

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,¹
Petitioner,

v.

SCRAMOGE TECHNOLOGY LTD.,
Patent Owner.

IPR2022-00529
Patent 10,193,392 B2

Before BRIAN J. McNAMARA, KRISTINA M. KALAN, and
MICHELLE N. WORMMEESTER, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Granting-in-Part and Denying-in-Part Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

¹ Volkswagen Group of America, Inc. ("Volkswagen") filed a motion for joinder and a petition in IPR2022-01309. Volkswagen was joined as petitioner in IPR2022-00529, but later terminated pursuant to settlement, prior to issuance of this Final Written Decision. IPR2022-00529, Paper 23.

I. INTRODUCTION

Apple Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting *inter partes* review of claims 1–8 of U.S. Patent No. 10,193,392 B2 (Ex. 1001, “the ’392 patent”). Scramoge Technology Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 6. Pursuant to Board authorization, Petitioner filed a Reply to the Patent Owner Preliminary Response. Paper 7. Patent Owner filed a Sur-Reply to Petitioner’s Reply. Paper 8.

We instituted *inter partes* review of claims 1–8 of the ’392 patent on the grounds of unpatentability alleged in the Petition. Paper 9 (“Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 16 (“PO Resp.”). Petitioner filed a Reply. Paper 21 (“Reply”).

Patent Owner also filed a Motion to Amend. Paper 17 (“Mot.”). Petitioner filed an Opposition. Paper 20 (“Opp.”). We issued Preliminary Guidance. Paper 22. Patent Owner filed a Reply to Petitioner’s Opposition. Paper 24 (“Opp. Reply”). Petitioner filed a Sur-Reply. Paper 28 (“Opp. Sur-Reply”). We held an oral hearing on June 12, 2023, and a transcript of the hearing is included in the record. Paper 32 (“Tr.”).

We have jurisdiction over this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). Based on the non-contingency of the Motion to Amend, as confirmed by Patent Owner (Opp. Reply 1), we grant Patent Owner’s Motion to Amend to the extent it requests cancellation of challenged claims 1–8 of the ’392 patent. We also find that Petitioner has shown, by a preponderance of the evidence, that proposed substitute claims 9 and 10 of the ’392 patent are unpatentable. Accordingly, we deny Patent Owner’s Motion to Amend with respect to proposed substitute claims 9 and 10.

A. Related Proceedings

The parties identify the following district court litigation as a related matter: *Scramoge Technology Ltd. v. Apple Inc.*, No. 6-21-cv-01071-ADA (W.D. Tex.). Pet. 116; Paper 3, 3 (Patent Owner’s Mandatory Notices); Paper 13, 2 (Patent Owner’s Second Amended Mandatory Notice). Patent Owner also identifies IPR2022-00532 and IPR2022-00573 as related matters. Paper 13, 2.

B. Real Parties-in-Interest

Petitioner identifies Apple Inc. as the real party-in-interest. Pet. 116. Patent Owner identifies Scramoge Technology Ltd. as the real party-in-interest. Paper 3, 2.

C. The ’392 Patent

The ’392 patent is titled “Wireless Power Transfer Device and Wireless Power Transfer System” and is directed to “wireless power transfer technology.” Ex. 1001, codes (54), (57), 1:19–20. A wireless power transfer system disclosed in the ’392 patent includes “a receiving part for receiving power from a transmitting part, wherein the transmitting part comprises: a power conversion part comprising a full bridge inverter” and “a control part for controlling the power conversion part using a pulse width modulation (PWM) control signal.” *Id.*, code (57). The disclosed wireless power transfer device can minimize current wasted or consumed, enhance a wireless power transfer efficiency, improve a harmonic distortion ratio, and provide a duty ratio that is capable of minimizing the harmonic components. *Id.* at 2:38–62.

Figure 8 of the ’392 patent is reproduced below.

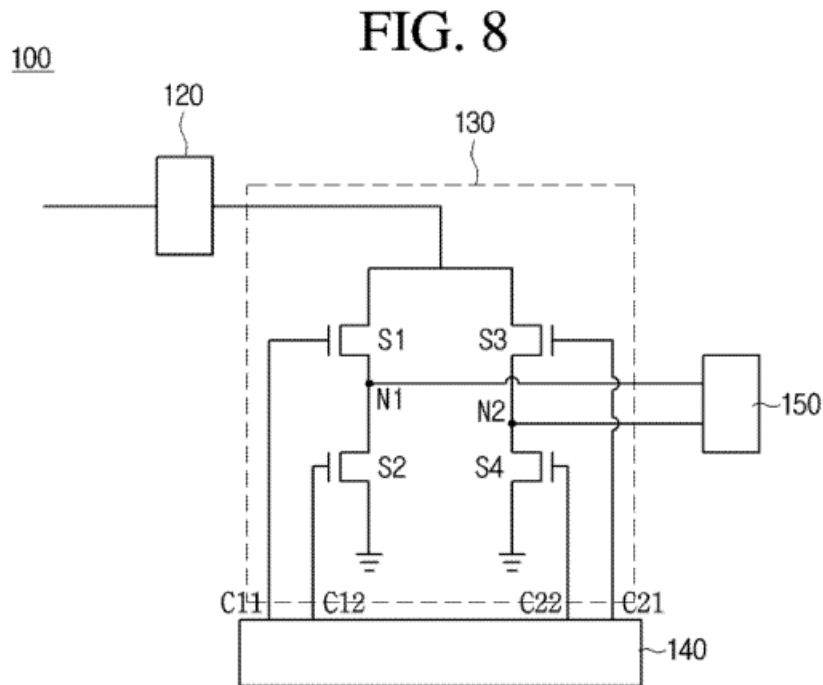


Figure 8 of the '392 patent illustrates a connection relationship and an operation method of power conversion part 130. *Id.* at 12:9–13. As shown in Figure 8, power conversion part 130 may convert power provided from converter 120 into an AC power based on an AC power control signal provided from control part 140. *Id.* at 12:14–17. Power conversion part 130 may include first to fourth switching elements S1, S2, S3 and S4; each may conduct when a first to a fourth AC power control signal C11, C12, C21 and C22 provided from control part 140 are in a high level, and open when in a low level. *Id.* at 12:19–24. First switching element S1 may be connected between first node N1 and converter 120, and controlled by first AC power control signal C11 of control part 140. *Id.* at 12:25–27. Second switching element S2 may be connected between first node N1 and a ground and controlled by second AC power control signal C12 of control part 140. *Id.* at 12:28–30. Third switching element S3 may be connected between second

node N2 and converter 120, and controlled by third AC power control signal C21 of control part 140. *Id.* at 12:31–34. Fourth switching element S4 may be connected between second node N2 and a ground, and controlled by fourth AC power control signal C22 of control part 140. *Id.* at 12:34–37.

Figure 12 of the '392 patent is reproduced below.

FIG. 12

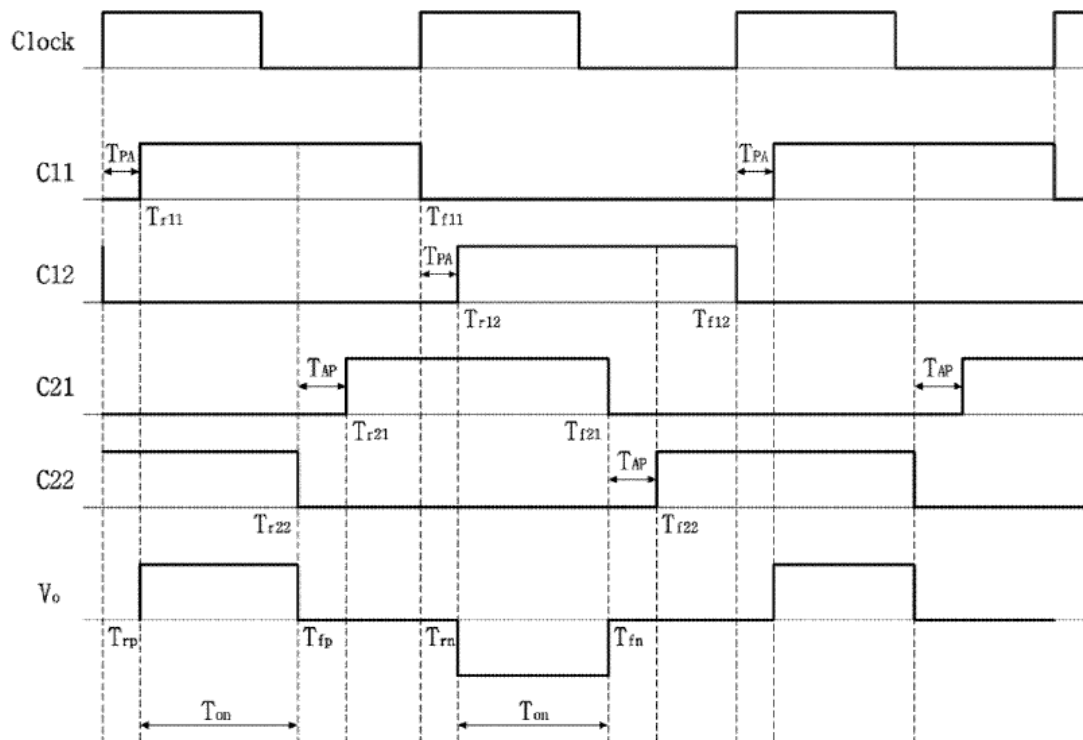


Figure 12 of the '392 patent illustrates waveform diagrams to control a duty ratio of an AC voltage by controlling a blank interval. *Id.* at 5:29–31. In particular, Figure 12 illustrates waveform diagrams of the first to fourth AC power control signals that are PWM signals to generate an AC power having an AC voltage of 50% duty ratio. *Id.* at 13:53–56. As shown in Figure 12, a duty ratio of first to fourth AC power control signals C11, C12, C21 and C22 that are PWM signals provided from the control part 140 may be

changed. *Id.* at 13:31–49. For example, rising times Tr11, Tr12, Tr21, and Tr22, and falling times Tf11, Tf12, Tf21, and Tf22 of high levels of first to fourth AC power control signals C11, C12, C21 and C22 that are PWM signals provided from control part 140 may be changed. *Id.* In response to first to fourth AC power control signals C11, C12, C21 and C22 that are changed, conduction times of first to fourth switching elements S1, S2, S3 and S4 are changed, and resultantly, duty ratio Ton of AC voltage Vo of the AC power supplied to transmitting antenna system 102 may be changed. *Id.*; *see also id.* at 14:65–15:8 (explaining that a “high level overlapping interval of the first and fourth AC power control signals C11 and C22 is a power transfer interval, which may be defined as a duty ratio (Ton),” such that the “duty ratio (Ton) is an interval where a power may be transferred for a cycle, the maximum being set 50%”; in addition, “an overlapped high level interval of the second and third AC power control signals C12 and C21 is a power transfer available interval, which may be defined as a duty ratio (Ton)”). This enables receiving part 200 to receive a constant power by differing a duty ratio Ton of the AC voltage Vo of the AC power depending on a status of the receiving part 200, for example, a charging status and/or a receiving status. *Id.* at 13:31–49.

D. Illustrative Claim

Claim 1 (now cancelled), the only independent claim in the as-issued '392 patent, is reproduced below for reference.

1. [1.0] A transmitter for generating a wireless power transmitted to a receiver, the transmitter comprising:
 - [1.1] a control part for generating first to fourth AC power control signals; and

[1.2] a power conversion part for generating an AC power including a positive polarity output voltage and a negative polarity output voltage in response to the first to fourth AC power control signals, [1.3.0] wherein the power conversion part includes:

[1.3.1] a first switching element connected between a first node and a second node and controlled in response to the first AC power control signal;

[1.3.2] a second switching element connected between the second node and a ground and controlled in response to the second AC power control signal;

[1.3.3] a third switching element connected between the first node and a third node and controlled in response to the third AC power control signal; and

[1.3.4] a fourth switching element connected between the third node and the ground and controlled in response to the fourth AC power control signal,

[1.7] wherein when the first and fourth switching elements are turned on in response to the first and fourth AC power control signals, the positive polarity output voltage is generated, and

[1.8] when the second and third switching elements are turned on in response to the second and third AC power control signals, the negative polarity output voltage is generated,

[1.9] wherein a duty ratio of the positive polarity output voltage is determined by a falling time of the fourth AC power control signal, and

[1.10] wherein a duty ratio of the negative polarity output voltage is determined by a falling time of the third AC power control signal.

Ex. 1001, 20:9–42 (bracketed designations added by Petitioner (*see* Pet. 28–55)).

Proposed substitute claim 9 is reproduced below:

[9.0] 9. A transmitter for generating a wireless power transmitted to a receiver, the transmitter comprising:

[9.1] a control part for generating first to fourth AC power control signals; and

[9.2] a power conversion part for generating an AC power including a positive polarity output voltage and a negative polarity output voltage in response to the first to fourth AC power control signals,

[9.3] wherein the power conversion part includes: a first switching element connected between a first node and a second node and controlled in response to the first AC power control signal; a second switching element connected between the second node and a ground and controlled in response to the second AC power control signal; a third switching element connected between the first node and a third node and controlled in response to the third AC power control signal; and a fourth switching element connected between the third node and the ground and controlled in response to the fourth AC power control signal;

[9.4] wherein when the first and fourth switching elements are turned on in response to the first and fourth AC power control signals, the positive polarity output voltage is generated, and

[9.5] when the second and third switching elements are turned on in response to the second and third AC power control signals, the negative polarity output voltage is generated,

[9.6] wherein a duty ratio of the positive polarity output voltage is determined by a rising time of the first AC power control signal and a falling time of the fourth AC power control signal, and

[9.7] wherein at the rising time of the first AC power control signal, the fourth AC power control signal is in a high level interval, wherein the falling time of the fourth AC power control signal occurs before the falling time of the first AC power control signal, and

[9.8] wherein a duty ratio of the negative polarity output voltage is determined by a rising time of the second AC power control signal and a falling time of the third AC power control signal, and

[9.9] wherein at the rising time of the second AC power control signal, the third AC power control signal is in a high level interval, wherein the falling time of the second AC power control signal occurs after a falling time of the third AC power control signal, and

[9.10] wherein the first AC power control signal and third AC power control signal overlap partially when in high level intervals, wherein the second AC power control signal and the fourth AC power control signal overlap partially when in high level intervals,

[9.11] wherein the duty ratio of the positive polarity is decreased or increased by shifting the falling time of the fourth AC power control signal relative to the rising time of the first AC power control signal and the duty ratio of the negative polarity is decreased or increased by shifting the falling time of the third AC power control signal relative to the rising time of the second AC power control signal.

Mot. 3–11 (bracketed designations added by Petitioner (*see* Opp. 1–21)).

Proposed substitute claim 10 is reproduced below:

[10.1] 10. The transmitter of claim [[1]] 9, wherein the control part defines a first blank interval where high level intervals of the first and second AC power control signals do not exist between [[a]] the falling time of the first AC power control signal and [[a]] the rising time of the second AC power control signal or between [[a]] the rising time of the first AC power control signal and [[a]] the falling time of the second AC power control signal, and

[10.2] wherein the control part defines a second blank interval where high level intervals of the third and fourth AC power control signals do not exist between the falling time of the third AC power control signal and the rising time of the fourth AC power control signal or between the rising time of

the third AC power control signal and the falling time of the fourth AC power control signal.

Mot. 12–13 (bracketed designations added by Petitioner (*see* Opp. 21–25)).

E. Instituted Grounds of Unpatentability

We instituted *inter partes* review of now-cancelled claims 1–8 on the following grounds:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 6	103	Hui ² (Embodiment of Figs. 1a and 5b)
2–4	103	Hui (Embodiment of Figs. 1a and 5b), Taylor ³
1, 5, 7, 8	103	Hui (Embodiment of Figs. 1b and 2a)

In support of those unpatentability arguments, Petitioner relied on the Declaration of Joshua Phinney, Ph.D. Ex. 1003.

After the filing of the Motion to Amend by Patent Owner, and Patent Owner’s confirmation that the request to cancel claims 1–8 is ‘non-contingent’ on whether the Board determines those claims are unpatentable (Opp. Reply 1), the following grounds remain in this proceeding.

Claims Challenged	35 U.S.C. §	References/Basis
9, 10	103	Wu ⁴⁵

In support of these unpatentability arguments, Petitioner relies on the supplemental Declaration of Joshua Phinney, Ph.D. Ex. 1017.

² US 2011/0199045 A1, published August 18, 2011 (Ex. 1005).

³ US 10,250,083 B2, issued April 2, 2019 (Ex. 1011).

⁴ US 2013/0188397 A1, published July 25, 2013.

⁵ Petitioner’s obviousness challenge against claim 10 also references Dent (US 8,937,822 B2, issued January 20, 2015 (Ex. 1016)), Hui (Ex. 1005) and Ye (US 9,509,168 B2, issued November 29, 2016 (Ex. 1007)) as evidence of background knowledge. *See* Opp. 22–24; Opp. Sur-Reply 3–6.

II. ANALYSIS

A. *Legal Standards*

1. *Motion to Amend*

“Before considering the patentability of any substitute claims, . . . the Board first must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121.” *See Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 4 (PTAB Feb. 25, 2019) (precedential). Patent Owner bears the burden of persuasion to show, by a preponderance of the evidence, that the Motion meets those requirements. 37 C.F.R. § 42.121(d)(1).

A motion to amend “may not enlarge the scope of the claims of the patent or introduce new matter.” 35 U.S.C. § 316(d)(3). New subject matter is any addition to the claims that lacks sufficient support in the subject patent’s original disclosure. *See TurboCare Div. of Demag Delaval Turbomach. Corp. v. Gen. Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001) (“When the applicant adds a claim, [the new claim] must find support in the original specification.”). Corresponding Rule 42.121 requires a motion to amend to “set forth: (1) The support in the original disclosure of the patent for each claim that is added or amended; and (2) The support in an earlier-filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought.” 37 C.F.R. § 42.121(b). A motion to amend may be denied where the “amendment seeks to enlarge the scope of the claims or the patent or introduce new subject matter.” 37 C.F.R. § 42.121(a)(2)(ii).

Sufficiency of a specification’s written description is a fact question, and “the test for sufficiency is whether the disclosure of the application

relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). “And while the description requirement does not demand any particular form of disclosure, or that the specification recite the claimed invention *in haec verba*, a description that merely renders the invention obvious does not satisfy the requirement.” *Id.* at 1352 (internal citations omitted).

When an explicit limitation in a claim “is not present in the written description whose benefit is sought it must be shown that a person of ordinary skill would have understood, at the time the patent application was filed, that the description *requires* that limitation.” *Hyatt v. Boone*, 146 F.3d 1348, 1353 (Fed. Cir. 1998) (emphasis added). In other words, where the written description fails to disclose an element *explicitly*, “the applicant must show that *any absent text* is *necessarily* comprehended in the description provided and would have been so understood at the time the patent application was filed.” *Id.* at 1354–55 (emphases added).

2. Obviousness

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) when in evidence, objective

indicia of nonobviousness, i.e., secondary considerations.⁶ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). A decision on the ground of obviousness must include “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The obviousness analysis “should be made explicit” and it “can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR*, 550 U.S. at 418.

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

B. Level of Ordinary Skill in the Art

In our Institution Decision, we adopted Petitioner’s undisputed contention:

A Person of Ordinary Skill in The Art (“POSITA”) in January of 2014 would have had a working knowledge of the wireless charging art that is pertinent to the ’392 patent. That person would have a bachelor’s degree in electrical engineering, or equivalent training, and approximately two years of experience

⁶ Neither Patent Owner nor Petitioner appears to present any evidence directed to secondary considerations. *See* Pet.; PO Resp.; Mot.; Opp.; Opp. Reply; Opp. Sur-Reply.

working in the field of electric circuits and wireless charging. Lack of work experience can be remedied by additional education, and vice versa.

Pet. 15–16 (citing Ex. 1003 ¶¶ 18–20); Dec. 9. Patent Owner does not dispute Petitioner’s definition of level of ordinary skill. *See generally* PO Resp.

We adopt Petitioner’s proposal regarding the level of one of ordinary skill in the art. We further note that the prior art itself demonstrates the level of skill in the art at the time of the invention. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that “specific findings on the level of skill in the art . . . [are not required] ‘where the prior art itself reflects an appropriate level and a need for testimony is not shown’” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

C. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” *Phillips*, 415 F.3d at 1312. The “ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1313. Only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner states that “for the purposes of this proceeding, the terms of the Challenged Claims should be given their plain and ordinary meaning, and no terms require specific construction.” Pet. 16–17. Patent Owner does

not dispute Petitioner’s statement regarding claim construction. *See generally* PO Resp; Mot.; Opp. Reply. We determine we need not expressly construe any claim terms. *See Vivid Techs.*, 200 F.3d at 803.

D. Summary of Asserted Art

Wu is titled “Switch Wear Leveling” and is directed to an “apparatus for switch wear leveling” that “includes a switching module that controls switching for two or more pairs of switches in a switching power converter.” Ex. 1015, codes (54), (57).

Wu’s Figure 6 is reproduced below.

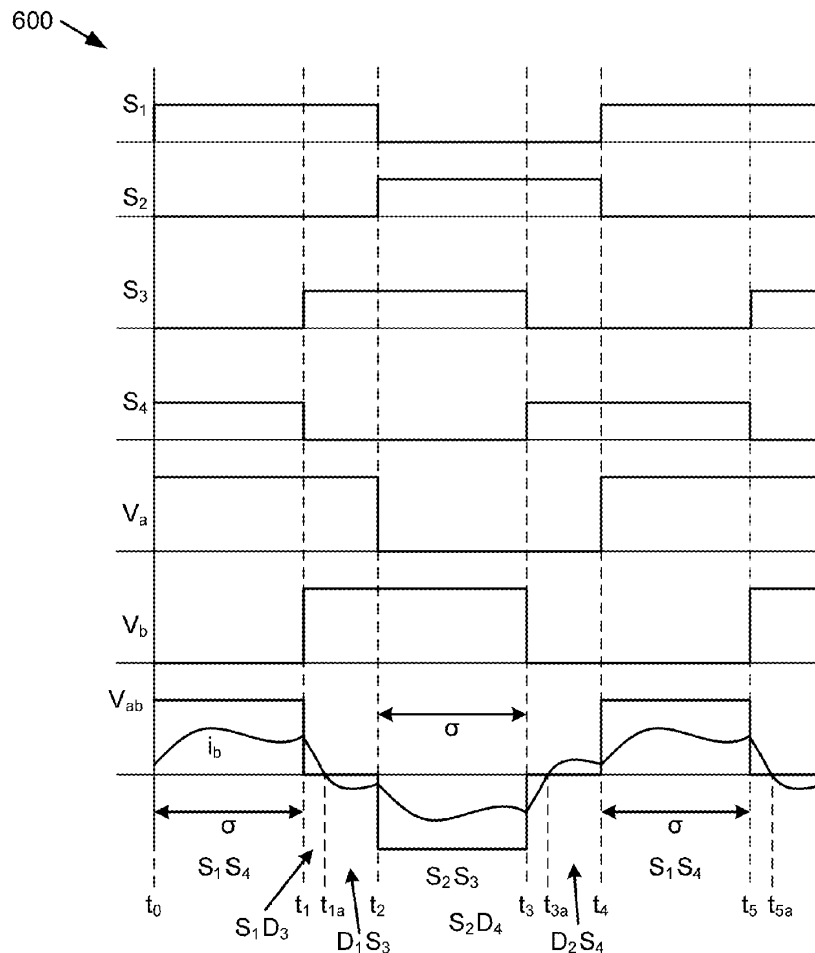


FIG. 6

Wu's Figure 6 is a timing diagram for an H-bridge converter.

Ex. 1015 ¶ 23. Wu's Figure 6 features timing diagram 600 for an H-bridge converter, which may be the H-bridge converter shown in Figure 5. *Id.*

¶¶ 110–113, Figs. 5, 6. Wu's switching module "controls each of the two or more pairs of switches closed and open based on a duty cycle control technique." *Id.* ¶ 90. Wu lists different techniques of controlling the duty cycle, including a "symmetric voltage cancellation ('SVC') control technique." *Id.* ¶ 95. In this technique, "the conduction angle [“conduction angle ‘ σ ’”] is varied from 0–180°” to vary the duty cycle of the output voltage. *Id.* ¶¶ 187, 190.

E. Claims 1–8

Our rules provide for cancellation of challenged claims. *See* 37 C.F.R. § 42.121(a)(3) (“A motion to amend may cancel a challenged claim”).⁷ As set forth in Patent Owner's Reply to Petitioner's Opposition, “Patent Owner requests herewith that original claims 1–8 be cancelled and further that Patent Owner's December 7, 2022 Motion to Amend be treated as non-contingent.” Opp. Reply 1. Although the Motion to Amend was originally filed as “contingent on whether the Board found original claims 1–8 unpatentable” (*id.*), we treat Patent Owner's Reply to Petitioner's Opposition as converting the originally contingent Motion to Amend to a

⁷ In a non-contingent motion to amend, “the Board provides a final decision on the patentability of substitute claims in place of determining the patentability of corresponding original claims.” Notice Regarding a New Pilot Program Concerning Motion To Amend Practice and Procedures in Trial Proceedings Under the America Invents Act Before the Patent Trial and Appeal Board, 84 Fed. Reg. 9497, 9505 (Mar. 15, 2019).

non-contingent Motion to Amend. *Id.* We grant Patent Owner’s Motion to Amend to the extent it requests cancellation of claims 1–8 accordingly.

F. Motion to Amend Statutory and Regulatory Requirements

1. Reasonable Number of Substitute Claims

A motion to amend must “propose a reasonable number of substitute claims.” 35 U.S.C. § 316(d)(1)(B); *see* 37 C.F.R. § 42.121(a)(3) (“A motion to amend may cancel a challenged claim or propose a reasonable number of substitute claims.”). Patent Owner proposes no more than 1 substitute claim for each of challenged claims 1 and 7. Mot. 1–2, 15, 19–21 (Claim Listing). Petitioner does not argue otherwise. *See generally* Opp. “There is a rebuttable presumption that a reasonable number of substitute claims per challenged claim is one (1) substitute claim.” *Lectrosonics*, Paper 15 at 4; *see* 37 C.F.R. § 42.121(a)(3). Petitioner does not argue otherwise. *See generally* Opp. Therefore, we determine that Patent Owner proposes a reasonable number of substitute claims.

2. Support in the Original Disclosure

Patent Owner appears to have identified adequate written description support for proposed substitute claims 9 and 10. Mot. 2–13. Patent Owner explains in detail how Figs. 1, 6, 9, 10, 12, and 13 of the original disclosure of the ’392 patent provide written description support for the limitations in proposed substitute claims 9 and 10. *See id.* (citing Ex. 1002). We have reviewed Patent Owner’s assertions of support in the original disclosure for the proposed revised substitute claims and determine that sufficient support exists. Petitioner does not argue otherwise. *See generally* Opp. Therefore, we determine that Patent Owner has met this requirement.

3. *Respond to a Ground of Unpatentability*

“A motion to amend may be denied where . . . [t]he amendment does not respond to a ground of unpatentability involved in the trial.” 37 C.F.R. § 42.121(a)(2)(i). Patent Owner responds to the grounds of unpatentability on which we instituted trial. Mot. 15–18. Upon review of Patent Owner’s arguments, we agree that proposed substitute independent claim 9 and proposed substitute dependent claim 10 recite new limitations, and new combinations of limitations, that directly respond to the grounds of unpatentability involved in the trial. *See* Mot. 15–18, 19–21 (Claim Listing). Petitioner does not argue otherwise. *See generally* Opp. Therefore, we determine that Patent Owner has met this requirement.

4. *Scope of the Claims*

Proposed substitute independent claim 9 includes narrowing limitations as compared to corresponding original independent claim 1. *See* Mot. 13–14, 19–21 (Claim Listing). Petitioner does not argue otherwise. *See generally* Opp. Proposed substitute dependent claim 10 includes narrowing limitations as compared to corresponding original dependent claim 7. Claim 10 also depends from narrowed substitute claim 9. Thus, claim 10 does not enlarge the scope of the claims of the challenged patent. Mot. 13–14, 21 (Claim Listing). Petitioner does not argue otherwise. *See generally* Opp. Therefore, we determine that Patent Owner has met this requirement.

G. *Proposed Substitute Claim 9*

1. *Petitioner’s Opposition Arguments*

Petitioner asserts that Wu teaches or suggests every element of proposed substitute claim 9. Opp. 1–21. Generally, Petitioner relies on

Wu's apparatus for switch wear leveling with a voltage driven H-bridge LCL converter illustrated in Figure 5, and the timing diagram for the H-bridge converter illustrated in Figure 6. *Id.*; Ex. 1015, Figs. 5–6.

More particularly, Petitioner argues Wu discloses every element of proposed substitute claim 9, as follows:

[9.0] 9. A transmitter for generating a wireless power transmitted to a receiver, the transmitter comprising: (Opp. 1–3 (citing Ex.1015 ¶¶ 85, 87, 121, Fig. 9; Ex. 1017 ¶¶ 12–15));

[9.1] a control part for generating first to fourth AC power control signals; and (Opp. 3–5 (citing Ex.1015 ¶¶ 80, 84, 89, 90, 117, Figs. 5, 6; Ex. 1017 ¶¶ 16–21));

[9.2] a power conversion part for generating an AC power including a positive polarity output voltage and a negative polarity output voltage in response to the first to fourth AC power control signals, (Opp. 5–7 (citing Ex. 1015 ¶ 85, Figs. 5, 6; Ex. 1017 ¶¶ 22–25));

[9.3] wherein the power conversion part includes; a first switching element connected between a first node and a second node and controlled in response to the first AC power control signal; a second switching element connected between the second node and a ground and controlled in response to the second AC power control signal; a third switching element connected between the first node and a third node and controlled in response to the third AC power control signal; and a fourth switching element connected between the third node and the ground and controlled in response to the fourth AC power control signal; (Opp. 7–9 (citing Ex. 1015, Figs. 5, 6; Ex. 1017 ¶¶ 26–28) (arguing that switch S1 502 teaches the claimed “first switching element,” switch S2 504 teaches the claimed “second switching

element,” switch S3 506 teaches the claimed “third switching element,” and switch S4 508 teaches the claimed “fourth switching element”));

[9.4] wherein when the first and fourth switching elements are turned on in response to the first and fourth AC power control signals, the positive polarity output voltage is generated, and (Opp. 9–10 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 29–30));

[9.5] when the second and third switching elements are turned on in response to the second and third AC power control signals, the negative polarity output voltage is generated, (Opp. 10–11 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 31–32));

[9.6] wherein a duty ratio of the positive polarity output voltage is determined by a rising time of the first AC power control signal and a falling time of the fourth AC power control signal, (Opp. 11–13 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 33–37));

[9.7] wherein at the rising time of the first AC power control signal, the fourth AC power control signal is in a high level interval, wherein the falling time of the fourth AC power control signal occurs before the falling time of the first AC power control signal, and (Opp. 13–14 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 38–39));

[9.8] wherein a duty ratio of the negative polarity output voltage is determined by a rising time of the second AC power control signal and a falling time of the third AC power control signal, and (Opp. 14–15 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 40–42));

[9.9] wherein at the rising time of the second AC power control signal, the third AC power control signal is in a high level interval, wherein the falling time of the second AC power control signal occurs after a falling

time of the third AC power control signal, and (Opp. 15–16 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 43–44));

[9.10] wherein the first AC power control signal and third AC power control signal overlap partially when in high level intervals, wherein the second AC power control signal and the fourth AC power control signal overlap partially when in high level intervals, (Opp. 16–17 (citing Ex. 1015, Fig. 6; Ex. 1017 ¶¶ 45–46));

[9.11] wherein the duty ratio of the positive polarity is decreased or increased by shifting the falling time of the fourth AC power control signal relative to the rising time of the first AC power control signal and the duty ratio of the negative polarity is decreased or increased by shifting the falling time of the third AC power control signal relative to the rising time of the second AC power control signal. Opp. 17–21 (citing Ex. 1015 ¶¶ 80, 90, 95, 187, 190, Fig. 6; Ex. 1017 ¶¶ 47–53).

2. Patent Owner's Reply Arguments

Patent Owner focuses its arguments on limitation 9.11, asserting that Petitioner has not shown that Wu teaches or suggests the “shifting the falling time” element of limitation 9.11. Opp. Reply 3. Patent Owner argues that the control part of the '392 patent is shown as “actually *shifting* the third and fourth control signal times *relative* to the first and second control signal times to change the duty cycle of the positive output polarity and the negative output polarity” but “Wu does not in fact teach or otherwise suggest varying duty ratio” as in limitation 9.11. *Id.* at 3–4. Although Wu “discusses controlling the opening and closing of pairs of switches generally ‘based on duty cycle control technique[s]’” according to Patent Owner, Wu “does not provide any detail in this regard.” *Id.* at 4–5. Patent Owner faults

Wu for listing “an array of duty cycle control techniques, including ‘symmetric voltage cancellation’ (‘SVC’) control,” but apart from SVC, “Wu does not discuss any of these techniques further” and there “is no discussion in Wu” what the sequence of closing and opening switches under SVC control may be. *Id.* at 5. Wu’s Figure 6 and discussion of Figure 6, according to Patent Owner, do not allow “one to conclude that Wu teaches *shifting* control signal falling times *relative* to the rising times of other control signals, as claimed.” *Id.*

3. *Petitioner’s Sur-Reply Arguments*

Petitioner replies that the “Opposition explains how Wu’s variable conduction angles teach the claimed shifting of falling times of the third and fourth control signals relative to the rising times of the first and second control signals” and it is “unclear” “what Patent Owner believes is missing from Wu.” Opp. Sur-Reply 1–2 (citing Opp. 17–21). Petitioner provides an annotated version of Wu to illustrate its assertion that “Wu’s conduction angle “ σ ” specifically represents one control signal’s falling time *relative* to another control signal’s rising time, where the conduction angle is varied (i.e., made larger or smaller)” and that “varying the conduction angle is, **by definition**, shifting a control signal’s falling time relative to another control signal’s rising time.” *Id.* at 2–3 (citing Opp. 17–19; Ex. 1017 ¶ 50). In sum, Petitioner argues, because “Wu describes varying the duty cycle of the output signal by varying the conduction angle between the first and fourth control signals, as well as varying the conduction angle between the second and third control signals to control positive and negative duty cycles, Wu renders obvious” limitation 9.11. *Id.* at 3.

4. *Analysis*

Regarding Petitioner's arguments for limitations 9.0–9.10, we have reviewed those uncontested arguments and find that Petitioner has met its burden of demonstrating by a preponderance of the evidence that Wu discloses limitations 9.0–9.11.

Regarding the parties' arguments for limitation 9.11, we note that Petitioner provides a number of annotated versions of Wu's Figure 6 to illustrate its arguments. *See, e.g.*, Opp. 5–21. We provide below an annotated version of Wu's Figure 6 compiling and referencing certain of Petitioner's annotations.

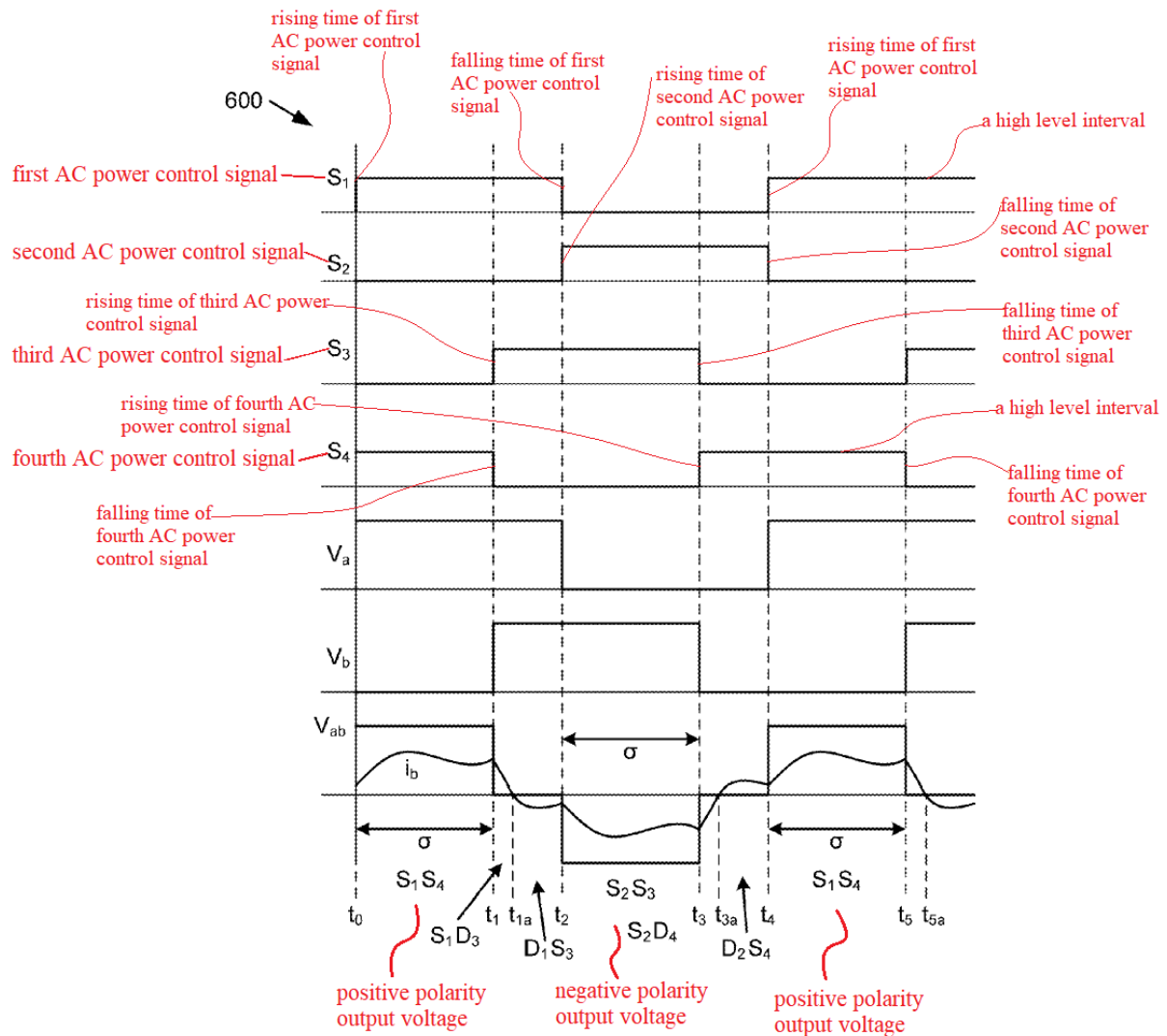


FIG. 6

The annotated version of Wu’s Figure 6 shown above illustrates various features that correspond to the “first to fourth AC power control signals” and their respective rising and falling times, as recited in proposed substitute claim 9. As noted by Petitioner, the timing of the first to fourth AC power control signals (as shown in annotated Fig. 6 of Wu, above) applied to respective first to fourth switches of Wu (S_1 , S_2 , S_3 , and S_4) satisfies the timing and control limitations recited in proposed substitute claim 9, including limitations 9.1–9.10. *See* Mot. 19–20 (claim 9); Opp. 2–21.

We are persuaded by Petitioner's arguments that "Wu teaches controlling the duty ratio of the positive and negative portions of the output signal" and that "Wu explains that its switching module is capable of varying the duty cycle ("*duty ratio*") of the output signal V_{AB} ." Opp. 17–18. Relying on Wu's SVC duty cycle control technique, Petitioner argues that "the **conduction angle is varied from 0–180°**" to vary the duty cycle of the output voltage. *Id.* at 18 (citing Ex.1015 ¶ 187). We agree that because Wu describes "varying the conduction angle ' σ ' (Ex. 1015, [0187]), it teaches increasing or decreasing the duty cycle of the positive portion of output signal V_{AB} *by shifting the falling time of the fourth AC power control signal relative to the rising time of the first AC power control signal.*" *Id.* at 19 (citing Ex.1017 ¶¶ 48–50). Similarly, we agree that because Wu describes "varying the conduction angle ' σ ' (Ex. 1015, [0187]), it teaches increasing or decreasing the duty cycle of the negative portion of output signal V_{AB} *by shifting the falling time of the third AC power control signal relative to the rising time of the second AC power control signal.*" *Id.* at 21 (citing Ex. 1017 ¶¶ 51–53); *see* Ex. 1015 ¶¶ 95 ("The duty cycle control technique may have a fixed or a variable duty cycle."), 187 ("the conduction angle is varied from 0–180°"). In other words, (i) Wu teaches that the conduction angle σ is varied (Ex. 1015 ¶ 187); (ii) conduction angle σ associated with Wu's positive polarity output voltage correlates with the period between a rising time of the first AC power control signal and a falling time of the fourth AC power control signal (Ex. 1015, Fig. 6); and (iii) conduction angle σ associated with Wu's negative polarity output voltage correlates with the period between a rising time of the second AC power control signal and a falling time of the third AC power control signal. Ex. 1015, Fig. 6.

We disagree with Patent Owner’s argument that Wu fails to teach the limitations of proposed substitute claim limitation 9.11, and are unable to discern within Patent Owner’s arguments a reason that Petitioner has not met its burden. Patent Owner’s criticism that Wu provides insufficient detail about the use of its SVC technique to adjust or vary a conduction angle (Opp. Reply 4–5) is sufficiently refuted by Petitioner’s arguments, which detail how Wu teaches shifting control signal falling times relative to the rising times of other control signals, as in limitation 9.11. Opp. 17–21; Opp. Sur-Reply 1–3 (“It is unclear, however, what Patent Owner believes is missing from Wu.”).

Accordingly, Petitioner has shown by a preponderance of the evidence that substitute claim 9 is rendered obvious by Wu.

H. Proposed Substitute Claim 10

Proposed substitute claim 10 replaces original dependent claim 7 and adds new limitations (derived from original dependent claim 8 (Opp. Sur-Reply 8–9)) directed to “a second blank interval.” Mot. 21.

1. Petitioner’s Opposition Arguments

Petitioner asserts that Wu teaches or suggests every element of proposed substitute claim 10 (including those of parent proposed substitute claim 9, as discussed above), as follows:

[10.1] 10. The transmitter of claim 9, wherein the control part defines a first blank interval where high level intervals of the first and second AC power control signals do not exist between the falling time of the first AC power control signal and the rising time of the second AC power control signal or between the rising time of the first AC power control signal and the falling time of the second AC power control signal, and (Opp. 21–25

(citing Ex. 1015, Figs. 5, 6; Ex.1016, 8:23–25, Figs. 5, 15; Ex.1005 ¶¶ 65–71, Figs. 4A–5C; Ex. 1017 ¶¶ 54–60));

[10.2] wherein the control part defines a second blank interval where high level intervals of the third and fourth AC power control signals do not exist between the falling time of the third AC power control signal and the rising time of the fourth AC power control signal or between the rising time of the third AC power control signal and the falling time of the fourth AC power control signal. Opp. 25 (citing Ex. 1017 ¶¶ 62–63).

Petitioner argues that Wu renders claim 10 obvious because a person of ordinary skill “would have found it obvious for Wu’s control technique to include ‘*blank intervals*’ as claimed so as to avoid turning switches S1 and S2 (or S3 and S4) on at the same time, which would cause a short.”

Opp. 21. Petitioner also argues that the concept of a blank interval “is not novel, but is a known technical solution to avoid shorting the power source,” relying on Dent to illustrate this concept and “[a]pplying this known concept to Wu.” *Id.* at 22–23 (citing Ex. 1016, 8:23–25, Figs. 5, 15; Ex. 1017 ¶¶ 56–58). Petitioner additionally relies upon Hui as “further evidence of such background knowledge of a POSITA” of a “dead time for transition from one pair of switches to the other pair.” Opp. 22–23 (citing Ex. 1005 ¶ 66).

2. Patent Owner’s Reply Arguments

Patent Owner argues that claim 10 expressly requires that the claimed first blank interval and second blank interval be “intentionally introduced” into the driving pattern of the respective first and second, and third and fourth, switching elements by the control part. Opp. Reply 8. Patent Owner argues that it would not have been obvious to modify Wu in view of Dent or Hui, because (1) Petitioner has not shown that Wu, Dent, or Hui, alone or in

combination, teach or otherwise suggest the intentionally introduced blank intervals of claim 10, and (2) Petitioner has not explained why one skilled in the art would modify Wu in view of Dent and/or Hui to achieve the claimed invention according to claim 10. *Id.* at 8–9. Patent Owner argues that it is not enough to show that certain pairs of switches are not turned on at the same time, but, rather, the prior art “must teach ‘blank intervals’ that are inserted into the timing of the control signals.” *Id.* at 9. Patent Owner disagrees with Petitioner that Dent teaches blank signals (because Dent’s switch pairs are turned on and off at the same exact time), or that Hui teaches blank signals (because Hui’s “dead time” is nothing more than the “inherent delay in the operation of the inverter switches”). *Id.* at 10.

3. *Petitioner’s Sur-Reply Arguments*

Petitioner argues that “the ‘blank intervals’ concept was a known technique not worthy of patent protection,” as explained in the Opposition. Opp. Sur-Reply 3 (citing Opp. 22). Petitioner reiterates that Dent illustrates that certain switches in an inverter should never be turned on at the same time, and the solution is to introduce “dead time” for transition from one pair of switches to the other pair. *Id.* at 3–4 (citing Opp. 23). Petitioner also reiterates that one of ordinary skill would have found it obvious for Wu’s control signals to utilize the known ‘dead time’ solution. *Id.* at 4. Petitioner relies on the evidence of record, particularly, Hui and Ye, to illustrate that “dead time” was “a term of art known to POSITAs in 2014 that refers to controlled intervals in the timing of the control signals for complementary transistors.” *Id.* at 6 (citing Ex.1005 ¶ 73; Ex.1007). Regarding Petitioner’s reliance on Dent, Petitioner argues that Dent simply “provides evidence that the risk of shorting an inverter was a known technical problem” and Patent

Owner’s argument that one of ordinary skill in the art “would have avoided putting Dent’s H-bridge directly into Wu,” is “irrelevant to the ground of [unpatentability]” in which “Dent is exclusively cited for the known concept that turning on complementary switches simultaneously can create a short condition.” *Id.* at 7. Petitioner acknowledges that, while “Dent’s design prevents both switches from being turned *on* at the same time, it explicitly allows for both switches to be turned *off* at the same time” and, thus, “Dent’s design can . . . indeed accommodate a ‘blank interval’ where both switches are off.” *Id.* at 8 (citing Ex. 1016, 8:34–36).

Petitioner also argues that substitute claim 10 is “substantively identical to original claims 7 and 8, as it simply combines them together into a single claim,” and that the “Petition explained how Hui rendered obvious the claimed ‘blank intervals’ recited in claims 7 and 8.” *Id.* at 8–9 (citing Pet. 108–112). Because Patent Owner “did not dispute in its Response that Hui’s Fig. 2a example . . . teaches the claimed ‘blank intervals,’” Petitioner argues, Patent Owner “waived any argument that Hui’s Fig. 2a fails to teach the claimed ‘blank intervals.’” *Id.* at 11. In the same vein, Petitioner argues that by “cancelling claims 7 and 8, Patent Owner dedicated the subject matter of claims 7 and 8 to the public” and “is precluded from now pursuing the patently indistinct subject matter of substitute claim 10.” *Id.* at 11 (citing 37 C.F.R. § 42.73(d)(3)(i) (a patent owner may not pursue a “claim that is not patentably distinct from a finally refused or canceled claim”)).

4. *Analysis*

On review of the full record, we find that Petitioner has demonstrated that Wu (in view of the disclosures of Dent, Hui, and Ye relied upon by Petitioner as evidence of background knowledge) teaches or suggests the

limitations of proposed substitute claim 10. We agree that Wu does not appear to expressly teach or suggest the claimed blank intervals. Opp. 21–22; Opp. Reply 7–8. Petitioner, however, persuasively relies on the knowledge of one of ordinary skill in the art, as evidenced by Dent, Hui, and Ye, to argue that the “blank intervals” concept was a known technique to address a particular problem. Opp. Sur-Reply 3. We are persuaded by Petitioner’s argument, as supported by the evidence, that one of ordinary skill in the art “would have found it obvious for Wu’s control technique to include ‘*blank intervals*’ as claimed so as to avoid turning switches S1 and S2 (or S3 and S4) on at the same time, which would cause a short.” Opp. 21–24 (citing Ex. 1017 ¶ 54–60).

Petitioner’s declarant relies on Dent to illustrate the concept that complementary switches “should never be turned on at the same time, as this would short the DC input.” *Id.* at 22–23 (citing Ex. 1016, 8:23–25, Figs. 5, 15; Ex. 1017 ¶ 56–58). Petitioner does not propose bodily incorporation of Dent into Wu, despite Patent Owner’s arguments to the contrary. Opp. Sur-Reply 7; Opp. 22. We also are persuaded by Petitioner’s argument that Dent’s design prevents both switches from being turned *on* at the same time, but allows for both switches to be turned *off* at the same time and, thus, that Dent’s design can “indeed accommodate a ‘blank interval’ where both switches are off.” Opp. Sur-Reply 8 (citing Ex. 1016, 8:34–36).

Petitioner’s declarant relies on Hui to illustrate the concept of “dead time,” a “known technical solution” to “avoid shoot-through.” Ex. 1017 ¶ 59; Opp. 23–34; Opp. Sur-Reply 4–5; Ex. 1005 ¶¶ 66, 73. Upon review of Hui’s disclosures, in view of Petitioner’s arguments (Opp. Sur-Reply 4–6), it appears that Hui’s “dead time” is more than merely an inherent delay or

artifact (Opp. Reply 10) but, rather, intentionally introduced to avoid shoot-through. The introduction of “dead time,” as demonstrated by Petitioner, is “controlled” and can be “adjusted” by, i.e., an inverter, as in Hui. Opp. Sur-Reply 5–6 (citing Ex. 1007, 7:50–64, code (57), 7:30–32 (“inverter 302 is configured to adjust the dead time of transistors”); 8:6–8 (discussing “generating proper dead times between switching”), 7:55–58 (“In general, the ‘dead time’ of a transistor pair is the time interval between one transistor turning off and its complement transistor being turned on.”), Fig. 5).

Wu has an identified “control part” driving its control technique. Opp. 3–5 (discussing limitation 9.1; identifying Wu’s “switch wear leveling apparatus 102” (including “switching module 202”) as the “control part”). We credit the testimony of Dr. Phinney that employing the control technique to include blank intervals provides a “known technical solution to avoid shorting the power source.” Ex. 1017 ¶ 56 (citing Ex. 1015, 8:23–25). We also credit Dr. Phinney’s testimony that one of ordinary skill in the art would have known that “in actual operation of a full-bridge inverter one would introduce dead time (*blank intervals*) to avoid shorting the source” and would have “recognized that Wu’s phase control method would have to similarly operate with a ‘dead time for transition from one pair of switches to the other pair’ to prevent the short condition well known to POSITAs.” *Id.* ¶¶ 58, 60 (citing Ex. 1005 ¶ 66; Ex. 1015, 8:23–25). Accordingly, we do not share Patent Owner’s concern that the blank intervals are not “intentionally introduced,” and we are persuaded by Petitioner’s arguments and evidence that in the proposed modification, Wu’s “control part defines” the blank intervals.

Although we reached a different conclusion in the Preliminary Guidance, such guidance is merely preliminary and not binding, and the record has been developed further since that time. Additionally, although Petitioner presents arguments that claim 10 “simply combines” claims 7 and 8 “together into a single claim” (Opp. Sur-Reply 9–10) and “has dedicated the subject matter of claims 7 and 8 to the public” (*id.* at 12) we are unpersuaded that these arguments constitute circumstances in which the Board may “raise a ground of unpatentability that a petitioner did not advance, or insufficiently developed, against substitute claims proposed in a motion to amend.” *Hunting Titan, Inc. v. DynaEnergetics Europe GmbH*, IPR2018-00600, Paper 67 (PTAB July 6, 2020) (precedential); 37 C.F.R. § 42.121(d)(3). Moreover, Petitioner’s claims 7 and 8 argument asks us to conclude “that the ‘blank interval’ concept in substitute claim 10 is not patentable subject matter” (Opp. Sur-Reply 11), which we have already determined, above. Accordingly, we do not reach the alternative arguments presented by Petitioner. *See id.* at 8–12.

Upon review of the evidence and arguments presented on the complete record, we determine that Petitioner has shown by a preponderance of the evidence that the teachings of Wu (in view of the knowledge of one of ordinary skill in the art as demonstrated by the disclosures of Dent, Hui, and Ye) render obvious the limitations in proposed substitute claim 10.

I. Conclusion

We determine that Petitioner has met its burden of proof for the disputed limitations of the proposed substitute claims, whether expressly recited in the independent claim or incorporated by reference in the dependent claim. *See* 35 U.S.C. § 112(d) (“A claim in dependent form shall

be construed to incorporate by reference all the limitations of the claim to which it refers.”). Therefore, based on the full record developed during the trial, we determine that Petitioner has met its burden to demonstrate unpatentability of the proposed substitute claims.

III. CONCLUSION

For the reasons discussed above, we grant Patent Owner’s Motion to Amend as to cancellation of original claims 1–8. We deny Patent Owner’s Motion to Amend as to proposed substitute claims 9 and 10. We provide the following tables summarizing our disposition.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 6	§ 103	Hui (Embodiment of Figs. 1a and 5b)		
2–4	§ 103	Hui (Embodiment of Figs. 1a and 5b), Taylor		
1, 5, 7, 8	§ 103	Hui (Embodiment of Figs. 1b and 2a)		
Overall Outcome⁸				

Motion to Amend Outcome	Claims
Original Claims Cancelled by Amendment	1–8
Substitute Claims Proposed in the Amendment	9, 10
Substitute Claims: Motion to Amend Granted	
Substitute Claims: Motion to Amend Denied	9, 10

⁸ For the reasons stated herein, because Patent Owner has moved to cancel all originally challenged claims 1–8, we do not reach the alleged unpatentability of those claims.

Motion to Amend Outcome	Claims
Substitute Claims: Not Reached	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Patent Owner's Motion to Amend is *granted* as to the request to cancel original claims 1–8 of the '392 patent;

FURTHER ORDERED that Patent Owner's Motion to Amend is *denied* as to the request to add proposed substitute claims 9 and 10 to the '392 patent; and

FURTHER ORDERED that this is a Final Written Decision; therefore, 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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