶¶ 10–15, 45–51, claims 1–2, 4, 9; Figs. 1–3, 5, 7, 8, code (57); Ex. 1002 ¶ 152).

Petitioner further asserts that the corresponding structure for “an average means for determining an average value as a function of a current value and a new value” “is a microprocessor that ‘averages the torque signal in the microprocessor using the [‘683 Patent’s Averaging Formula]’ and that

“monitors the average torque/current.” Pet. 23. According to Petitioner, “Hosokawa’s tightening assessment part . . . uses ‘moving averages’ to calculate average tightening torque values and then calculates the ‘torque-fluctuation amount T_q ,’ or the rate of torque change, based on those averaged torque values.” Pet. 23–24 (reproducing Ex. 1005, Eq. 10–11; citing Ex. 1005 ¶¶ 31, 41–42, 94; Ex. 1002 ¶ 154). Petitioner concludes that Hosokawa teaches a microprocessor that averages the torque signal. *See* Pet. 24.

Petitioner contends that “[a]lthough Hosokawa does not disclose the ’683 Patent’s Averaging Formula exactly, Hosokawa discloses an equivalent means” on the basis that “Hosokawa discloses ‘moving averages’ in Equations 10 and 11 that are calculated as a function of a ‘current value’ and a ‘new value’” and “perform the *identical function* of attenuating noise; in substantially the *same way* by averaging newly detected torque values and past torque values; and with substantially the *same result* of a smoothed output signal, as the ’683 Patent’s Averaging Formula.” Pet. 25 (citing Ex. 1005 ¶¶ 41–42; Ex. 1002 ¶¶ 153–155). According to Petitioner, a person of ordinary skill in the art “would have understood that Hosokawa’s moving averages are an equivalent of the ’683 Patent’s Averaging Formula.” *Id.* (citing Ex. 1002 ¶¶ 153–155). Petitioner further asserts that Hosokawa discloses that the tightening assessment part monitors the torque fluctuation amount on an ongoing basis, and, therefore, discloses a microprocessor that monitors the average torque/current. *See id.* (citing Ex. 1005 ¶¶ 27, 47, 55, Fig. 7; Ex. 1002 ¶ 156). Petitioner concludes that Hosokawa discloses both the function and structure of an average means for determining an average value as a function of a current value and a new value. *See id.*

We are not persuaded that Hosokawa discloses, teaches, or suggests “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip,” as recited in claim 1. As explained above in Section II.A., consistent with Petitioner’s proposed construction, we construe this claim term as an algorithm that causes a microprocessor to perform the following steps: averages the torque signal in the microprocessor using the formula: $(\text{Current Value} \times 0.9 + \text{New Value} \times 0.1) / 10 = \text{New Current Value}$; monitors the average torque/current using the microprocessor; and determines when a decrease in current, corresponding to a drop in torque, is detected, as well as equivalents thereof.

Petitioner’s assertions regarding the teachings of Hosokawa, however, fail to address how or where Hosokawa discloses, teaches, or suggests an algorithm that causes a microprocessor to determine when a decrease in current, corresponding to a drop in torque, is detected. *See* Pet. 21–25. In particular, Petitioner does not direct us to where Hosokawa discloses, teaches, or suggests an algorithm that causes a microprocessor to determine when a decrease in current is detected. *See id.* Petitioner’s contentions regarding Hosokawa merely address determining a decrease in the torque signal without addressing current. *See* Pet. 21–23.

Based on the record before us, Petitioner does not set forth sufficient argument and evidence to demonstrate that Hosokawa discloses, teaches, or suggests “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip,” consistent with our construction and Petitioner’s proposed construction for

this means-plus-function limitation. *See* Pet. 21–25. As applied by Petitioner, the teachings of Minogue do not remedy the deficiencies of Hosokawa. *See* Pet. 36–43. Therefore, Petitioner also does not set forth sufficient argument and evidence to demonstrate that the combination of Hosokawa and Minogue teaches or suggests “determining a time when the torque reaches a maximum by an average means for determining an average value as a function of a current value and a new value, thereby determining the optimum point of grip,” in accordance with our construction and Petitioner’s proposed construction for this means-plus-function limitation.

Independent claim 6 recites limitations identical to the limitations of claim 1. *Compare* Ex. 1001, 17:31–64 (claim 1), *with* Ex. 1001, 18:58–19:23 (claim 6). Petitioner’s arguments and evidence addressing the identical limitation recited independent claim 6 relies on substantially the same arguments and evidence as those presented addressing claim 1. *See* Pet. 30 (citing Ex. 1002 ¶ 168; citing Pet. 20–25). For the same reasons as those addressing claim 1, Petitioner does not set forth sufficient argument and evidence to demonstrate that Hosokawa alone describes, teaches, or suggests the identical limitation of claim 6, and that the combination of Hosokawa and Minogue teaches or suggests the identical limitation of claim 6. Due to the dependency of claims 2–5 and 7 from claims 1 and 6 (*see* Ex. 1001, 4:21–31, 4:45–50), and for the same reasons as those addressing claims 1 and 6, Petitioner does not set forth sufficient argument and evidence to demonstrate that Hosokawa describes, teaches, or suggests all of the limitations of claims 2–5 and 7, and that the combination of Hosokawa and Minogue teaches or suggests all of the limitations of claims 2–5 and 7.

Accordingly, there is not a reasonable likelihood that Petitioner would prevail in showing that claims 1–7 are anticipated by Hosokawa, and showing that claims 1–7 are unpatentable as obvious over Hosokawa alone and over the combination of Hosokawa and Minogue.

E. Challenges to Claims 1–7 as Unpatentable as Obvious over Hartung and Minogue

1. Overview of Hartung (Exs. 1008 and 1009)

Hartung is directed to a method for tightening screws in bone structures with a variable-torque motorized screwdriver system. *See* Ex. 1009, code (57), 2:3–4. A measurement device measures tightening torque M and angle of rotation δ which are connected to a motor control unit that outputs a shutoff signal upon reaching a threshold torque M_s based on a gradient $\Delta M/\Delta \delta$ obtained from the derivative of the tightening torque/angle of rotation curve. *See id.* at code (57), 2:4–14.

Figure 3 of Hartung is reproduced below:

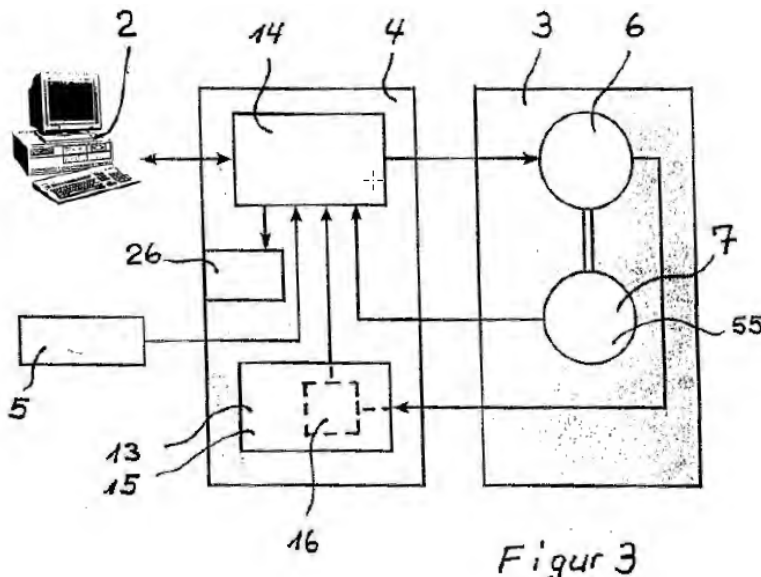


Figure 3 of Hartung depicts a block diagram of the motorized screwdriver system, including handle 3 comprising drive unit 6 composed of a DC motor

and optical rotational angle indicator 7 and base unit 4 composed of measuring device 13 and motor control unit 14 which are connected to personal computer 2 and foot pedal 5. *See* Ex. 1009, 7:15–16, 8:23–9:10. Measuring device 13 forms a motor current measuring device 15 for indirectly measuring the tightening torque M via the motor current I_A . *See id.* at 9:10–12. Motor current measuring device 15 comprises measuring electronics 16. *See id.* at 9:12–13.

Figure 5 of Hartung is reproduced below.

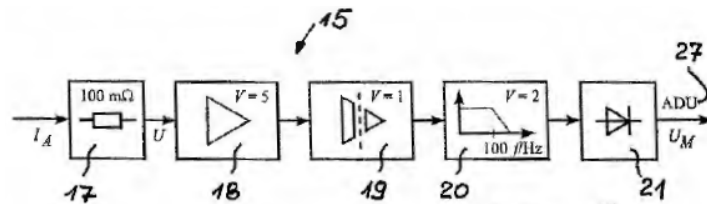


Figure 5 depicts a block diagram of the measuring electronics for motor current measuring device 15, including 100 mΩ measuring resistor 17 measurement amplifier 18, buffer amplifier 19, active Bessel low-pass filter 20 of the 3rd order, and precision full-wave rectifier 21. *See* Ex. 1009, 7:15–16, 9:12–24. The 100 mΩ measuring resistor 17 is connected in series between motor control unit 14 and the motor. *See id.* at 9:13–14. The voltage signal U output from resistor 17 is subsequently amplified by amplifier 18 with a factor of $V=5$, and buffer amplifier 19 with an amplification of $V=1$. *See id.* at 9:14–19. “A subsequent active Bessel low-pass filter (20) of the 3rd order with a limit frequency of 100 Hz is used to smooth the measuring signal, which is pulsed up to there.” *Id.* at 9:19–20. A precision full-wave rectifier 21 with a grounded output is downstream of the filter stage to obtain a positive output signal from measuring electronics 16 independently of the rotation direction of the motor. *See id.*

at 9:21–24. The processed measurement signal U_M is sent to an 8-bit analog-digital converter 27 in motor control unit 14. *See id.* at 9:24–26.

Figure 4 is reproduced below.

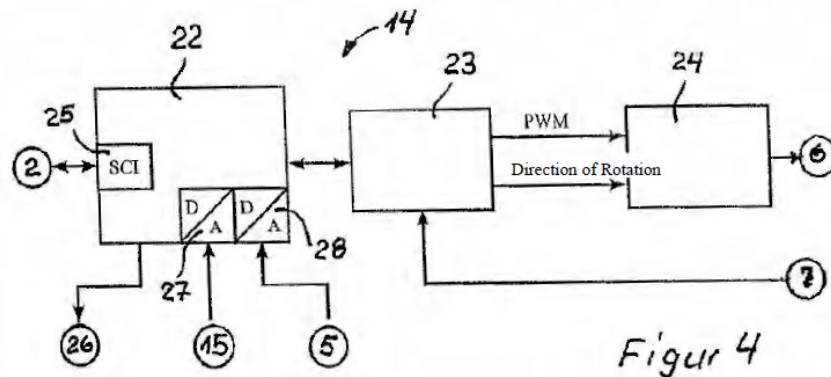


Figure 4 depicts a block diagram of motor control unit 14, including microcontroller 22, motor control unit 23, and power amplifier 24. *See* Ex. 1009, 7:14, 9:27–10:3. Motor controller 23 computes motor control data. *See id.* 10:8–9. The main task of microcontroller 22 is regulating the screwdriving process. *See id.* at 10:24. Microcontroller 22 receives commands for individual operating modes for the screwdriver system from PC 2 via serial interface 25 and then converts them into commands for motor controller 23. *See id.* at 10:9–12. Serial interface 25 also is used to transmit tightening torque/angle of rotation curves recorded with the screwdriver system. *See id.* at 10:13–15, 11:27–31. Various screwdriving algorithms for regulating the screwdriving process are stored in a memory of microcontroller 22. *See id.* at 12:7–8, *see also id.* at 12:9–18:22, Figs. 6–13 (disclosing nine different screwdriving algorithms).

2. Analysis

Petitioner asserts that Hartung discloses “determining a time when the torque reaches a maximum . . . thereby determining the optimum point of

grip,” based on Hartung’s disclosures of a motor control unit that includes a microprocessor, monitoring torque M by monitoring motor current, and determining the gradient $\Delta M/\Delta \delta$ which is the derivative of the tightening torque/angle of rotation curve. *See* Pet. 47–48 (citing Ex. 1009, 2:3–14, 2:18–22, 4:26–5:3, 5:10–18, 7:26–28, 9:9–10:3, 12:9–18, 13:12–28, 15:4–20, 16:8–10, 17:27–19:9, Figs. 3, 5, 6, 9, 14, 15, code (57), claims 28–29; Ex. 1002 ¶¶ 117–19, 189–190). According to Petitioner, “[w]hen the condition $\Delta M/\Delta \delta < 0$ (i.e., when the torque remains constant or is *decreasing*) is satisfied, the screwdriving process is interrupted and the motor is stopped.” Pet. 48 (citing Ex. 1009, 5:13–16, 11:1–3, Figs. 9, 15; Ex. 1002 ¶¶ 117–119, 189–190).

Petitioner acknowledges that Hartung does not expressly disclose an average means for determining an average value as a function of a current value and a new value, but asserts that Minogue discloses this limitation. *See* Pet. 48 (citing Pet. 36–40). According to Petitioner, “[a]t the time of the alleged invention, it would have been obvious to a [person of ordinary skill in the art] to modify Hartung’s method and system to include Minogue’s weighted averaging functionality (including the weighted averaging formula) to reduce signal noise and help ‘extract meaning from signals acquired from physical sensors,’ as taught by Minogue.” Pet. 48–49 (citing Ex. 1007, 1:14–18; Ex. 1002 ¶¶ 134–136, 191). Petitioner contends that “[s]uch modification would have been further motivated as a way to help ‘smooth the measuring signal,’ as desired by Hartung.” Pet. 49 (citing Ex. 1009, 9:19–20; Ex. 1002 ¶¶ 134–136, 191). Petitioner further asserts that “[i]ncorporating Minogue’s averaging formula into Hartung would have been a predictable use of well-known prior art elements according their

established smoothing functions.” *Id.* (citing Ex. 1009, 9:19–20; Ex. 1002 ¶¶ 134–136, 191).

Patent Owner contends that Petitioner’s reasoning for combining the teachings of Hartung and Minogue is generic. *See* Prelim. Resp. 33. According to Patent Owner “*any* additional algorithm, when added to the Hartung algorithms’ measurement of energy, torque, and angle, would represent an increase in ‘meaning from signals acquired from physical sensors.’ In order for it to be a rational addition, the algorithm would have to be accomplishing a specific purpose.” *Id.* Patent Owner asserts that Petitioner “seeks to construct their obviousness case as though any expressed desire to ‘extract meaning from signals’ would bring a [person of ordinary skill in the art] directly to the particular average required for their hindsight reconstruction.” *Id.* at 34 (citing Ex. 2001, pp. 37–38). Patent Owner also contends that Petitioner’s assertion that a person of ordinary skill in the art would have been motivated to modify Hartung with Minogue’s averaging formula to reduce signal noise as a way to help smooth the measuring signal omits that Hartung already has a method for smoothing the signal—the active Bessel low-pass filter of the 3rd order with a limit frequency of 100 Hz that is used to smooth the measuring signal. *See id.* (quoting Ex. 1009, 9:19–20). Patent Owner points out that the Petition and Dr. Klopp’s testimony does not: (1) provide “substantive discussion of Hartung’s Bessel low-pass filter in their obviousness analysis” and (2) “attempt to explain why Minogue’s averaging formula . . . would have been better-suited to smoothing the signal, or whether it would have been feasible as an addition.” *Id.* at 34–35.

We agree with Patent Owner’s arguments that Petitioner’s rationale to combine the teachings of Hartung and Minogue is insufficient. The general desirability of reducing signal noise and extracting meaning from physical sensor signals may prompt the addition of any noise reduction signal processing to any system that utilizes physical sensor signals. This general desirability of reducing signal noise and extracting meaning from physical sensor signals, however, fails to sufficiently address why a person of ordinary skill in the art would modify Hartung’s system and method which already includes a Bessel filter for smoothing the measuring signal to further include Minogue’s specific weighted averaging algorithm. The question of “obviousness concerns whether a skilled artisan . . . *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). A rationale to combine should “imply a motivation to pick out those two references and combine them to arrive at the claimed invention.” *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993–94 (Fed. Cir. 2017). Indeed, it is often necessary

to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to ***determine whether there was an apparent reason to combine the known elements in the fashion claimed*** by the patent at issue.

KSR, 550 U.S. at 418 (emphasis added). “[K]nowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references.” *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1373 (Fed. Cir. 2008). Similarly, Petitioner’s assertion that modifying Hartung to include Minogue’s weighted averaging functionality “would

have been motivated as a way to help smooth the measuring signal” also lacks sufficient rational underpinning because Petitioner does not explain sufficiently why adding Minogue’s weighted averaging formula to Hartung’s system and method that already includes a Bessel filter for smoothing the measuring signal would be helpful to smoothing the measuring signal.

The Petition also does not explain sufficiently how a person of ordinary skill in the art would include Minogue’s weighted averaging formula with Hartung’s system and method that includes a Bessel filter for smoothing the measuring signal. For example, Petitioner does not explain whether Hartung’s Bessel filter smoothed measuring signal would be later processed using Minogue’s averaging formula, or whether Minogue’s averaging formula would be applied first to the measuring signal and then later processed with Hartung’s Bessel filter.

Petitioner’s cited declaration testimony of Dr. Klopp largely mirrors Petitioner’s arguments, and, therefore, fares no better than the Petition. *Compare* Pet. 48–49, *with* Ex. 1002 ¶¶ 134–136, 191. Like the Petition, Dr. Klopp’s declaration testimony sets forth generic and conclusory statements without explaining why or how the teachings of Hartung and Minogue could be combined, and how any specific combination would operate.

“[C]onclusory expert testimony does not qualify as substantial evidence.” *TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1358–59 (Fed. Cir. 2019). The Federal Circuit has found that, when “[t]he expert failed to explain how specific references could be combined, which combination(s) of elements in specific references would yield a predictable result, or how any specific combination would operate or read on the asserted claims,” the “expert’s

testimony on obviousness was essentially a conclusory statement.”

ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc., 694 F.3d 1312, 1327 (Fed. Cir. 2012); *see also In Touch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1353–54 (Fed. Cir. 2014) (finding the expert testimony “failed to provide any meaningful explanation for why one of ordinary skill in the art would be motivated to combine these references at the time of this invention.”).

In summary, based on the record before us, Petitioner does not set forth sufficient articulated reasoning with rational underpinning to support its argument that “it would have been obvious to a [person of ordinary skill in the art] to modify Hartung to include Minogue’s weighted averaging functionality (including the weighted averaging formula).” Accordingly, there is not a reasonable likelihood that Petitioner would prevail in showing that claim 1 and claims 2–5, dependent therefrom, are unpatentable as obvious over Hartung and Minogue.

Independent claim 6 recites limitations identical to the limitations of claim 1. *Compare* Ex. 1001, 17:31–64 (claim 1), *with* Ex. 1001, 18:58–19:23 (claim 6). Petitioner’s assertions of obviousness with respect to the identical limitation of claim 6 relies on the same arguments and evidence presented addressing claim 1. *See* Pet. 52–53 (citing Ex. 1002 ¶ 203; citing Pet. 40, 46). For the same reasons as those addressing claim 1, based on the record before us, there is not a reasonable likelihood that Petitioner would prevail in showing that independent claim 6 and claim 7, dependent therefrom, are unpatentable as obvious over Hartung and Minogue.

F. Challenges to Claims 1–7 as Unpatentable as Obvious over Ishii, Minogue, and Hosokawa or Hartung

1. Overview of Ishii (Ex. 1011)

Ishii discloses “a method for preventing a wire from being twisted off in a reinforcing bar fastening machine.” Ex. 1011, 1:6–9.

Figure 5 of Ishii is reproduced below.

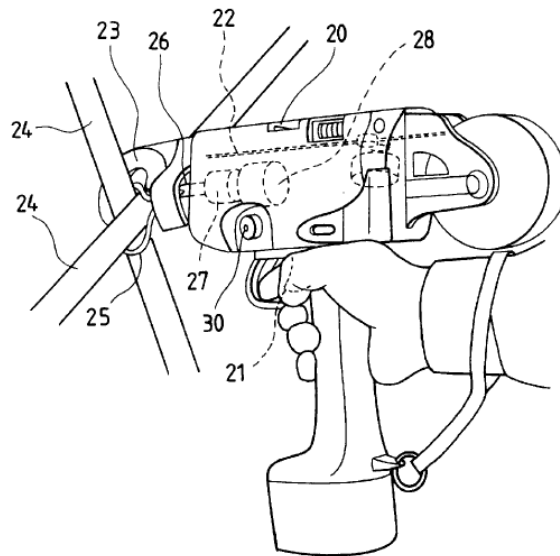


Figure 5 depicts a perspective view showing how a conventional reinforcing bar fastening machine is used for fastening crisscrossing reinforcing bars used for constructing buildings and structures. *See* Ex. 1011, 1:14–30, 2:19–20. Wire 22 is fed by operating trigger 21 and forwarded to form wire loop 25 from a curved section in front of guide arm 23 and then wound around a crossing point of reinforcing bars 24. *See id.* 1:17–21. Wire loop 25 is then picked up by twisting hook 26 and twisted to fasten reinforcing bars 24. *See id.* at 1:22–24. The torque of motor 28 that drives twisting device 27 for turning twisting hook 26 is measured and when the torque reaches a predetermined value, the operation of twisting device 27 and motor 28 is stopped. *See id.* at 1:24–29.

Ishii discloses a reinforcing bar fastening machine that includes a measuring means that measures the torque of the motor by measuring the drive current and stops the motor when the peak torque or drive current is reached. *See* Ex. 1011, 2:53–58, 2:65–3:9, 3:12–22. The reinforcing bar fastening means includes a control means constructed of a microprocessor that monitors changes in the torque based on a control program resident in a built-in memory. *See id.* at 3:10–12. The control means monitors the increase in the torque of the motor for twisting a wire and when the torque (drive current) has reached a peak, the control means judges that the reinforcing bar force has been maximized and applies a fastening end signal that turns off the power and stops the motor. *See id.* at 3:12–22. The determination of when the torque (drive current) has reached a peak can be judged by measuring the drive current for every unit of time (e.g., 1 ms) after the motor has started rotating, monitoring the rate of change in the drive current every unit time, and detecting when the rate of change has switched to a decrease. *See id.* at 3:35–40. “To make sure [that the torque (drive current) has reached a peak] it may be regarded that the torque has reached a peak when torque does not increase for four unit times, that is, 4 ms.” *Id.* at 3:41–43.

2. Analysis

Petitioner asserts that Ishii discloses “determining a time when the torque reaches a maximum . . . thereby determining the optimum point of grip,” based on Ishii’s disclosure of a control means comprising a microprocessor that ends operation of the machine under an optimally fastened condition. *See* Pet. 59 (citing Ex. 1011, 1:47–56, 3:10–22, 4:19–28). Petitioner further asserts that the control means judges that the

fastening force is maximized when the drive current has reached a peak which occurs when the drive current is switched from an increase to a decrease. *See* Pet. 59–60 (quoting Ex. 1011, 3:16–18, 3:31–33; citing Ex. 1011, 3:10–22, 3:23–42, 3:49–4:5, Fig. 3; Ex. 1002 ¶¶ 211–212). According to Petitioner, [t]o the extent Ishii does not expressly disclose an average means for determining an average value as a function of a current value and a new value, Minogue does.” Pet. 60 (citing Pet. 36–40).

Petitioner asserts that “at the time of the alleged invention, it would have been obvious to a [person of ordinary skill in the art] to modify Ishii to include Minogue’s weighted averaging functionality (including the weighted averaging formula) to reduce signal noise and help ‘extract meaning from signals acquired from physical sensors,’ as taught by Minogue.” Pet. 60 (citing Ex. 1007, 1:14–18; Ex. 1002 ¶¶ 134–136, 213). Petitioner contends that “[s]uch noise reduction would also further Ishii’s objective of overcoming the problem of premature shutdown.” *Id.* (citing Ex. 1011, 1:31–56; Ex. 1002 ¶¶ 134–136, 213). Petitioner further asserts that incorporating Minogue’s features into Ishii would have been a predictable use of well-known prior art elements according their established smoothing functions. *See id.* (citing Ex. 1002 ¶¶ 134–136, 213).

Patent Owner contends that Petitioner’s combination of the teachings of Ishii and Minogue is based on hindsight because “Ishii measures torque repeatedly, at 1ms intervals,” and “[w]hen four of these intervals have passed without increase, the peak is assumed to have been reached and the motor is stopped.” Prelim. Resp. 40 (citing Ex. 1011, 3:35–43). According to Patent Owner,

The rate of change is not calculated mathematically from a rolling value, but is evaluated as a conditional comparison of five torque measurements (since each unit time requires a start and end value). If no two consecutive values in the collection of five torque readings show an increase (i.e., if “the torque does not increase for four unit times”), the unit assumes that torque has peaked and shuts off the motor.

Prelim. Resp. 40. Patent Owner contends that Petitioner’s analysis “overlooks that since Ishii is evaluating five torque measurements at any given time rather than two, *it has no need for a smoothing function.*” *Id.* at 40–41. According to Petitioner, “Ishii explicitly states in the specification that the reason for considering four unit times is to ‘make sure’ that the torque has reached the peak, i.e., to avoid spurious shutdown.” *Id.* at 41 (footnote omitted).

We agree with Patent Owner’s arguments that Petitioner’s rationale to combine the teachings of Ishii and Minogue is insufficient. Similar to our explanation above addressing the combination of Hartung and Minogue in Section II.E.2., the general desirability of reducing signal noise and extracting meaning from physical sensor signals fails to sufficiently address why a person of ordinary skill in the art would modify Ishii’s teachings of a control means which determines when the peak current/torque has been reached by determining when the measured current/torque does not increase for four units of time (i.e., 4 ms) to include Minogue’s specific weighted averaging algorithm. *See Belden v. Berk-Tek*, 805 F.3d at 1073; *Personal Web v. Apple*, 848 F.3d at 993–94; *KSR*, 550 U.S. at 418; *Innogenetics v. Abbott*, 512 F.3d at 1373. Similarly, Petitioner’s assertion that Minogue’s “noise reduction would also further Ishii’s objective of overcoming the problem of premature shutdown” also lacks a rational underpinning because

Petitioner does not explain why adding Minogue’s weighted averaging formula to Ishii’s control means which determines when the peak drive current/torque has been reached by determining when the measured current/torque does not increase for four units of time (i.e., 4 ms) would help to overcome premature shutdown.

The Petition also does not explain sufficiently how a person of ordinary skill in the art would add Minogue’s weighted averaging formula with Ishii’s disclosed control means for detecting peak current/torque. For example, Petitioner does not explain if Minogue’s averaging formula would be added to Ishii’s control means by applying Minogue’s averaging formula to Ishii’s measured drive current, monitoring the rate of change in the averaged drive current for every unit time, and then making sure the that the peak has been reached by determining that the averaged drive current/torque does not increase for four units of time.

Petitioner’s cited declaration testimony of Dr. Klopp largely mirrors Petitioner’s arguments, and, therefore, fares no better than the Petition. *Compare* Pet. 60, with Ex. 1002 ¶¶ 134–136, 213. Like the Petition, Dr. Klopp’s declaration testimony sets forth generic and conclusory statements without explaining why or how the teachings of Ishii and Minogue could be combined, and how any specific combination would operate. *See TQ Delta, v. Cisco*, 942 F.3d at 1358–59; *ActiveVideo Networks v. Verizon*, 694 F.3d at 1327; *In Touch v. VGO*, 751 F.3d at 1353–54.

In summary, based on the record before us, Petitioner does not set forth sufficient articulated reasoning with rational underpinning to support its argument that “it would have been obvious to a [person of ordinary skill in the art] to modify Ishii to include Minogue’s weighted averaging

functionality (including the weighted averaging formula).” As applied by Petitioner, the teachings of Hosokawa and Hartung do not remedy the deficiencies of the combined teachings of Ishii and Minogue. *See* Pet. 58–59, 61, 63–64. Accordingly, there is not a reasonable likelihood that Petitioner would prevail in showing that claim 1 and claims 2–5, dependent therefrom, are unpatentable as obvious over Ishii, Minogue, and Hosokawa or Hartung.

Independent claim 6 recites limitations identical to the limitations of claim 1. *Compare* Ex. 1001, 17:31–64 (claim 1), *with* Ex. 1001, 18:58–19:23 (claim 6). Petitioner’s assertions of obviousness with respect to the identical limitation of claim 6 relies on the same arguments and evidence presented addressing claim 1. *See* Pet. 63–64 (citing Ex. 1002 ¶ 224; citing Pet. 59–60). For the same reasons as those addressing claim 1, based on the record before us, there is not a reasonable likelihood that Petitioner would prevail in showing that independent claim 6 and claim 7, dependent therefrom, are unpatentable as obvious over Ishii, Minogue, and Hosokawa or Hartung.

G. Challenge to Claim 8 as Unpatentable as Obvious over any of Hosokawa, Hartung, or Ishii, in view of Minogue, and further in view of Germanton or Koselke

Claim 8 depends ultimately independent claim 6. *See* Ex. 1001, 4:48–50. As applied by Petitioner, neither the teachings of Germanton nor Koselke remedy the deficiencies identified in the previous sections addressing Hosokawa alone, the combination of Hosokawa and Minogue, the combination of Hartung and Minogue, and the combination of Ishii and Minogue. *See* Pet. 65–68. Due to the dependency of claim 8 from claim 6

and for the same reasons as those addressing claims 1 and 6 in the previous sections, Petitioner does not set forth sufficient argument and evidence to demonstrate that the subject matter of claim 8 would have been obvious over any of Petitioner's proposed combinations of references. Accordingly, there is not a reasonable likelihood that Petitioner would prevail in showing that claim 8 is unpatentable as obvious over any of Hosokawa, Hartung, or Ishii, in view of Minogue, and further in view of Germanton or Koselke.

III. CONCLUSION

For the foregoing reasons, we determine there is not a reasonable likelihood that Petitioner would prevail in showing at least one of the challenged claims of the '683 Patent is unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), the Petition is denied, and no *inter partes* review is instituted.

IPR2023-00218
Patent 7,091,683 B1

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