

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMA SOLAR TECHNOLOGY AMERICA, LLC,
Petitioner,
v.

TIGO ENERGY, INC.,
Patent Owner.

Patent 9,584,021
Filing Date: August 8, 2015
Issue Date: February 28, 2017
Title: SYSTEMS AND METHODS FOR ENHANCED EFFICIENCY
AUXILLARY POWER SUPPLY MODULE

Inter Partes Review No.: IPR2023-00879

**PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE
FILED UNDER 37 C.F.R. § 42.23**

TABLE OF CONTENTS

PETITIONER’S EXHIBIT LIST	2
I. INTRODUCTION	4
II. MIETH ANTICIPATES CLAIMS IN GROUND A	5
A. Anticipation Standard.....	5
B. Mieth’s genus “load” anticipates the recited “micro-controller,” as “load” is a term of art in the field of electronics and allows a PHOSITA to “readily envisage” each member of the genus.....	5
C. Mieth’s “load 20” discloses the micro-controller of the ‘021 patent in that a PHOSITA can reasonably understand or infer that a micro-controller is disclosed therein.....	8
D. Anticipation Conclusion.....	11
III. THE COMBINATION OF MIETH AND BALOUGH RENDER OBVIOUS CLAIMS OF GROUND B	11
A. Obviousness Standard	11
B. The Differences Between Mieth’s “Load 20” and the Claimed Micro-Controller are such that the Subject Matter as a Whole Would Have Been Obvious to a PHOSITA.....	12
C. Obviousness Conclusion	19
IV. REMAINING ISSUES RAISED IN THE POR.....	19
V. CONCLUSION.....	23
CERTIFICATE OF COMPLIANCE WITH WORD COUNT	24
CERTIFICATE OF SERVICE	25
CLAIM LISTING APPENDIX	26

PETITIONER'S EXHIBIT LIST

Exhibit	Description
Ex.1001	U.S. Patent No. 9,966,848
Ex.1002	Certified English Translation of DE3725476 (Mieth)
Ex.1003	U.S. Patent No. 6,246,592 (Balogh)
Ex.1004	The IEEE Standard Dictionary of Electrical and Electronics Terms, Sixth Edition 1996 (IEEE)
Ex.1005	U.S. Patent No. 6,798,177 (Liu)
Ex.1006	File wrapper of U.S. Patent No. 9,966,848
Ex.1007	Declaration of Dr. Douglas Holberg
Ex.1008	German Language DE3725476 (Mieth)
Ex.1009	Allen, Philip E., and Douglas R. Holberg. "CMOS Analog Circuit Design" (2002) ("CMOS")
Ex.1010	Solibro GmbH Data Sheet, CIGS THIN FILM SOLAR MODULE SL2 ("Solibro")
Ex.1011	MITSUBISHI ELECTRIC Data Sheet, PHOTOVOLTAIC MODULE ("ME")
Ex.1012	US Patent Publication No. 2007/0001653 (Xu)
Ex.1013	U.S. Patent Publication No. 2006/0207192 (Durham)

Ex.1014	Arias et al., “A Modular PV Regulator Based on Microcontroller with Maximum Power Point Tracking,” IEEE, IAS 2004
Ex.1015	U.S. Patent No. 4,617,529 (Suzuki)
Ex.1016	Claim Construction Opinion [D.I. 97] from <i>Tigo Energy Inc. v. SMA Solar Technology America LLC et al.</i> , 1-22-cv-00915 (D. Del. December 4, 2023).
Ex.1017	Claim Construction Order [D.I. 98] from <i>Tigo Energy Inc. v. SMA Solar Technology America LLC et al.</i> , 1-22-cv-00915 (D. Del. December 4, 2023).
Ex. 1018	IEEE Standard Dictionary of Electrical and Electronic Terms, 6 th Edition, 1996, p. 156.
Ex. 1019	IEEE Standard Dictionary of Electrical and Electronic Terms, 6 th Edition, 1996, p. 593.
Ex. 1020	Silicon Labs, C8041F020/1/2/4, 8K ISP FLASH MCU Family, 2003.
Ex. 1021	Analog Devices, “Choosing the Right Power-Supply IC for your Application”, November 29, 2001 at https://www.analog.com/media/en/technical-documentation/tech-articles/choosing-the-right-powersupply-ic-for-your-application.pdf , and republished as Tutorial 337 on October 28, 2009.
Ex. 1022	U.S. Patent Publication No. 2008/0266922 (Mumtaz)
Ex. 1023	Declaration of Dr. Douglas Holberg in Support of Petitioner’s Reply to the Patent Owner’s Response
Ex. 1024	Merriam-Webster Dictionary, definition of “analogous,” https://www.merriam-webster.com/dictionary/analogous

I. INTRODUCTION

As the Petition showed, every claim of the '021 patent is unpatentable. Patent Owner's Response ("POR") provides no evidentiary basis for concluding otherwise. Paper 18. This IPR has been instituted, and this very panel has already held that Petitioner has met its burden of showing that a reasonable likelihood exists that Petitioner would prevail with respect to at least one of the challenged claims of the '021 patent under both Sections 102 and 103. Paper 9, at 16-17, 19. Patent Owner ("PO") fails to provide any exhibits or expert testimony to support its contention that the claims are neither anticipated nor rendered obvious, despite both issues being issues of fact. Rather, PO argues that companion IPRs were not instituted and thus the requisite factual analysis of the claims of this IPR is moot. Paper 18, at 9-29. This is incorrect.

PO also raises vague claim construction arguments about Petitioner ignoring prosecution history of a parent application with respect to the "first power converter" element, yet cites to no actual claim amendment or argument in the relevant prosecution history that impacts the meaning of the term. *Id.* at 5. Lastly, PO's arguments regarding motivation to combine Mieth and Balough (*Id.* at 39-41) are baseless and ignores the evidence proffered in the Petition, and thus fail.

II. MIETH ANTICIPATES CLAIMS IN GROUND A

A. Anticipation Standard

Anticipation requires that each and every element in a claim, arranged as recited in the claim, be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). Regarding genus/species issues where a prior art reference discloses the genus while a patent recites a species of that genus, anticipation depends on the factual aspects of the specific disclosure and the particular products at issue. In particular, in such circumstances anticipation turns on *whether the genus disclosed in the prior art is of such a defined and limited class* that one of ordinary skill in the art (“PHOSITA”) could “at once envisage” each member of the genus. *Eli Lilly & Co. v. Zenith Goldline Pharm., Inc.*, 471 F.3d 1369, 1376 (Fed. Cir. 2006). Lastly, *the dispositive question in anticipation is whether a PHOSITA would have reasonably understand or infer from a prior art reference that every claim element is disclosed in that reference.* Paper 9, p. 17 (citing *Eli Lilly & Co. v. L.A. Biomedical Research Inst.*, 849 F.3d 1073, 1074–1075 (Fed. Cir. 2017)).

B. Mieth’s genus “load” anticipates the recited “micro-controller,” as “load” is a term of art in the field of electronics and allows a PHOSITA to “readily envisage” each member of the genus.

Load 20 of Mieth constitutes a genus that encompasses the micro-controller as a species. Paper 1, p. 25 (stating a PHOSITA understands load can be or

include a micro-controller). PO does not address this issue, but instead makes conclusory statements, and asserts a PHOSITA would conclude no anticipation, issues of fact, without providing any evidentiary support. Paper 18, pp. 14-16. PO is incorrect. When properly analyzing the genus/species issue, in conjunction with the extrinsic evidence and expert testimony provided below and submitted herewith, the load of Mieth anticipates the micro-controller claim feature.

A genus disclosed in a prior art reference does not automatically anticipate each species within such genus. However, a disclosed genus does anticipate each species contained therein when *the genus is of such a defined and limited class* that one of ordinary skill in the art could “at once envisage” each member of the genus. *Eli Lilly/Zenith* at 1376. The term “load” at issue is a well-defined term of art that permits a PHOSITA to readily envisage each species therein, in particular, the claimed micro-controller as a species of that genus. Ex. 1023, ¶¶ 22-30.

A load is any circuit, device or apparatus that, when connected to a source of electrical energy, consumes electrical energy. Ex. 1023, ¶¶ 4-21. In other words, a load is a device that consumes electrical energy in the form of a current and transforms it into other forms of energy like heat, light, work, etc. Ex. 1018, p. 156, Ex. 1023, ¶¶ 4-21. This definition of “load” was accepted by the District Court in the parallel litigation. Ex. 1017, p. 3. The definition of “load” defines and limits the scope of the genus class; electrical items failing this criteria fall

outside the genus and do not constitute a load. A PHOSITA knows “load” is a term of art, has clear meaning, and can list items that constitute a load. Ex. 1023, ¶ 14 (e.g., resistor, heater element, a charging battery). What makes each electrical item a load is they each, when connected to an electrical source, consume electrical energy and perform a useful work function. Ex. 1023, ¶¶ 4-21. Therefore a PHOSITA can evaluate any circuit, circuit element, or electric device in its context and readily ascertain whether that item constitutes a load. *Id.*

Therefore the genus “load” satisfies the *Eli Lilly/Zenith* standard ***because the definition as a term of art in electronics defines and limits the class such that a PHOSITA can immediately envisage each member of the class.*** The micro-controller of the ’021 patent satisfies the definition of a load. It is a collection of circuit elements that receives electrical energy (from a buck converter 402), and performs a useful work function (i.e., providing control signals). Ex. 1023, ¶¶ 22-30. This is buttressed by the teaching of the ’021 patent itself which calls the micro-controller ***the load*** of the buck converter 402. Ex. 1001, 8:28-34.

Thus, Mieth’s “load” anticipates the recited species “micro-controller” of the ’021 patent.

C. Mieth's "load 20" discloses the micro-controller of the '021 patent in that a PHOSITA can reasonably understand or infer that a micro-controller is disclosed therein.

PO argues that Mieth's "load 20" does not expressly disclose a micro-controller. Paper 18, p. 12. This is incorrect. The Petition and accompanying expert report cited to load 20 of Mieth and to Ex. 1014, Fig. 5 to support its contention (Paper 1, pp. 25-26; Ex. 1007, ¶¶103-106) that Mieth anticipates a micro-controller because a PHOSITA would *reasonably understand or infer from Mieth that a micro-controller is disclosed therein*, as required by *Eli Lilly/L.A. Biomedical*. Ex. 1023, ¶¶ 31-33. As PO raised this issue whether Mieth anticipates a micro-controller, and the standard is whether a PHOSITA would reasonably understand or infer from Mieth that a micro-controller is disclosed therein, Petitioner responds to PO's argument below, and thus such argument does not constitute a new issue.

Mieth describes the operation of load 20 multiple times, and each time states load 20 receives power from a source (e.g., solar generator) that exhibits fluxuating performance through a power converter 19, which regulates the voltage to the load. Ex. 1002; 1:19-21; 1:23-28; 2:1-15; 4:25-27; 4:30-32; 4:37-5:2; 8: 8-9. The '021 patent summarizes its "invention" by stating its micro-controller receives power via a power converter. Ex. 1001; 2:54-56. It also states when the micro-controller receives power from an unstable source, such as a solar generator, the micro-

controller may issue commands that result in a false-start. *Id.*, 8:4-14. The '021 patent describes Fig. 4 that shows cascaded first and second buck converters (401, 402) between the fluctuating power source (Vin) and the micro-controller (connected to Vbuck output terminal), which the '021 patent refers to as the buck converter's 402 "load." *Id.*, 8:19-26. Finally, the '021 patent reiterates that its micro-controller operates as "the load" to buck converter 402 (i.e., consumes electrical energy via the received current), stating:

Circuit (400) therefore can be used to address the false start problem... when the solar panel is able to provide enough output voltage... but not enough to sustain even a small current **provided by the buck converter (402) to its load, such as a control logic, a control circuit, a micro-controller, etc.** (Ex. 1001, 8:28-34)(Emphasis added).

And,

Typically, the load of resistor P1 (405) should exceed the load of buck converter (402) (**buck converter's load being the MCU which is not shown**).... (Ex. 1001, 8:55-58)(Emphasis added).

A PHOSITA, upon reading Mieth understands its load 20 is the output of a power converter 19 and receives and consumes a regulated supply of power despite a fluctuating power source (i.e., the solar generator). Upon reading the '021 patent, a PHOSITA understands that the micro-controller when connected to buck converter 405 operates as a load and receives a regulated supply of energy supplied by buck converter 402. Thus, both Mieth and the '021 patent are configured

identically, and operate identically to Ex. 1014, Fig. 5, as noted in the expert's report, which stated:

Since the introduction of the Intel 8051 circa 1980, the micro-controller has become ubiquitous in electronic systems. When these devices are powered, invariably, the raw power source is the ac mains, a battery or some other ***unregulated source that must be reduced and stabilized.*** ***Thus it is commonplace for a micro-controller to load the output of a voltage regulator*** whether it is a linear regulator or a switch-mode regulator. For example, Arias et al. ([sic Ex.1014]) illustrates a PV system with a buck converter powering a microcontroller operating as a load. Ex. 1007, ¶ 105. (Emphasis added).

As both Mieth and the '021 patent are providing the exact same functionality: (1) taking energy from a fluctuating power source, (2) regulating it with a power converter, and (3) delivering the regulated power (electrical energy) to an electrical element that: (1) requires regulated energy, (2) consumes such electrical energy, and (3) performs a useful work function, ***a PHOSITA reasonably understands or infers that Mieth is disclosing the same element as recited in the claims of the '021 patent.*** Ex. 1023, ¶¶ 32-40; Ex. 1014, Fig. 5; Ex. 1012, Fig. 2.

Thus, this evidence of record, set forth in the original Petition, causes a PHOSITA (as evidenced by citation to Ex. 1014 in the Petition and discussion in Ex. 1007, the expert report) to reasonably understand or infer that the load discloses a micro-controller, thus satisfying the *Eli Lilly/L.A. Biomedical* standard for anticipation. The POR provides no evidence, either via exhibit or expert testimony, to contravene this evidence of record, and should be accorded no weight. Therefore the claims set forth in Ground A are anticipated by Mieth for at least this additional reason.

D. Anticipation Conclusion

In conclusion, PO's arguments that Mieth fails to anticipate the claim element at issue amount to little more than arguing that "load" and "micro-controller" are spelled differently. PO's arguments are backed by no evidence (no exhibits, no expert testimony). Petitioner shows that Mieth discloses the claimed micro-controller in a manner that satisfies the standards set forth in *Eli Lilly/Zenith* and *Eli Lilly/L.A. Biomedical*, respectively. Therefore the claims listed in Ground A are anticipated by Mieth.

III. THE COMBINATION OF MIETH AND BALOUGH RENDER OBVIOUS CLAIMS OF GROUND B

A. Obviousness Standard

Obviousness under 35 U.S.C. § 103 is resolved on the basis of factual determinations, including: (1) the scope and content of the prior art; (2) differences

between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) if in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). With regard to prong (2), a claim is obvious 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 to a PHOSITA. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

B. The Differences Between Mieth’s “Load 20” and the Claimed Micro-Controller are such that the Subject Matter as a Whole Would Have Been Obvious to a PHOSITA

As highlighted in Section III.A, obviousness is a factual matter. In arguing that Mieth-Balough fail to obviate the claims, PO asserts: (1) the Petition did not propose to modify Mieth’s load 20, Paper 18, p. 17, and (2) Petitioner is limited in its obviousness argument to those asserted in the anticipation grounds. *Id.* at 17-18. Both these arguments are incorrect. Argument (1) is unpersuasive because Petitioner is under no duty to show a modification, but instead must show the teaching of the combination renders the claim as a whole obvious and that the combination was proper. *See KSR* at 406. Regarding argument (2), PO argued Petitioner’s assertion that Mieth’s load 20 was “analogous” to a micro-controller constituted an admission that the load 20 did not expressly disclose the claim feature. Paper 18, at 13. PO thus concedes that Mieth’s load being “analogous” to a “micro-controller” means that differences exist, but Petitioner is arguing that they

are sufficiently insubstantial to render the claim element obvious.¹ Thus, Petitioner’s argument below that Mieth in combination with Balough renders the independent claims obvious is not a new argument (*see* 37 C.F.R. § 42.23(b) (stating a reply may respond to arguments raised in the corresponding patent owner response), and must be evaluated in full by this panel.

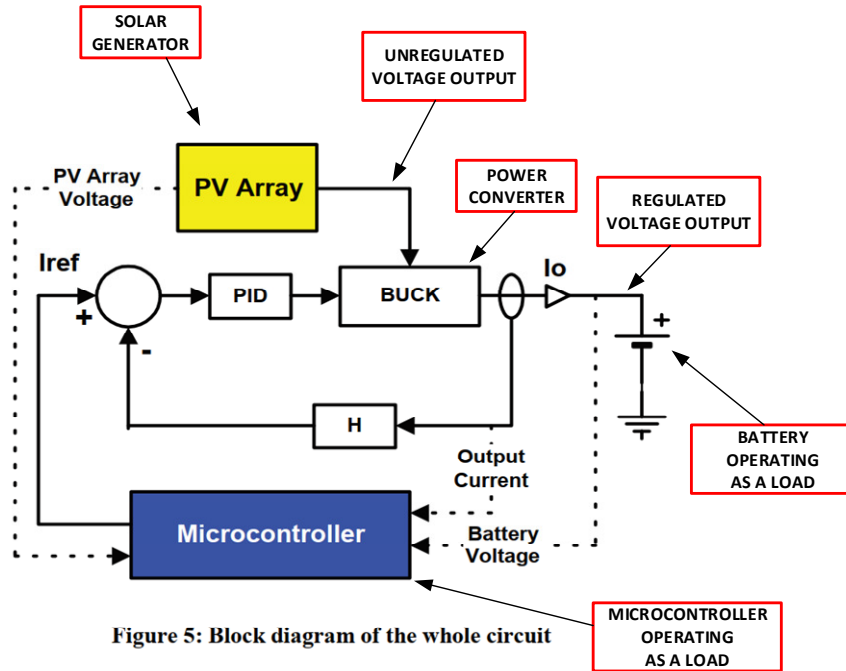
“Load” is a term of art in electronics and has a well-known meaning to a PHOSITA. Ex. 1023, ¶¶ 4-20, 48. A PHOSITA understands there are different kinds of loads, for example, resistive, capacitive, inductive, and combinations thereof. Further, loads may differ from one another in the useful work function they perform. For example, some loads, such as a motor, may be considered an “AC load” as it receives and consumes AC power from a source, while other loads, such as a micro-controller, are considered a “DC load” as it receives and consumes DC power from a source. *Id.* Based on that intended work, loads may also have different requirements. For example, a resistive load (e.g., a resistive heater) does not need regulation in the supply of electrical energy thereto. *Id.* Other loads (e.g.,

¹ The Merriam-Webster dictionary defines “analogous” as “similar or comparable to something else either in general or in some specific detail.” Ex. 1024. Thus, PO argues that Petitioner’s assertion that Mieth’s load is analogous means that the load 20 is sufficiently similar such that a PHOSITA deems the micro-controller to be obvious in view of Mieth. This is buttressed by PO’s Table of Contents, IV, A, stating, “Grounds A-D (Claims 1-20): Mieth does not disclose **or suggest** “a micro-controller.” Paper 18, at i.

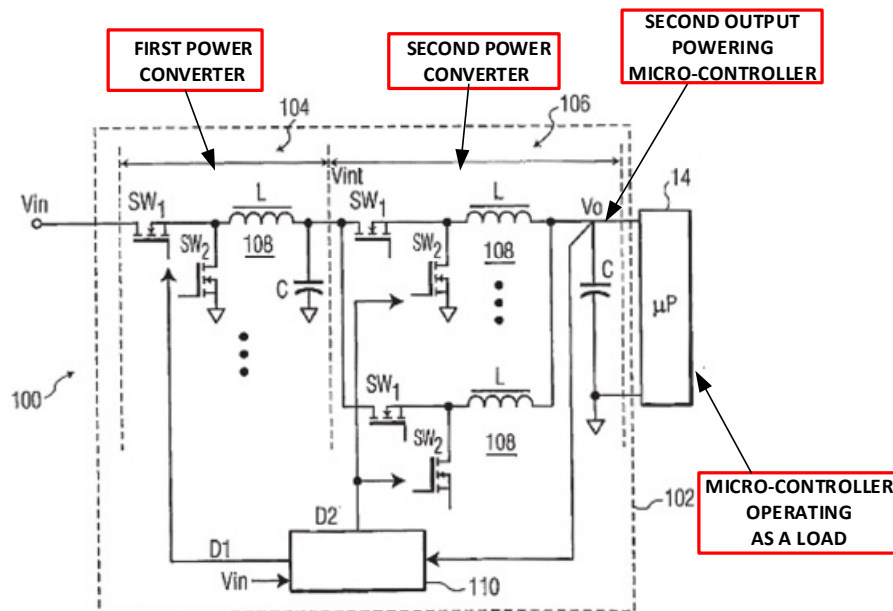
digital circuitry), often have strict input voltage requirements to operate properly and avoid damage. *Id.* Ex. 1020, pp. 1, 31-32; Ex. 1021, p. 2. One load that needs voltage regulation provided thereto is a micro-controller. Ex. 1021, p. 2. For example, micro-controllers have an input voltage requirement (e.g., 3.3V), and their data sheets specify a small supply voltage range be provided thereto to ensure reliable operation. Ex. 1020, pp. 1, 31-32. Thus, while there are various types of loads, based on whether the load environment employs voltage regulation to ensure a regulated supply of AC or DC electrical energy thereto, a PHOSITA can readily anticipate the type of load being employed. Ex. 1023, ¶ 48.

Mieth receives a fluctuating voltage from a solar generator 1, and provides that fluctuating DC voltage to a power converter 19 that outputs a regulated DC voltage and thus a regulated DC supply of energy to the load 20. Ex. 1002, 1:19-21; Ex. 1023, ¶ 49. Thus, a PHOSITA understands the load 20 is a load that requires a regulated DC supply of energy to perform properly (as providing regulation when unneeded undesirably increases circuit area, cost and complexity). *Id.* Micro-controllers and other low-voltage digital circuits such as memory require a regulated DC supply voltage. *Id.* Ex. 1014 (Fig. 5), Ex. 1012 (Fig. 2) and Ex. 1022 (Fig. 2a) are three exhibits showing prior art with this exact same configuration of an unregulated DC source being regulated by one or more

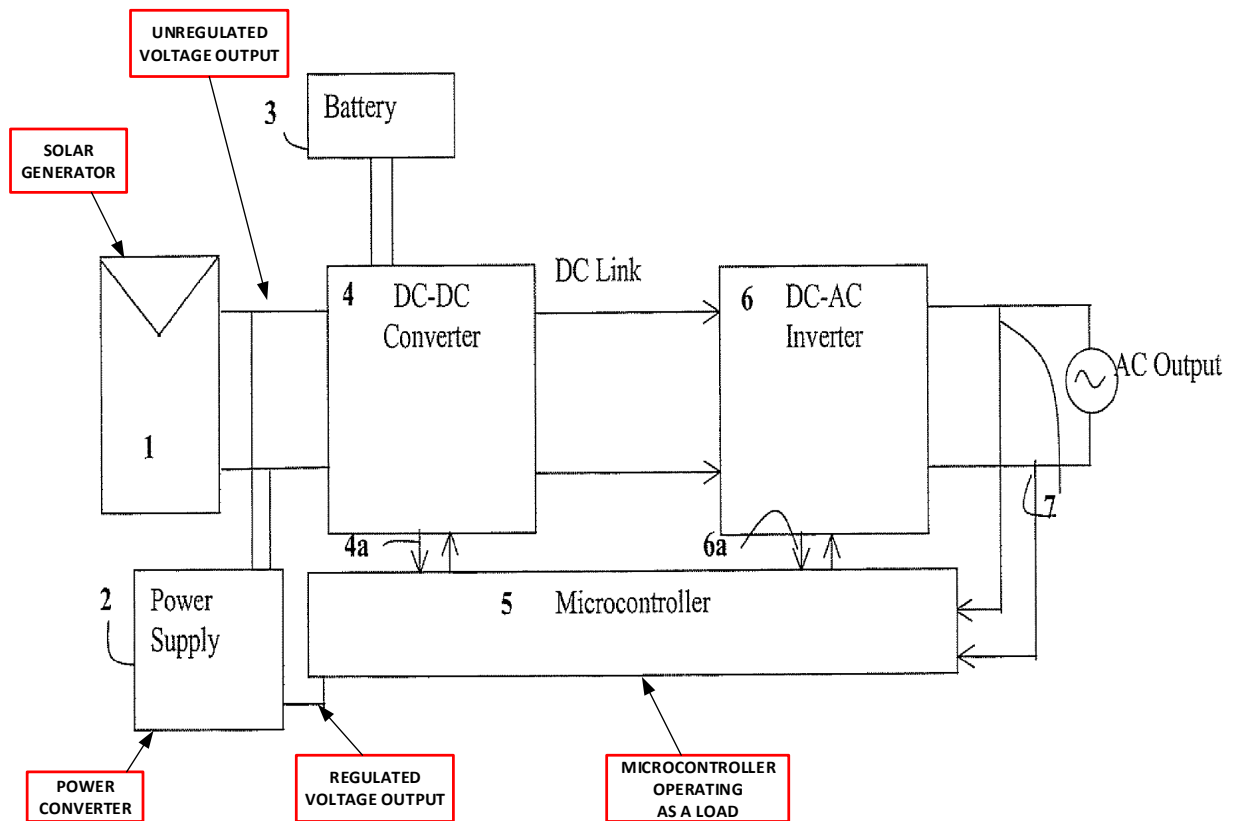
converters, and then providing a regulated DC supply of electrical energy to a micro-controller that is operating as a load. Ex. 1023, ¶50.



Ex. 1014



Ex. 1012



Ex. 1022

Figure 2a

Thus, a PHOSITA readily appreciates Mieth suggests load 20 requires a regulated supply of DC electrical energy, thus substantially reducing the pool of devices and circuits that may constitute a load. One type of load that satisfies these additional constraints is a micro-controller. Ex. 1023, ¶ 51; Ex. 1021, p. 2. Further, as both the load 20 and the micro-controller of the '021 patent are configured exactly the same (as an output of a power converter receiving regulated DC electrical energy), a PHOSITA understands the parts (if not the same) that

meet the requirements are finite in number, and can be substituted for one another without any circuit/system alterations and thus would have a reasonable expectation of success. *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374 (Fed. Cir. 2007)(holding obviousness when prior art discloses a device that differed from claimed element by a substitution of components when substituted components and their function was known in the art and substitution was predictable). Upon evaluating Exs. 1012, 1014 and 1022 above, a PHOSITA understands that a micro-controller is a typical type of load that could be substituted into and replace whatever type of load is being employed by Mieth. For example, if the load 20 of Mieth was instead a memory, as a memory also requires a regulated low-voltage supply of electrical energy (Ex. 1021, p. 2), a micro-controller could be substituted for the memory without any circuit alterations and thus would have a reasonable expectation of success. Alternatively, if the load 20 of Mieth was any other type of DC load, such as a resistive heater, such a device could be readily substituted with a micro-controller with the only type of alteration needed being the conversion ratio of the power converter 19 to ensure a proper usable voltage value for the micro-controller. A PHOSITA knows how to vary the conversion ratio of a power converter, and thus such a substitution would have a reasonable expectation of success.

As stated above, a PHOSITA understands Mieth suggests load 20 requires a regulated supply of DC electrical energy, thus substantially reducing the number of devices and circuits that may constitute a load in this application to a limited, finite number of circuits. One of the few loads that satisfy these constraints is a micro-controller. Ex. 1023, ¶ 51; Ex. 1022, p. 2. As a micro-controller is one of a limited number of predictable solutions for a load receiving a regulated supply of DC energy, it would be obvious to try a micro-controller in the system of Mieth, and thus the claimed micro-controller is obvious in view of Mieth. *Perfect Web Tech., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328-29 (Fed. Cir. 2009)(relying on *KSR* that claim feature is “obvious to try” when there is a finite number of identified predictable solutions). Ex. 1023, ¶ 51.

Therefore, any differences that might exist between Mieth’s load 20 and the recited micro-controller (which the ’021 patent repeatedly calls a load) are such that it would have been obvious to a PHOSITA. Consequently, the combination of Mieth and Balough render obvious the various claims of the ’021 patent under Ground B. *Id.*

PO provides no extrinsic evidence to support its assertion that differences between Mieth’s load and the ’021 patent’s micro-controller are such as to be non-obvious to a PHOSITA. Rather, PO’s arguments are conclusory and have no evidentiary basis, and thus should be given no weight.

C. Obviousness Conclusion

In conclusion, PO's arguments that Mieth fails to render obvious the claim element at issue (and thus the claim as a whole) is conclusory. Petitioner shows that any difference between the load 20 of Mieth and the micro-controller of the '021 are such that the subject matter as a whole would have been obvious to a PHOSITA in accordance with *KSR*.

IV. REMAINING ISSUES RAISED IN THE POR

A. POR Attacks Claim Interpretation While Ignoring the Markman Order in the Delaware Litigation

PO asserts without any support from expert testimony that “first stage” in element [1C] and “first stage power converter” in elements [10C] and [18C], are the same elements, and they require either a step-up or step-down converter. Paper 18, pp. 22-27. They are not. The District Court has ruled on claim construction for both terms; they have different constructions, and neither require an interpretation as PO argues. A “first stage” is “a first set of one or more circuit components that operate alone or together to provide a specified function set forth in the claim.” Ex. 1017, p. 2. A “first stage power converter” is a “power converter that is temporally before the second stage power converter.” *Id.* And a “power converter” is a power electronics circuit that converts *one type* or level *of voltage or current waveform to another.*” *Id.* at p. 4 (emphasis added). The expert report stated a PHOSITA understands a voltage across a capacitor is

proportional to the integral of the current through the capacitor. ($V=(1/C)\int i(t)dt$ or $I=C(dv/dt)$). Ex. 1007, ¶¶ 103, 186. Thus, the DC current from the solar generator charges the capacitor resulting at a voltage at the capacitor output, consistent with the court's claim construction of converting one type of voltage or current waveform to another.

B. PO MISCHARACTERIZES THE COMBINATION OF MIETH AND BALOUGH

In arguing that the combination of Mieth and Balough results in the combination not teaching the control circuit, PO mischaracterizes the combination. Paper 18, pp. 33-35. The Petition does not seek to replace all the elements of Mieth in front of the power converter 19 with Mieth, but instead asserts that a PHOSITA would be motivated to replace the capacitor with the first stage power converter of Balough. Paper 1, p. 51 (stating, "Balogh (Ex.1003) also discloses a first stage, and a PHOSITA would have been motivated to combine Mieth and Balogh.")

Further, the Petition states that a PHOSITA would be motivated to employ the cascaded architecture of Balough with the switchable load of Mieth. Id. at 52 (stating, "[a] PHOSITA is motivated to combine the cascaded power converter architecture of Balogh with the switchable load feature of Mieth.")

Thus, as asserted in the Petition, replacing the capacitor 2 of Mieth with the first power converter (converter 1) of Balough establishes a cascaded power

converter architecture that keeps all the teachings of Mieth regarding the switchable load, including the control circuitry thereof, and thus renders obvious the claims of Ground B.

C. PO ATTEMPTS TO CONFUSE GROUND B WHEN IT IS CLEAR HOW THE GROUND IS CONSTRUCTED

The PO attacks Ground B, feigning confusion on how the ground is constructed. Paper 18, pp. 35-37. Ground A asserted that Mieth disclosed or were analogous to each of elements [1A]-[1G]. Paper 1, p. 33. The Petition states that in Ground B, the combination of Meith and Balough renders the claims obvious, and that Balough is relied upon for disclosing elements [1B]-[1D]. *Id.*, p. 50. Thus, it is clear that Mieth is relied upon for the disclosure or suggestion of elements [1A] and [1E]-[1G], and no confusion exists.

D. THE PETITION'S RATIONALE FOR COMBINING MIETH AND BALOUGH PROVIDES ADEQUATE UNDERPINNING

The PO argues the combination of Mieth and Balough is improper as not supported by rationale underpinnings. Paper 18, pp. 39-41. This is incorrect. The Petition goes into detail explaining the rationale for combining Mieth and Balough, Paper 1, pp. 51-55, and cites extensively to the expert report which provides even greater detail. Ex. 1007, ¶¶ 151-160.

The Petition states that Mieth converts an input PV voltage of as high as 36V. Paper 1, p. 52 (citing Ex. 1002, 12:21-26). The Petition notes that Balough

states that cascading multiple converters together is advantageous in applications having large conversion ratios, and states in its example, an input voltage of 48V.

Id. The Petition further cites to multiple data sheets that indicate PV modules (similar to Mieth's solar generator) can often exhibit open-circuit voltages of 80V.

Id. The Petition then states that a "PHOSITA would have known to combine the cascaded power converter architecture of Balogh for high DC applications (e.g., 48V or 80V solar panel modules) to realize an appropriate intermediate voltage for the switchable load and load 20 of Mieth." *Id.* (citing to Ex.1007,¶156).

In addition the expert report cites to Ex. 1012 as general knowledge of a PHOSITA, that indicates that employing cascaded converters also advantageously improves circuit efficiency. Ex. 1007, ¶ 153; Ex. 1012; ¶ 6. Thus, as Mieth discloses a PV application, and a PHOSITA knows such applications can involve high conversion ratios, Balough teaches that cascaded converters are advantageous for larger conversion ratios, prior art data sheets of record show PV module voltages even higher than Balough, and Xu states that such a cascaded architecture improves circuit efficiency, the Petition adequately showed a detailed rationale that would motivate a PHOSITA to combine together the cited prior art.

V. CONCLUSION

Claims 1-20 should be cancelled.

Respectfully submitted,

April 29, 2024

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(a)(1)(i), I certify that this paper includes 4,318 words. In accordance with 37 C.F.R. § 42.24(a)(1), this word count does not include a count of the words in a table of contents, a certificate of service or word count, appendix of exhibits or appendix of claims. Furthermore, in accordance with 37 C.F.R. § 42.24(d), this word count is the word count of the word-processing system used to prepare the paper.

Respectfully submitted,

April 29, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.105, I hereby certify that I caused a true and correct copy of the **PETITIONER'S REPLY TO THE PATENT OWNER'S RESPONSE** in connection with U.S. Patent No. 9,584,021 and supporting evidence to be served via electronic mail on April 29, 2024 to the following email addresses:

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April 29, 2024

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CLAIM LISTING APPENDIX

U.S. Patent No. 9,584,021 - Avrutsky	
Claim Element Designation	Claim Element
Claim 1	
[1A]	A method to supply power,
[1B]	the method comprising: providing a power supply having a first stage and a second stage,
[1C]	wherein the first stage converts power from a direct current input into a first output,
[1D]	and the second stage powered by the first output has a second output for a micro-controller;
[1E]	connecting the first output of the first stage to a switchable load to consume at least a portion of the first output while disabling the second stage in supplying the second output to the micro-controller;
[1F]	determining whether the first output from the first stage powering the switchable load is above a threshold during a time period in which the second output to the micro-controller is disabled; and
[1G]	in response to a determination that the first output from the first stage powering the switchable load is above the threshold during the time period in which the second output to the micro-controller is disabled, disconnecting the switchable load from the first output of the first stage; and instructing the second stage to enable the second output to the micro-controller using power from the first output of the first stage.
Claim 2	
[2A]	The method of claim 1, wherein the switchable load comprises: a resistive device; and
[2B]	a switching device connected to the resistive device,
[2C]	wherein the switching device is configured to be turned on to be connected to the first output to consume the portion of the first output and turned off to be disconnected from the first stage.

Claim 3: The method of claim 2, wherein the disconnecting of the switchable load from the first output of the first stage comprises sending a first signal to the switching device to turn off the switching device.	
Claim 4	
[4A]	The method of claim 3, further comprising: generating the first signal based on the determining of whether the first output from the first stage powering the switchable load is above the threshold; and
[4B]	delaying the first signal to generate a second signal to the second stage, the second signal enabling the second output to the micro-controller.
Claim 5	
[5A]	The method of claim 4, further comprising: providing a control circuit comprising: a hysteresis amplifier configured to receive the first output of the first stage and generate the first signal; and
[5B]	a delay circuit to generate the second signal according to the first signal.
Claim 6: The method of claim 3, wherein the switching device includes one of: a field effect transistor (FET), a metal-oxide-semiconductor field-effect-transistor (MOSFET), and a bipolar junction transistor.	
Claim 7: The method of claim 6, wherein when the switch device is turned on, the switchable load and an input of the second stage are connected in parallel to the first output of the first stage.	
Claim 8: The method of claim 1, wherein the first stage comprises a first step-down converter; and the second stage comprises a second step-down converter.	
Claim 9: The method of claim 1, wherein the disconnecting is performed prior to the instructing of the second stage to enable the second output to the micro-controller.	
Claim 10	
[10A]	A system to supply power, the system comprising:
[10B]	a power source to provide a direct current input;
[10C]	a first stage power converter configured to convert the direct current input into a first output;
[10D]	a second stage power converter configured to be powered by the first output to generate a second output;
[10E]	a micro-controller powered by the second output; a switchable load; and
[10F]	a control circuit powered by the first output and configured to connect the first output to the switchable load to consume at least

	a portion of the first output while disabling the second stage power converter in supplying the second output to the micro-controller;
[10G]	determine whether a voltage of the first output powering the switchable load is above a threshold during a time period in which the second output to the micro-controller is disabled; and
[10H]	in response to the voltage being above the threshold during the time period in which the second output to the micro-controller is disabled, disconnect the switchable load from the first output of the first stage power converter
[10I]	and signal the second stage power converter to enable the second output to the micro-controller using power from the first output of the first stage power converter.
Claim 11	
[11A]	The system of claim 10, wherein the control circuit comprising: a hysteresis amplifier configured to receive the first output and generate a first control signal for the switchable load; and
[11B]	a delay circuit to generate a second control signal for the second stage power converter by delaying the first signal.
Claim 12	
[12A]	The system of claim 11, wherein in response to the voltage going above the threshold: the first control signal causes the switchable load to be disconnected from the first output of the first stage power converter; and
[12B]	the second control signal causes the second stage power converter to enable the second output to the micro-controller.
Claim 13: The system of claim 12, wherein the micro-controller is configured to maximize power generated by the power source.	
Claim 14: The system of claim 13, wherein the power source comprises a photovoltaic panel; the first stage power converter comprises a first step-down converter; and the second stage power converter comprises a second step-down converter.	
Claim 15	
[15A]	The system of claim 12, wherein the switchable load comprises: a resistive device; and a switching device connected to the resistive device,
[15B]	wherein the switching device is configured to be turned on to be connected to the first output to consume the portion of the first output and turned off to be disconnected from the first stage, and

[15C]	wherein the first control signal is connected to control the switching device.
Claim 16: The system of claim 15, wherein the switching device includes one of: a field effect transistor (FET), a metal-oxide-semiconductor field-effect-transistor (MOSFET), and a bipolar junction transistor.	
Claim 17: The system of claim 16, wherein when the switch device is turned on, the switchable load and an input of the second stage are connected in parallel to the first output of the first stage.	
Claim 18	
[18A]	A system to supply power, the system comprising:
[18B]	a photovoltaic panel to provide a direct current input;
[18C]	a first stage power converter connected to the photovoltaic panel to generate a first output from the direct current input;
[18D]	a second stage power converter connected to convert the first output to a second output;
[18E]	a micro-controller;
[18F]	a power absorption circuit; and
[18G]	a control circuit coupled with the first stage power converter and the second stage power converter, the control circuit powered by the first output to control the second stage power converter, wherein
[18H]	when the second stage power converter is disabled in providing the second output to the micro-controller, the control circuit monitors a voltage of the first output powering the power absorption circuit and signals the second stage power converter to continue disabling the providing of the second output to the micro-controller during a time period in which the voltage is below a threshold;
[18I]	when the voltage is above the threshold, the control circuit signals the second stage power converter to enable the providing of the second output to the micro-controller.
Claim 19	
[19A]	The system of claim 18, wherein the power absorption circuit includes a capacitor coupled to the first output;
[19B]	and the threshold allows the capacitor to power the second stage to operate the micro-controller for a predetermined period of time even without the output of the first stage.
Claim 20	

[20A]	The system of claim 18, wherein the power absorption circuit comprises a switchable load;
[20B]	and the control circuit signals the switchable load to be in a first state to consume a portion of the first output when the voltage is below the threshold
[20C]	and to be in a second state not to consume a portion of the first output when the voltage is above the threshold.