

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.

CASE: IPR2023-00879
U.S. Patent No. 9,584,021 B2

DECLARATION OF DOUGLAS HOLBERG IN SUPPORT OF
PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

I. INTRODUCTION

1. The facts set forth below are known to me personally and I have firsthand knowledge of them. I am a U.S. citizen over eighteen years of age. I am fully competent to testify as to the matters addressed in this Declaration. I understand that this Declaration is being submitted along with Petitioner's Reply to Patent Owner's Response, in *inter partes* review of US Patent No. No. 9,584,021 ("the '021 patent"), IPR2023-00879.
2. In this declaration I was asked to respond to the arguments raised in Patent Owner's Response. Paper 18.

II. MATERIALS CONSIDERED

In forming the opinions expressed herein, in addition to the materials listed in my original declaration in this matter, I have reviewed and considered the following additional materials:

- A. Patent Owner's Response ("POR"), Paper 18.
- B. Ex. 1018; IEEE Standard Dictionary of Electrical and Electronic Terms, 6th Edition, 1996, p. 156.
- C. Ex. 1019; IEEE Standard Dictionary of Electrical and Electronic Terms, 6th Edition, 1996, p. 593.
- D. Ex. 1020: Silicon Labs, C8041F020/1/2/4, 8K ISP FLASH MCU Family, 2003.

E. 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.

F. Ex. 1022: U.S. Patent Publication No. 2008/0266922 (Mumtaz).

G. Ex. 1024: Merriam-Webster dictionary, definition of analogous.

III. PATENT OWNER’S RESPONSE MISCHARACTERIZES THE MEANING OF “LOAD” AND THE MIETH PATENT

3. In this section I respond to the arguments made about Ex. 1001 (“The Invention” of the ’021 Patent”) in the Patent Owner’s Response. Paper 18.

As indicated in the heading, it is my opinion that the Patent Owner mischaracterizes both the state of the art leading up to the ’021 patent as well the scope of the ’021 patent.

A. Patent Owner’s Response Mischaracterizes “load.”

4. In my declaration, Ex. 1007, I presented evidence that Mieth anticipates Claims 1-7 and 9 of the ’021 patent. In particular, I argued that a PHOSITA would understand that a load in a circuit can include a micro-controller, which means that a load can comprise a list of electrical components, devices or even systems that satisfy the well-known, understood definition of a load, and such a list includes a micro-controller. Therefore, the load

disclosed by Mieth covers multiple components, including a micro-controller, and thus Mieth anticipates the '021 in this aspect.

5. To summarize my supplemental declaration as a whole, it is my opinion as a PHOSITA that Mieth discloses and thus anticipates a micro-controller under both the *Eli Lilly/Zenith* and *Eli Lilly/L.A. Biomedical* anticipation standards, and alternatively has differences such that the load of Mieth renders the micro-controller of the '021 obvious.

6. A PHOSITA would understand that the term “load” has a well-known meaning in the art. The IEEE dictionary defines load as follows:

load (7): (electric) (electric utilization) The electric power used by devices connected to an electrical generating system. Ex. 1018, p. 156.

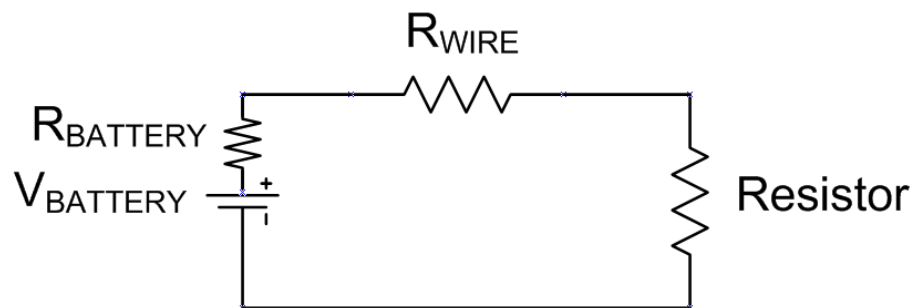
7. Thus, a load is a device defined by its function of consuming electrical energy or power when connected to an energy supply source. To discover the full import of this definition, it is necessary to consider the fundamental nature of a circuit device that in many instances operates as a load. Again, the IEEE dictionary is helpful in this regard:

Circuit (7) (A) A circuit is an arrangement of interconnected components that has at least one input and one output terminal, and whose purpose is to produce at the output terminals a signal that is a function of the signal at the input terminals. Ex. 1019, p. 593.

8. A PHOSITA understands a circuit to contain at least one input and at least one output. The input is a signal source where the signal might be dynamic (e.g., audio provided by a transducer), or static (e.g., a battery). Circuits typically have multiple inputs with one of those inputs supplying power (e.g., from a battery). In the present art being evaluated and in the '021 patent, the input source supplying power is a solar generator (e.g., comprising one or more photovoltaic modules). A simple circuit example is one where the input is a battery, and the output is a resistor. Such a circuit is shown below.



9. Ideally, the battery would be a perfect voltage source, meaning that it has no intrinsic resistance and the voltage is fixed and time invariant. Such a battery is considered an ideal voltage source and does not exist in reality. Moreover, the wires connecting the battery to the resistor are not superconductors having zero resistance. Indeed, real wire has resistance. A real-world model of the battery/resistor circuit is shown below.



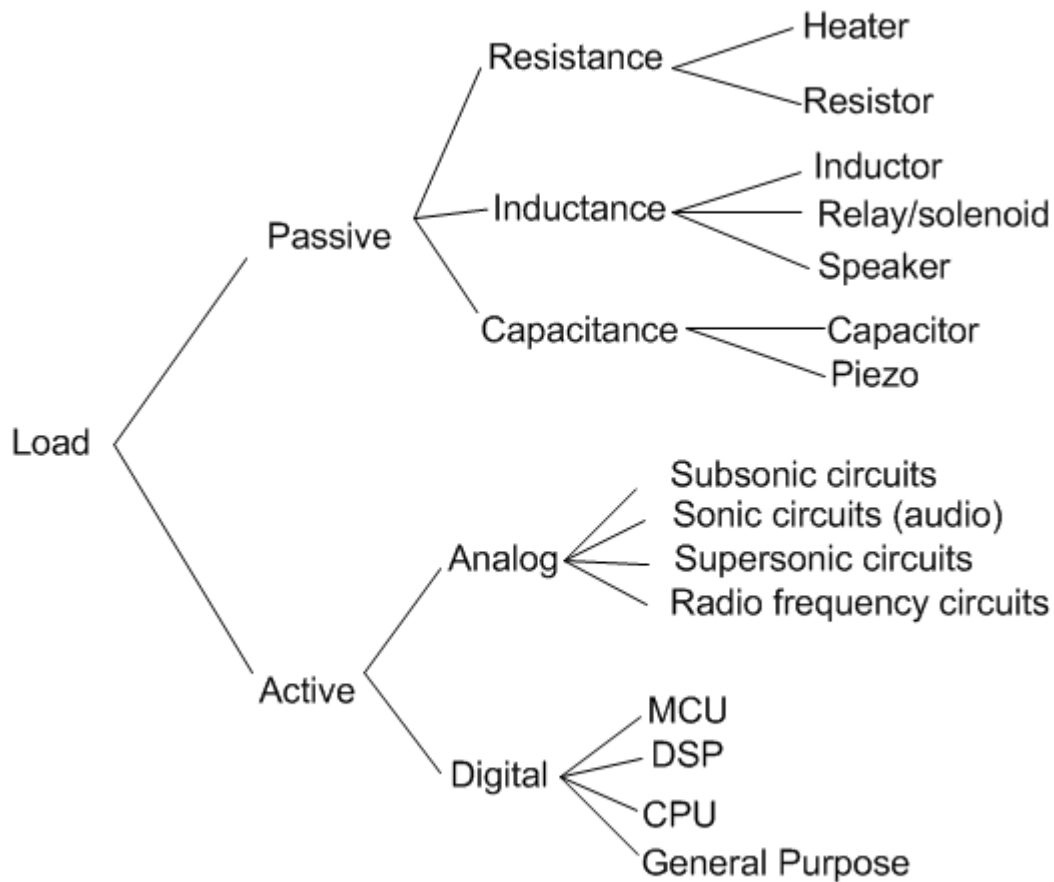
10. In this case two new elements are added. Specifically an additional resistance that represents the resistance associated with a real-world battery (R_{BATTERY}) and a resistance representing the lumped resistance of all interconnecting wire, R_{WIRE} . A PHOSITA would view the obvious, that this circuit contains a source (the battery and its resistance) and the load (Resistor). In this example, the load resistor is the “load” as it is consuming electrical energy from the battery in order to perform its intended work function.

11. When analyzed as a lumped time invariant circuit, one would use Ohms law to find that conventional current flows from the positive terminal of the battery through the lumped interconnecting resistor, to the load resistor and returns to the negative terminal of the battery. Thus, stored energy in the battery is dissipated by its own intrinsic resistance as well as the interconnect resistance and the load resistance. A PHOSITA understands that the intrinsic resistance of the battery and the resistance of the interconnecting wire are parasitic in nature, meaning that they are undesirable components that cannot be avoided, and do not contribute to the intended work function of the load. In contrast, the resistor load is the desired component in that it is providing a useful function resulting from the energy transfer from the battery to the load. Perhaps this useful function is as fundamental as generating heat. (It is typical, for example, for HVAC systems using heat pumps to provide auxiliary resistive heating—simply mains voltage shunted by a resistor constructed as a coil of wire in the air handler).
12. Referring again to the realistic circuit above, a PHOSITA would appreciate that if the load resistor were removed, no current would flow and thus there

would be no power dissipated in the intrinsic resistance of the battery, nor the intrinsic wire resistance. It would be an open circuit and no work would be done. Arguably, it would be a useless collection of electronic elements.

13. The principles thus far illustrated are not limited to such a simple resistive load. In fact the load could be a variety of elements alone or in combination that perform useful functions.

14. Loads come in many forms—all of which provide a useful function. A load could be a light bulb that when placed in the circuit receives energy flowing from the source (battery) to the filament of the light bulb. Illumination could alternatively be generated by a light emitting diode—also a load. A motor is a load. When a motor is connected to a source via interconnecting wire, current flows into the motor and causes it to spin and perform some useful function. A PHOSITA would consider the list below a fairly exhaustive catalog of loads.



15. It is common to identify different types of loads. As highlighted above, perhaps the most common or simplest type of load is a resistive load. A resistive load obstructs (but does not block) the flow of electrical energy in the circuit, and converts that electrical energy into thermal energy. The lamp and the heater described above are simple examples of a resistive load. In addition, resistive loads, when powered from an AC source, consume the

power in a manner that the current and voltage signals at the load remain in the same phase, and thus the power factor associated therewith is considered a unity power factor. (See, e.g., <https://www.ny-engineers.com/blog/top-3-types-of-electrical-load-resistive-inductive-capacitive>).

16. An inductive load uses a magnetic field for doing the work. Transformers, generators, and motors are examples of inductive loads. The inductive load has a coil which stores magnetic energy when the current from the electrical source passes through it. Inductive reactance comes from devices with a coil that can store energy from a magnetic field. The formula for inductive reactance is $X_L = 2\pi fL$, wherein L is the inductance in Henries. The inductive reactance is a linear function, as it increases with either an increase in frequency or an increase in inductance. (See, e.g., <https://www.sciencedirect.com/topics/engineering/inductive-reactance>).
17. The current wave of the inductive load is lagging behind the voltage wave, and the power factor of the inductive load is also lagging.
18. Capacitive loads include energy stored in materials and devices, such as capacitors, and cause changes in voltage to lag behind changes in current. Capacitive reactance comes from devices with a dielectric that can store

electrical charge. The formula for capacitive reactance is $X_C = 1/2\pi fC$, where X_C is the reactance in Ohms, f is the applied signal frequency in Hertz, and C is the capacitance in Farads. (See, e.g., <https://circuitglobe.com/electrical-load.html>).

19. This formula tells us that X_C becomes infinite at 0 Hz (DC) so a capacitor appears as an open circuit to a DC current. It also shows that capacitive reactance decreases as frequency increases. These properties make capacitors useful for DC power supply smoothing as they provide a short circuit path for unwanted frequency signals. These are also found in AC filter circuits.

20. Additionally, capacitors draw current that leads the voltage sinusoidal waveform - they have a leading power factor. This contrasts with motors and other inductive machines that have a lagging power factor. Accordingly, capacitor banks can be added to systems with motors as a counteractive element to bring the power factor as close as possible to unity; this minimizes the flow of unproductive, unwanted reactive currents in a circuit. (See, e.g., <https://www.newark.com/capacitive-load-definition>).

21. In my discussion with legal counsel on this matter, I understand that anticipation requires a prior art reference disclose each and every element in a claim, arranged as recited in the claim. I also understand that in some unique cases, a prior art reference will disclose a genus, and in those circumstances such a reference only anticipates a recited species in a claim when special circumstances are met. As a general rule, in such instances where a prior art reference discloses the genus while a patent claim 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 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. Lastly, according to the Institution Decision, the dispositive question is whether one skilled in the art would have reasonably understood or inferred from a prior art reference that every claim element is disclosed in that reference.

22. I understand that in the original Petition, the Petitioner argued that load 20 of Mieth constitutes a genus that encompasses the micro-controller as a species. Paper 1, p. 25. It is my understanding that when saying a

PHOSITA understands that a load in a circuit “can be or include” a micro-controller, it means that a load can be a list of things, such as A, B, or C, and that C, for example, is a micro-controller is included in that list. In such a context a PHOSITA understands that the term load is a general term of art that can encompass several types of devices that are related by their function. Thus, it is my understanding that the case law relating to the genus/species issue is relevant in determining whether the load of Mieth anticipates the micro-controller recited in the '021 patent.

23.As stated above in paragraphs 4-20, the term “load” is a well-known, clearly understood term of art in the field of electronics and electrical circuits. A PHOSITA is familiar with the term and its fundamental meaning, and when provided with a device or circuit element(s) in its context can readily ascertain whether that device or circuit element(s) constitutes a load. When I evaluate the micro-controller element recited in the '021 patent, it is immediately apparent that such element is a load, and falls within the defined and limited class of devices or circuit elements that constitute loads.

24.As stated above, a device is a load when it receives and consumes electrical energy to perform a useful work function. Because this definition defines

and limits the size of the class of elements therein, I as a PHOSITA can easily evaluate the '021 patent and determine that the micro-controller is a load, and is anticipated by the disclosure of Mieth.

25. When evaluating the micro-controller of the '021 patent, I note that it is not shown in any of the figures, but is described as being coupled to the output of the second buck converter 402. For example, the '021 patent reiterates that its micro-controller operates as a load to buck converter 402, stating: “Circuit (400) therefore can be used to address the false start problem that occurs when the solar panel is able to provide enough output voltage when it is not connected to the output, 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).
26. The '021 patent also states, “[t]ypically, 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). Thus, the '021 patent itself uses the term load as a generic term of art and then provides a list of elements (“control logic, a control circuit, a micro-controller” Ex. 1001

8:31,32) that operate as a load by consuming electrical energy from the buck converter 402 to perform a useful work function.

27. Upon conferring with counsel for the Petitioner, I have been informed of the Federal Circuit case of *Eli Lilly & Co. v. Zenith Goldline Pharm., Inc.*, 471 F.3d 1369, 1376 (Fed. Cir. 2006). In the *Eli Lilly/Zenith* case, it is my understanding that the technology is different than in the present case, as the patent at issue related to pharmaceutical compounds. The defendant asserted invalidity of a claim by citing to art that disclosed identified compounds from the same family of compounds as in the recited claim. The court distinguished cases where a prior art disclosure of a genus anticipated a species by stating that anticipating prior art in those cases were sufficiently detailed for a PHOSITA to appreciate the contours of the genus in question.
28. This requirement that the genus be well defined to limit the species class makes sense, particularly in technology fields such as chemistry and pharmaceuticals where a general compound definition can potentially encompass thousands or tens of thousands of species compounds. Further, in such areas of technology that are substantially less predictive than electronics and mechanics, it is my understanding that one often can

discover unexpected results for individual species within that genus, such that the genus itself does not properly define and limit itself in a manner that informs the public. To avoid such instances, the court indicated that for a genus disclosure to anticipate a recited species, the genus must clearly define and limit the class of species in such a manner that a PHOSITA could readily appreciate what species elements fall within the disclosed genus.

29. In the present case of the Mieth prior art (as well as the '021 patent), the field of technology is electronic circuits where all the components and elements therein predictably follow the laws of physics, such as Ohm's law and other basic laws of physics. In this present context, Mieth discloses a term "load" that is well-known to me (a PHOSITA) as a term of art that is well-defined and limits the contours of the species that fall within this term. More particularly, a load (as arranged in the claim) must consume electrical energy to perform a useful work function and those elements, devices, etc. that do not meet such definition would not constitute a load. Thus, as a PHOSITA, I can readily evaluate a circuit, circuit element, device, etc. in its context and determine whether it is a load. In evaluating the '021 patent, the micro-controller, as arranged in the claim, is configured to consume

electrical energy to produce a useful work function and therefore clearly operates as a load, as admitted in the '021 patent disclosure.

30. As a PHOSITA, upon reading Mieth, I understand the load 20 to be the output of the power converter 19, and the load receives a regulated supply of power from the power converter despite a fluctuating power source (i.e., the solar generator). Similarly, upon reading the '021 patent, as a PHOSITA I understand that the micro-controller (which is referenced as a load multiple times) is the output of buck converter 402 and receives a regulated supply of power via the buck converter 402 despite a fluctuating power source (i.e., a solar panel). Thus, both Mieth's load 20 and the micro-controller of the '021 patent are configured as the outputs of a power converter to receive a regulated supply of electrical energy. Further, both the load 20 of Mieth and the micro-controller of the '021 patent consume the regulated electrical energy to perform a useful work function. Further, as the '021 patent states that its micro-controller (i.e., the MCU, see Ex. 1001, 8:36-37) is a load, as a PHOSITA, I can immediately appreciate that the micro-controller of the '021 falls within the defined and limited genus class of "load" and thus is anticipated by Mieth.

31. Thus, it is my opinion that the *Eli Lilly/Zenith* case provides a standard that is applicable to the present facts, as the Mieth disclosure meets the specific requirements set forth by *Eli Lilly/Zenith* in that a load is a well-known term of art that clearly defines the class of species that reside therein. Therefore it is my opinion that the Mieth disclosure of the load 20 is a genus that anticipates the micro-controller of the '021 patent.

32. Upon further conferral with Petitioner's counsel, I have been informed and made aware of the Federal Circuit court case, *Eli Lilly & Co. v. L.A. Biomedical Research Inst.*, 849 F.3d 1073, 1074–1075 (Fed. Cir. 2017), that discusses the law of anticipation. I am informed the court held that in evaluating whether a reference anticipates a claim feature, whether the reference suggests the subject matter is not the standard, but instead the inquiry is whether a PHOSITA would reasonably understand and infer from the prior art disclosure that the claim element at issue is disclosed therein.

33. In the facts of the present case the load 20 of Mieth is a well-defined term of art in the field of electronics, and covers a limited class of circuits, devices and apparatuses that satisfy specific criteria. Specifically, the criteria that the load receives and consumes electrical energy. Upon evaluating the '021

patent, the micro-controller is arranged exactly as the load 20 in Mieth, consumes electrical energy from the buck converter 402 (exactly as the load 20 of Mieth receives energy from its power converter 19), and operates to provide a useful work function (i.e., control functionality). Based upon my knowledge of electronic circuits, their arrangement and function (even without the teaching of the '021 patent), it is my opinion the teaching of Mieth discloses a limited number of items, namely circuits and devices that satisfy the criteria of a load. I also know that control circuitry such as a micro-controller is an extremely common form of load, especially as an output from a power converter, as micro-controllers require a regulated supply voltage to prevent device damage from unregulated voltage spikes. Ex. 1020, pp. 1, 31-32; Ex. 1021, p. 2. Thus, I can easily understand that the micro-controller of the '021 is operating as a load. My conclusion is buttressed by the '021 patent itself, that states that its micro-controller is operating as the load of the buck converter 402, Ex. 1001, 8:28-34; Ex. 1001, 8:55-58. Thus, based on this evidence of record, it is my opinion that Mieth's load 20 anticipates the claim feature at issue under the *Eli Lilly/L.A. Biomedical* standard for anticipation (*supra* ¶¶**Error! Reference source not**

found.) because as a PHOSITA I can reasonably understand and infer from the Mieth disclosure that the claim element at issue is disclosed therein.

34. In my declaration, I did not make conclusory assertions about the anticipation of Mieth without citing extrinsic evidence for support, as in the POR. Paper 1, p. 23. Specifically, I opined that the load 20 as shown and described in Mieth leads a PHOSITA to understand that the term discloses a micro-controller. Ex. 1007, ¶¶ 103-105, citing to Ex. 1014, Fig. 5, to buttress the assertion the load of Mieth and the micro-controller are arranged and operate identically, and thus the load 20 of Mieth satisfies the Eli Lilly standard for anticipation. In my original declaration, I 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).

35. Fig. 5 of Ex. 1014 is provided in annotated form below for the Panel's easy reference in direct response to PO's assertion that Mieth's load fails to anticipate the micro-controller.

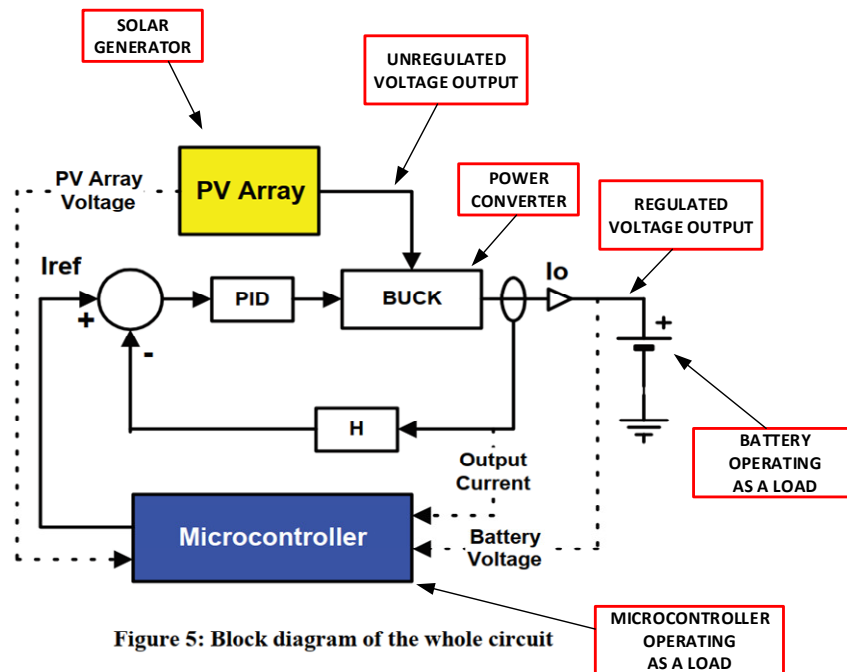
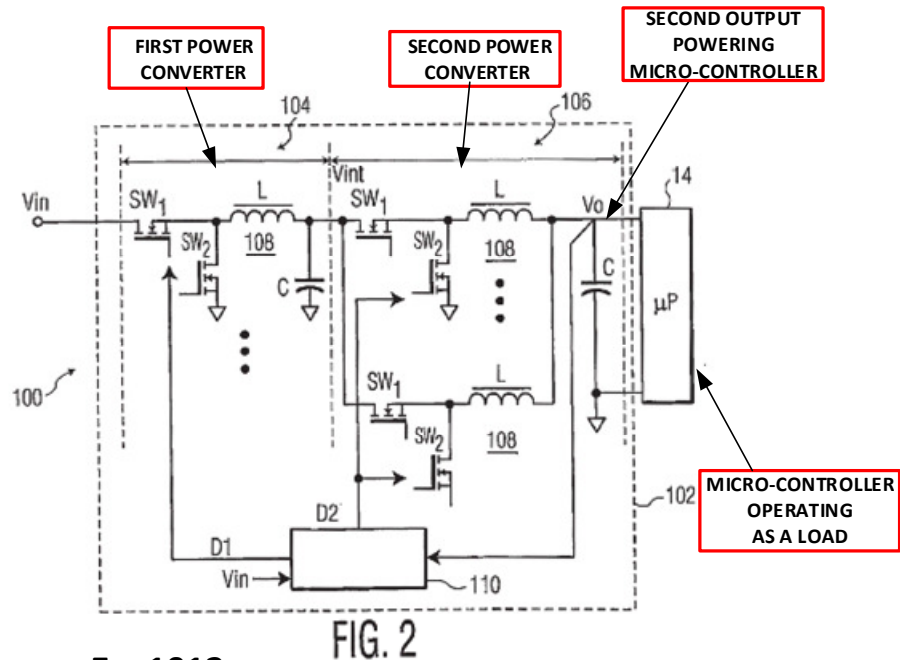


Fig. 5 of Ex. 1014 shows a photovoltaic (PV) array that operates as a fluctuating power source, similar to both Mieth and the '021 patent.. The PV array outputs a DC current with an unregulated (i.e., fluctuating) voltage to a buck converter (e.g., a power converter) that down-converts the unregulated PV array voltage to a regulated voltage (similar to Mieth and the '021 patent) that supplies regulated electrical power to a microcontroller (see dotted line) that consumes the electrical power from the buck converter *and thus operates as a*

load. Therefore Ex. 1014 shows an identical arrangement and functionality of both Mieth and the '021 patent, and buttresses Petitioner's contention that a PHOSITA readily concludes a load receiving a regulated source of energy is a digital circuit requiring regulated power, which is typically a micro-controller.

36. Ex. 1012 (Xu) of record also shows a micro-controller consuming electrical power and therefore operating as a load. Fig. 2 of Ex. 1012 provided below shows a cascaded power converter architecture, wherein a first power converter 104 drives a second power converter 106 having a second output (V_o) that powers a microprocessor 14, which is synonymous with a micro-controller. Operation of the circuit is provided in paragraph [0018] of the Exhibit, where it states:

The two-stage cascaded buck power delivery system 100 operates to provide an output voltage V_o at the output of the second buck stage 106 in response to an input voltage V_{in} applied to the input of the first buck stage 104.... The input voltage V_{in} is typically a pre-regulated bus voltage of 12 V $\pm$ 15% or a battery voltage of 6-24 V, ***and the output voltage V_o is the processor voltage of 0.x-1.x V.*** (Emphasis added).



37. The microprocessor 14 receives the second output (V_o) and consumes electrical power provided by the second output of the second power converter 106 *and thus operates as a load* in the same manner as the microcontroller of claims 1, 10 and 19 at issue. Thus, Mieth either anticipates the element or it is obvious over Mieth in view of the general knowledge of a PHOSITA, as evidenced by Xu.

38. Thus, Mieth discloses the element under either Sections 102 or 103.

39. Lastly, the '021 patent (Ex. 1001) itself clearly indicates that the microcontroller claim element is a load. For example, the '021 patent states:

Circuit (400) therefore can be used to address the false start problem that occurs when the solar panel is able to provide enough output voltage when it is not connected to the output, 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).

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).

40. The '021 patent admits that its micro-controller (i.e., the MCU, see Ex.

1001, 8:36-37) is a load. Thus, I, as a PHOSITA, readily understand that when I consider the load 20 of Mieth I readily understand and infer that it discloses the claimed micro-controller, i.e., the load 20 of Mieth anticipates the claimed micro-controller.

41. As a PHOSITA, upon reading Mieth, I understand the load 20 to be the output of the power converter 19, and the load receives a regulated supply of power from the power converter despite a fluctuating power source (i.e., the solar generator). Similarly, upon reading the '021 patent, as a PHOSITA I understand that the micro-controller (which is referenced as a load multiple times) is the output of buck converter 402 and receives a regulated supply of

power via the buck converter 402 despite a fluctuating power source (i.e., a solar panel). Thus, both Mieth's load 20 and the micro-controller of the '021 patent are configured as the outputs of a power converter to receive a regulated supply of electrical energy. Further, both the load 20 of Mieth and the micro-controller of the '021 patent consume the regulated electrical energy to perform a useful work function. Thus, just as the '021 patent explicitly states that its micro-controller (i.e., the MCU, see Ex. 1001, 8:36-37) is a load, as a PHOSITA, I can immediately appreciate that. Thus, based on this evidence of record, it is my opinion that Mieth's load 20 anticipates the claim feature at issue under the *Eli Lilly/L.A. Biomedical* standard for anticipation, I as a PHOSITA, reasonably understand and infer from the Mieth disclosure that the claim element micro-controller is disclosed therein.

42. Thus, a PHOSITA reasonably understands or infers that Mieth is disclosing the micro-controller recited in the claims of the '021 patent, as both function identically (i.e., receive and consume a regulated supply of power), and are arranged in an identical fashion (i.e., both are arranged between a power converter arrangement and a fluctuating power source).

43. It is my opinion as a PHOSITA that Mieth discloses the micro-controller claim element via its teaching of a load 20 under both the *Eli Lilly/Zenith* standard (§**Error! Reference source not found.**) and the *Eli Lilly/ L.A. Biomedical* standard (§**Error! Reference source not found.**), respectively. Nevertheless, if the PTAB panel disagrees, it is my opinion that the teaching of Mieth renders the micro-controller element obvious under the law of obviousness and the facts of the present matter.
44. Upon conferring with Petitioner's counsel, it is my understanding that 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 non-obviousness. It is my understanding that prong (1) is considering the teaching of the Mieth reference, prong (3) has been established in the Institution Decision, and that with respect to prong (4), the Patent Owner has not offered any objective evidence of non-obviousness. Thus, my analysis on whether Mieth renders the micro-controller obvious will focus upon prong (2).

45. With regard to prong (2), upon conferral with counsel, it is my understanding that 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).

46. I understand that a conclusion of obviousness can be based on various rationales that may support a conclusion of obviousness. Such rationales include: (A) Combining prior art elements according to known methods to yield predictable results; (B) Simply substituting one known element for another to obtain predictable results; (C) Using known techniques to improve similar devices (methods, or products) in the same way; (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (E) Using an obvious to try solution, i.e., choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (F) Applying known work in one field of endeavor to yield variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; (G)

Applying some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference disclosures to arrive at the claimed invention.

47. After reviewing and considering the facts in the present case, it is my opinion as a PHOSITA that consideration of at least factors (B), (D) and (E) lead me to conclude that the recited micro-controller in the '021 patent is obvious in view of the load 20 of Mieth.

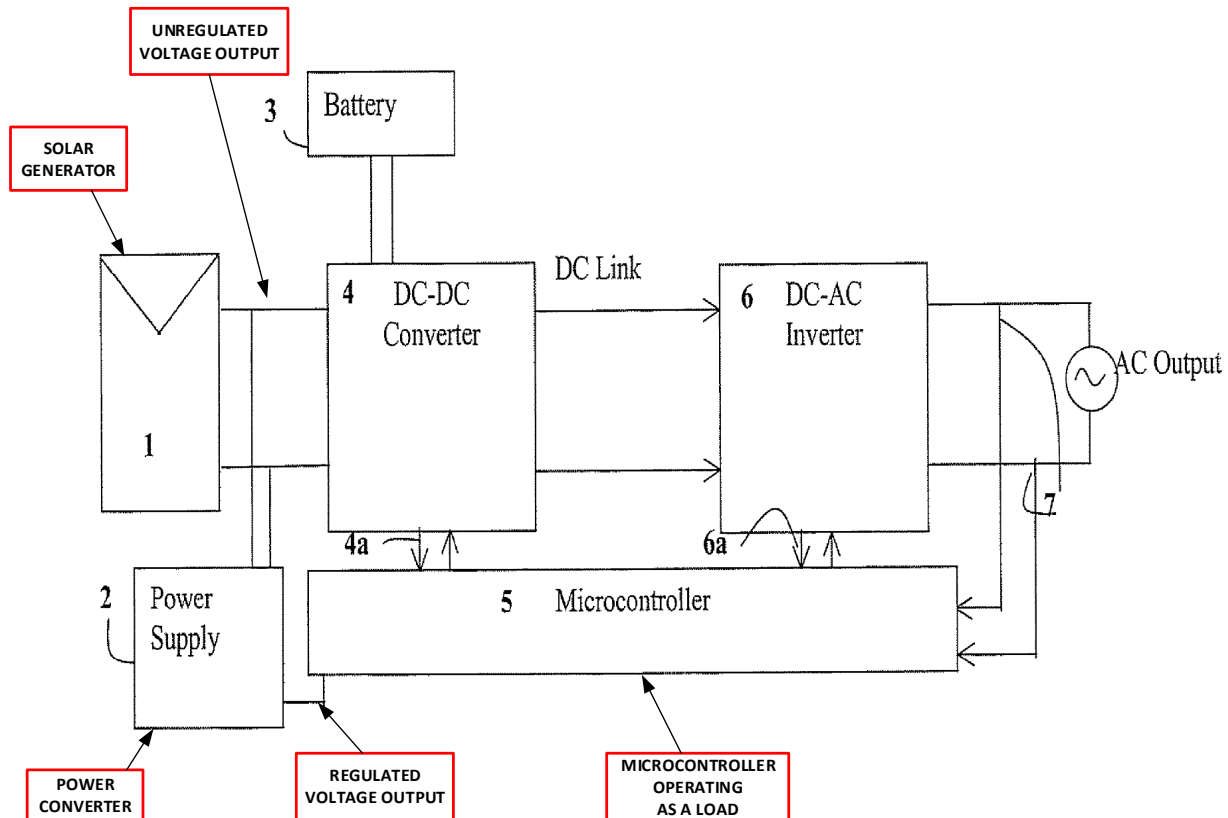
48. As stated above, “load” is a term of art in the field of electronics and has a well-known meaning to a PHOSITA (i.e., a circuit, circuit element or device that consumes electrical energy to perform a work function). That meaning has substantively been adopted by the Delaware Court in the parallel litigation proceeding. Ex. 1017, p. 3. As a PHOSITA, I understand that there are different kinds of loads: resistive, capacitive, inductive, and combinations thereof, for example. In addition, loads can differ from one another in the useful work function they perform. For example, some loads, such as a motor, are often referred to as an “AC load” as it receives and consumes AC power from a source. Further, other loads, such as a micro-controller, are considered a “DC load” as such a load receives and consumes

DC power from a source. Based on the intended work function, a PHOSITA knows that loads may have different requirements. For example, a simple resistive load (e.g., a resistive heater) may not need regulation in the supply of electrical energy thereto. Other loads (e.g., digital circuitry), may have strict input voltage requirements (e.g., a required voltage range for the input supply voltage) to operate properly and avoid damage. 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; Ex. 1022, Fig. 2a. For example, it is common for micro-controllers to have a supply voltage requirement (e.g., 3.3V), and their data sheets specify a small supply voltage range (e.g., $2.7V < V_{supply} < 3.6V$) be provided thereto to ensure reliable operation. Ex. 1020, pp. 1, 31-32. Thus, while there are various 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 anticipate the type of load being employed.

49. 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 voltage and thus a regulated supply of DC energy to the load 20. Ex. 1002;

1:19-21; 1:23-28; 2:1-15; 4:25-27; 4:30-32; 4:37-5:2; 8: 8-9. Thus, a PHOSITA understands the load 20 is a load that requires a regulated supply of energy, and such energy is DC, to perform properly (as providing regulation when unneeded undesirably increases circuit area, cost and complexity). Micro-controllers and other low-voltage digital circuits such as memory require a regulated supply voltage. Ex. 1014, Fig. 5; Ex. 1012, Fig. 2; Ex. 1022, Fig. 2a. Ex.. 1021, p. 2.

50. Ex. 1014, Fig. 5, Ex. 1012, Fig. 2, and Ex. 1022, Fig. 2a (submitted with this declaration), are three exhibits of record that support my opinion as a PHOSITA that Mieth's load 20 renders obvious the micro-controller of the '021 patent. These exhibits each show the exact same circuit configuration of an unregulated source (such as a PV source, Ex. 1014, Ex. 1022) being regulated by one or more converters, and then providing a regulated supply of electrical energy as a supply voltage to a micro-controller that is operating as a load.



Ex. 1022

Figure 2a

51. Thus, a PHOSITA readily appreciates that 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 therein. One type of load that satisfies all of these constraints is a micro-controller. 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

and consuming regulated DC electrical energy), a PHOSITA understands the circuit elements (if not the same) that meet the requirements required by both Mieth and the '021 patent 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. Thus, in my opinion as a PHOSITA, any differences that might exist between Mieth's load 20 and the recited micro-controller are such that it would have been obvious to a PHOSITA, as both elements could be substituted without any technical hurdles and thus would have a reasonable expectation of success, and because it would be obvious to try a micro-controller as a load in Mieth as it is one of only a few circuits needing such regulation. Ex. 1021, p. 2. Thus, as the micro-controller is obvious in view of Mieth, the combination of Mieth and Balough render obvious the various claims of the '021 patent under Ground B of my declaration.

52. I understand that the determination of obviousness is a factual inquiry. In reviewing the POR, I note an absence of evidence provided to support PO's position. That is, I do not see any evidence in the form of an exhibit or expert testimony that would support a position that differences between

Mieth and the '021 patent's micro-controller are such as to be non-obvious to a PHOSITA. Rather, PO's arguments state the '021 patent is non-obvious without supporting evidence. As a PHOSITA, such blanket, conclusory statements are not persuasive in coming to such a factual determination.

IV. ACKNOWLEDGEMENT

53.I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that willful false statements or the like may jeopardize the validity of the patent or any patent issuing thereon.

Signed in Wimberley, Texas on April 29, 2024

A handwritten signature in black ink, appearing to read "Douglas Holberg", written in a cursive style.

Douglas Holberg

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CERTIFICATE OF SERVICE

I hereby certify that on this 29th day of April, 2024, the foregoing **DECLARATION OF DOUGLAS HOLBERG IN SUPPORT OF PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE** was served upon Patent Owner's attorney of record by emailing to the following addresses:

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April 29, 2024

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