

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ANKER INNOVATIONS LTD.,
Petitioner,

v.

POWERMAT TECHNOLOGIES LTD.,
Patent Owner

Case: IPR2024-00996

U.S. Patent No. 8,626,461

**DECLARATION OF PATRICK MERCIER, PH.D.
REGARDING U.S. PATENT NO. 8,626,461**

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EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 8,626,461
1002	Prosecution History of U.S. Patent No. 8,626,461 (“the ‘461 application”)
1003	Expert Declaration of Gary Woods, Ph.D.
1004	U.S. Publication No. 2005/0075699 (“Olson”)
1005	PCT Publication No. WO2005/109597 (“Stevens”)
1006	US Publication No. 2002/0057164 (“Jin”)
1007	U.S. Provisional App. Serial No. 60/907,132 (March 22, 2007)
1008	U.S. Provisional App. Serial No. 60/935,847 (September 4, 2007)
1009	U.S. Provisional App. Serial No. 61/006,076 (December 18, 2007)
1010	U.S. Provisional App. Serial No. 61/006,448 (January 16, 2008)
1011	U.S. Provisional App. Serial No. 61/006,721 (January 29, 2008)
1012	<i>Powermat Technologies Ltd. v. Anker Innovations Ltd.</i> , Case No. 5-23-cv-00052 (E.D. Tex.), Document 1 (Complaint), June 5, 2023
1013	U.S. Patent No. 7,605,496 (“Stevens496”)
1014	U.S. Patent No. 7,791,312 (“Kook”)
1015	Petitioner’s <i>Sotera</i> Stipulation
1016	Waiver of Service, <i>Powermat Technologies Ltd. v. Anker</i>
2001	U.S. Patent Publication No. US 2007/0279002 (“Partovi”)
2002	PCT Publication No. WO2010/025156 (“Cook”)
2004	Deposition Transcript of Gary Woods, Ph.D., taken on May 14, 2025

LISTING OF CHALLENGED CLAIMS¹

Claim Element	Claim Text
[13.P]	An inductive power outlet comprising at least one primary coil, for inductively coupling with a secondary coil wired to an electric load, the inductive power outlet further comprising an efficiency monitor comprising:
[13.1]	at least one input power monitor configured to measure input power received by the primary coil from the power supply;
[13.2]	at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil;
[13.3]	at least one processor configured to receive data pertaining to the input power and the output power, the processor further configured to determine an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil;
[13.4]	wherein the index of power-loss comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential Δ , defined as the difference between the output power and the input power.
[14]	The inductive power outlet of claim 13 additionally comprising at least one circuit-breaker configured to disconnect the primary coil from the power supply.
[15.1]	An inductive power receiver comprising at least one secondary coil for inductively coupling to a primary coil and supplying power to an electric load,
[15.2]	the inductive power receiver further comprising at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil, and
[15.3]	at least one signal transmitter configured to transmit signals carrying data pertaining to the output power to the inductive power outlet of claim 13.

¹ For convenience purposes only, I have adopted the numbering of claim limitations advanced in the Declaration of Dr. Gary L. Woods (Ex. 1003). I do not concede the appropriateness of such grouping and numbering of claim limitations.

Claim Element	Claim Text
[16]	The inductive power receiver of claim 15 wherein the signal transmitter is selected from a group consisting of: light emitting diodes, radio transmitters, optocouplers, and transmitter circuits.
[17.1]	The inductive power receiver of claim 15 wherein the transmitter comprises: an ancillary load selectively connectable to the secondary inductive coil, a modulator for modulating a bit-rate signal with an input signal to create a modulated signal, and
[17.2]	a switch for intermittently connecting the ancillary load to the secondary inductive coil according to the modulated signal.
[18]	The inductive power receiver of claim 15 wherein the output power monitor is incorporated into an electric device.

I. INTRODUCTION

1. My name is Patrick Mercier and I have prepared this declaration at the request of the Patent Owner in this case, Powermat Technologies Ltd. (“Powermat”) regarding U.S. Patent No. 8,626,461 (Ex. 1001, “the ’461 Patent”). I am an independent consultant.

2. I have been asked by Powermat’s counsel to opine on whether the Challenged Claims of the ’461 Patent are rendered obvious by the prior art and to provide opinions regarding certain claim language in the ’461 Patent, and provide my understanding of the level of ordinary skill in the art related to this patent, as well as to explain the relevant technical background related to this patent.

3. My opinions are based on my education, research, knowledge, and experience in designing, developing, and testing wireless charging devices and/or systems, including those using inductive charging techniques. My opinions are also based on the documents and information referenced in this declaration, as well as my study of relevant materials, including the ’461 Patent and its file history.

4. I am compensated at an hourly rate of \$250 for my services on this case. I have no financial interest with the Patent Owner or Petitioner and my compensation does not depend upon my opinions rendered or on the outcome of this Petition.

5. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to amend or supplement my opinions based on additional documents or evidence I am presented, including without limitation any arguments or expert declarations advanced by Petitioner in this case.

6. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

7. I am over 18 years of age and, if I am called upon to do so, I am competent to testify as to the matters set forth herein. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

II. QUALIFICATIONS

8. I have devoted my career to the research and development of various types of power circuits and electronic systems, including circuits and systems for wireless power transfer. I am currently a Full Professor and Vice Chair of the Electrical and Computer Engineering department at the University of California, San Diego. I am the Site Director for the Power Management Integration Center – a

National Science Foundation Industry/University Research Cooperative Research Center – and I am the co-director of the Center for Wearable Sensors. My work with both centers includes power circuits and systems. My current CV is attached hereto as Appendix A and my prior engagements as an expert witness is attached hereto as Appendix B.

9. I received my Ph.D. in Electrical Engineering in 2012 and my S.M. in 2008, both from the Massachusetts Institute of Technology. My Ph.D. thesis focused on power delivery in medical devices and on wireless power transfer. I received my B.Sc. degree in Electrical and Computer Engineering in 2006 from the University of Alberta.

10. In 2012, after receiving my Ph.D., I joined the University of California, San Diego as an Assistant Professor. I also am a board member of several companies and co-founded another. Over the course of my educational and professional careers, I have received several honors and awards relating to my teaching and research, including from the IEEE, San Diego County, UCSD, DARPA, and Intel. I am an IEEE Fellow.

11. I have extensively published in the area of power electronics. For example, I was co-editor of a book entitled “Power Management Integrated Circuits” and co-editor of a book entitled “Ultra-low-power Short-Range Radios,” in which I

wrote a chapter entitled “Near-Field Wireless Power Transfer.” I have also been published in numerous journals on the topic of power electronics and wireless power transfer, including, for example:

- a. A. Abdulslam, P.P. Mercier, “A Symmetric Modified Multilevel Ladder PMIC for Battery-Connected Applications,” IEEE Journal of Solid-State Circuits, vol. 55, no. 3, pp. 767-780, Mar. 2020. (CICC Special Issue).
- b. S.S. Amin, P.P. Mercier, “A Fully-Integrated Li-ion-Compatible Hybrid 4-Level DC-DC Converter in 28nm FDSOI,” IEEE Journal of Solid-State Circuits, vol. 54, no. 3, pp. 720-732, Mar. 2019. (CICC Special Issue).
- c. C. Kim, S. Ha, J. Park, A. Akinin, P.P. Mercier, G. Cauwenberghs, “A 144 MHz Fully Integrated Resonant Regulating Rectifier with Hybrid Pulse Modulation for mm-sized Implants,” IEEE Journal of Solid-State Circuits, vol. 52, no. 11, pp. 3043-3055, Nov. 2017.
- d. L.G. Salem, J.F. Buckwalter, P.P. Mercier, “A Recursive Switched-Capacitor House-of-Cards Power Amplifier,” IEEE Journal of Solid-State Circuits (JSSC), vol. 52, no. 7, pp. 1719-1738, Jul. 2017.
- e. D. Ahn and P.P. Mercier, “Wireless Power Transfer with Concurrent 200 kHz and 6.78 MHz Operation in a Single Transmitter Device,” IEEE Transactions on Power Electronics, vol. 31, no. 7, pp 5018-5029, Jul. 2016.
- f. L.G. Salem and P.P. Mercier, “A Recursive Switched-Capacitor DC-DC Converter Achieving 2^N-1 Ratios with High Efficiency over a Wide Output Voltage Range,” IEEE Journal of Solid-State Circuits (JSSC), vol. 49, no. 12, pp 2773-2787, Dec. 2014. (ISSCC Special Issue).

g. P.P. Mercier and A.P. Chandrakasan, “Rapid Wireless Capacitor Charging using a Multi-Tapped Inductively-Coupled Secondary Coil,” IEEE Trans. Circuits and Systems I (TCAS-I), vol. 60, no. 9, pp 2263-2272, Sep. 2013.

12. I have also taught tutorials as part of engineering organization conferences. For example, I taught a tutorial entitled “Building Li-ion-compatible DC-DC Converters in Scaled CMOS” for the IEEE Solid-State Circuits Society CICCedu online mini-course. I also presented a tutorial entitled “Power Management for the Internet-of-Things” at the IEEE Custom Integrated Circuits Conference (CICC), and gave a keynote presentation entitled “Energy-Efficient Power Management Circuits for IoT and Wearable Devices” at the IEEE Sensor Interfaces Meeting.

13. I have extensively researched the Qi wireless power transfer standard and other competing standards, and have even built a prototype that can support concurrent operation for Qi at ~200kHz and a higher frequency standard at 13.56MHz, resulting in a publication in the IEEE Transactions in Power Electronics.

14. I am a named inventor on 24 U.S. patents, including several directed to power circuits and systems. For example, U.S. Patent 9,293,945 is entitled “Multi-Taped Inductively-Coupled Charging System”, U.S. Patent 10,855,115 is entitled “Wireless Power Transfer Device and Method with Dual-Frequency Operation”, and

U.S. Patent 10,873,215 is entitled “Resonant Regulating Rectifier with an Integrated Antenna.”

III. LEGAL UNDERSTANDING

15. I am not a lawyer and am not offering any opinions regarding legal matters. However, the legal principles relevant to my opinion herein have been explained to me by Powermat’s counsel. In this section, I summarize these legal principles as they have been explained to me.

16. I reserve the right to change or formulate new opinions in the event there is a change in the law concerning my opinions provided in this declaration.

A. Burden of Proof

17. I understand that in *inter partes* review (“IPR”) proceedings, the Petitioner bears the burden of proof to prove that the claims that were challenged in the Petition and for which the Board instituted review are unpatentable. It is my understanding that the Petitioner also bears the burden of proving a proposition of unpatentability by a preponderance of the evidence.

18. I further understand that in IPR proceedings, the Petitioner must demonstrate the obviousness of a claim by “a preponderance of the evidence.” I have been informed that the preponderance of the evidence⁰ standard requires that a reasonable factfinder would find a material fact more probable than the nonexistence

of that fact. I understand that this standard does not permit speculation concerning particular facts and is rather focused on whether the evidence more likely than not demonstrates the existence or non-existence of particular material facts. I have been informed that “preponderance of the evidence” is a lower standard than “clear and convincing evidence” (which requires a fact to be substantially more likely to be true than untrue), or “beyond a reasonable doubt” (which is an exceedingly high standard that I understand is usually used in criminal matters).

19. Throughout my Declaration, I have applied the “preponderance of the evidence” standard.

B. Anticipation

20. I understand that a patent claim is unpatentable as anticipated under 35 U.S.C. § 102 if each and every element of a claim is found either explicitly or inherently in a single prior art reference. I understand that inherency requires inevitability. For example, to be inherent, a result must be inevitable from the operation disclosed. For a characteristic to be inherent, it must be inevitably present in the device. I understand that it is improper to establish inherency if it is only a possibility or a probability that a reference includes the alleged inherent feature. The fact that something may result from a given set of circumstances is not sufficient to

establish inherency. Instead, an inherent feature must be necessarily present in the reference, not probably or possibly present in the reference.

21. I understand that inherency and obviousness are separate inquiries. I understand that what is inherent may not necessarily be known, and what is obvious cannot be predicated on what is unknown.

22. I understand that inherency is a question of fact.

23. I also understand that to turn to inherency, the reference must be silent as to the alleged inherent feature. If a reference discloses subject matter, principles of inherency cannot be used to ignore that explicit disclosure in favor of an alleged inherent disclosure that contradicts the explicit disclosure.

C. Obviousness

24. I understand that a claim may be unpatentable as obvious under 35 U.S.C. § 103 if the subject matter described in the claim as a whole would have been obvious before the effective filing date of the claimed invention to a person of ordinary skill in the art (“POSITA”) to which the claimed invention pertains.

25. I have been informed that, prior to considering the prior art, the claims are first analyzed to determine what subject matter the claims cover. I understand that the claims are read from a POSITA’s perspective at the time of the alleged invention. I understand that the words of a claim are generally given their ordinary

and customary meaning as understood by a POSITA in view of the entire patent specification in which they are present and the prosecution history of the patent.

26. I understand, nevertheless, that a claim's words may be given a meaning different than their plain and ordinary meaning if: (1) a patentee explicitly and unambiguously defined a term in a different manner as compared to its plain meaning; or (2) a patentee "disclaims" the full scope of a claim term's plain meaning, such as, by clearly and unambiguously stating during prosecution that a claim term does or does not encompass certain subject matter that may otherwise be encompassed by the plain words of the claim.

27. I have been informed that, after construing the claims, the teachings of the prior art are evaluated. I understand that the information that is used to evaluate whether an invention is new and not obvious is generally referred to as "prior art" and generally includes patents and printed publications (*e.g.*, books, journal publications, articles on websites, product manuals, etc.).

28. I understand that although the ultimate question of the obviousness analysis is a legal determination, obviousness is based on many factual inquiries, including: the prior art's scope and content, the distinctions between the claimed subject matter and the prior art, the level of ordinary skill in the art at the time of the

invention, and any “objective indicia” or “secondary considerations” of non-obviousness, which must all be considered.

29. I have been informed that, in ascertaining the scope and content of the prior art, a prior-art reference is deemed relevant if it falls within the field of the inventor’s endeavor, or if it is reasonably pertinent to the particular problem that the inventor was attempting to solve. I understand that a reference is reasonably pertinent if it logically caught an inventor’s attention in considering the problem sought to be solved.

30. I have been informed that, to evaluate the differences between the prior art references and the claimed subject matter, the claimed invention must be considered as a whole. I understand that this involves demonstrating that a POSITA, facing the same problems as the inventor and without knowledge of the claimed invention, would have recognized the elements in the prior art and combined them in the claimed manner.

31. I understand that there are many rationales for combining prior-art references. For example, I have been informed that it is considered obvious to:

- combine prior-art elements according to known methods to yield predictable results;
- substitute one known element for another to obtain predictable results;

- use the prior-art elements in a predictable way according to their established functions;
- apply a known technique to a known device (method or product) ready for improvement to yield predictable results;
- choose from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- or if there is some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify a prior-art reference or combine prior-art teachings to arrive at the claimed invention.

32. I understand, however, that a POSITA can come to the claimed invention for completely different reasons than the inventors and therefore does not need to have the same motivations or reasons to combine the prior art as the inventors.

33. I understand that when reviewing the prior art, the prior art cannot be combined or modified with “hindsight.” I have been informed that hindsight designates scenarios when the asserted patent is employed as a framework to pick and choose aspects from the prior art to arrive at the claims. I understand that hindsight also occurs when rationales are adopted that are identified by the patent-at-issue, but would not have been recognized by those in the art. Alternatively, I have been informed that the obviousness analysis is evaluated from the perspective of a POSITA, as of the critical date of the patent-at-issue and with all the prior art before them. I also understand that with this in mind, the analysis includes

determining whether the POSITA would have independently arrived at the claimed invention without the help of the patent-at-issue for guidance.

D. Secondary Considerations

34. I understand that to evaluate obviousness, “objective indicia” or “secondary considerations” of non-obviousness must also be considered, and include, among a few others, whether: (1) there was a long-felt need for the claimed invention; (2) the claimed invention has attained commercial success; (3) others have copied the claimed invention; (4) others have attempted but failed to create the alleged invention; (5) there was praise of the invention in the field; and (6) there was skepticism that the claimed invention could be achieved.

E. Claim Construction

35. I understand that the claim construction exercise begins with the language of the claims themselves, and that the general rule is that claim terms are given their plain and ordinary meaning to a POSITA, in view of the specification of the patent, at the time of the invention. I also understand that the intrinsic evidence (*i.e.*, the claims, the written description including the figures, and prosecution history) are the primary sources used in interpreting claim language.

36. I understand that if disputed claim language is clear on its face, the intrinsic evidence should be consulted to determine whether some deviation from the ordinary meaning of the claim language is warranted.

37. When the disputed claim language is not clear on its face, I understand that the intrinsic evidence should be used to resolve, if possible, any lack of clarity. I also understand that the specification is the best evidence of what the patentee intended the term to mean when there is no clear meaning of a claim term, and that the prosecution history may also shed light on the meaning of ambiguous terms. However, I understand that it is improper to import limitations from the specification into a patent claim through claim construction.

38. I have been informed that sometimes the ordinary meaning of claim language as understood by a POSITA may be readily apparent even to lay persons. I understand that claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.

39. Unless specifically stated otherwise in my analysis, I applied the plain and ordinary meaning to each term as understood by a POSITA.

IV. MATERIALS CONSIDERED

40. In addition to the materials considered in forming the opinions for my previous declaration here (*see* Ex. 2001), I also considered the following materials

at the time I formed my opinions regarding the '461 Patent. Among those materials are the '461 Patent; the file history of the '461 Patent and certain prior art cited therein; the Petition for IPR that is the subject of this proceeding; the Declaration of Dr. Gary L. Woods appended thereto; and the Patent Trial and Appeal Board's decision granting institution of this IPR.

41. In addition to these materials, I also relied upon my extensive experience and expertise in designing, developing, and testing wireless charging devices and/or systems, including those using inductive charging techniques. In forming my opinions, I have also taken into account the knowledge and background principles that a POSITA would be familiar with, as well as my experience and training in the field of art.

V. LEVEL OF ORDINARY SKILL IN THE ART

42. I understand that patent claims are to be interpreted from the viewpoint of one of ordinary skill in the relevant art. I am informed that the factors to be considered in determining the level of ordinary skill in the art are: (1) the education level of active workers in the field; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the speed with which innovations are made; and (5) the sophistication of the technology in the art.

43. I have been asked to assume that the relevant time period for determine the level of skill in the art for the '461 Patent is its earliest claimed priority date, March 17, 2008.

44. In my opinion, at the time of the '461 Patent, a POSITA would have a working knowledge of wireless charging and inductive charging. The person would have gained this knowledge through an undergraduate Bachelor of Science degree in electrical engineering, computer engineering, computer science, or a related field, with at least two years of experience working in the field of wireless or inductive charging device design, or testing of such wireless or inductive charging device testing, or an equivalent combination of academic study and work experience. More education (e.g., a Master's degree) or work experience any relevant field may compensate for a deficit in one of the relevant qualifications stated above.

45. I understand that Dr. Woods has asserted that "a POSITA would have had a bachelor's degree or higher in electrical engineering, at least three years of experience designing or researching electronic circuits, and familiarity with power electronics and inductive power transfer circuit.." Ex. 1003 ¶ 20.

46. As a result of my education and experience, under both definitions, I was at least a POSITA at the time of the '461 Patent, and am still a person of at least ordinary skill in the art and have applied the perspective of a POSITA in my analysis.

VI. BACKGROUND

47. Before discussing my specific opinions, I will first review the '461 Patent's disclosure as it would have been viewed by a POSITA. My discussion describes only certain examples of the inventions discussed in the '461 Patent, and my description here is in no way meant to suggest that the claimed inventions are limited to these examples. The inventions are limited only by the claims.

A. Overview of the '461 Patent

48. The '461 Patent is generally directed to “a system and method for monitoring efficiency and controlling power transfer across an inductive power coupling.” Ex. 1001 at 1:20-22. For example, the '461 Patent discusses a system for monitoring efficiency with wireless charger. Ex. 1001 at Abstract.

49. The '461 Patent explains that while primary inductive coils (or “socket-less outlets”) are less obtrusive because they do not require holes for coupling pins, they may also be “harder to spot than conventional outlets.” Ex. 1001 at 2:6-18. The difficulty in locating such primary inductive coils may lead to additional issues. Ex. 1001 at 2:19-31. For example, an uncoupled high power primary coil may cause “high energy electromagnetic waves to be transmitted which may be harmful to bystanders” or “become dangerously hot.” Ex. 1001 at 2:19-31.

50. The '461 Patent further explains that regulating certain parameters of power, such as voltage, current, or temperature, can help provide power in an efficient manner. Ex. 1001 at 2:32-38. For example, monitoring these parameters can help optimize power supply to an electric device by minimizing energy losses and preventing excessive heating of components. Ex. 1001 at 2:32-46. Further, the '461 Patent discusses that communication regarding these parameters can assist in features like leak prevention. Ex. 1001 at 2:47-50. However, such communication is challenging due to “the lack of connecting wires” in inductive power couplings which would make conductive communication channels impractical. Ex. 1001 at 47-55.

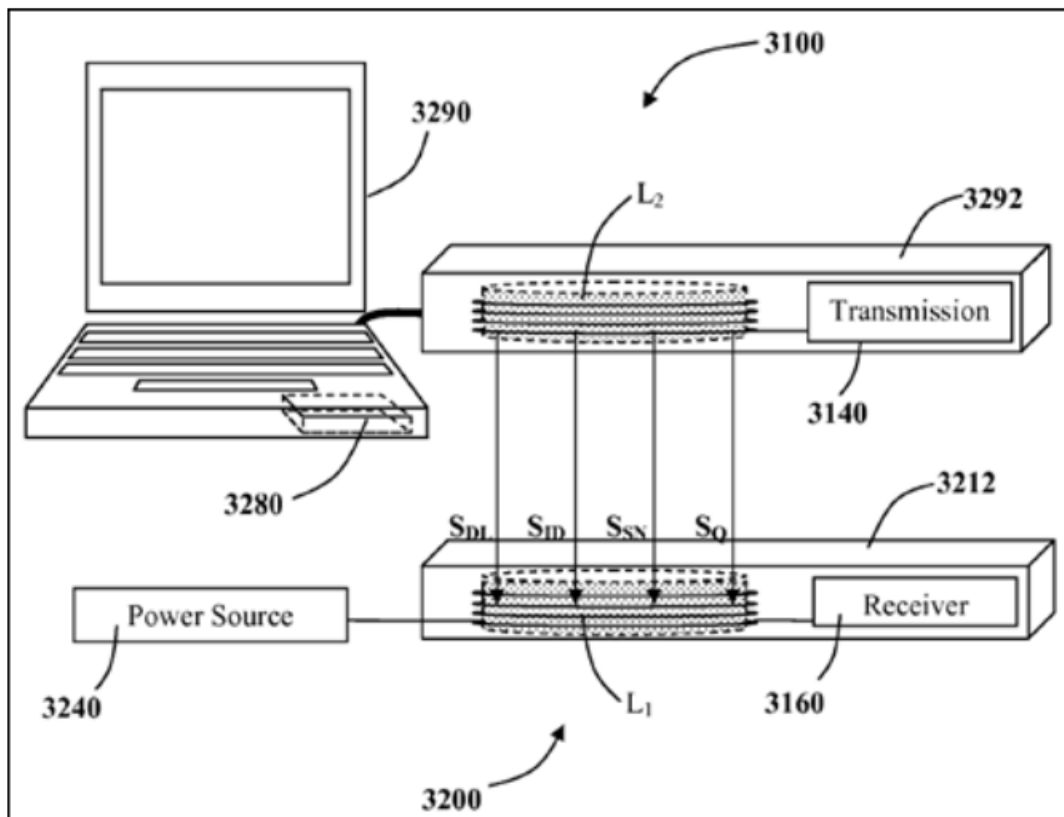
51. Therefore, the '461 Patent states that:

There is a need for a control system for inductive power outlets, which is capable of locating a concealed power outlet, preventing power leakage from the power outlet, locating secondary coils close to the power outlet and regulating power transfer from the power outlet to a secondary coil coupled thereto. The present invention addresses this need.

Ex. 1001 at 2:56-61.

52. The '461 Patent therefore describes an inventive system in which an inductive power outlet includes an efficiency monitor to monitor the efficiency of

an inductive coupling between a primary coil and a secondary coil. Ex. 1001 at 4:11-21. The '461 Patent further discloses the use of a transmitter and receiver, such as transmission circuit 3140 used to transmit control signals to a receiver circuit 3160. Ex. 1001 at 4:38-40, 11:22-33. For example, Figure 3 shows an inductive power outlet including a primary coil and a secondary coil, along with a method for transmitting and receiving signals related to power.



Ex 1001 Fig. 3.

53. The '461 Patent further discloses that the inductive power outlet may include a processor that obtains data relating to input power and output power and determines an index of power-loss. Ex. 1001 at Fig. 7, 12:8-18.

B. Relevant Aspects of the '461 Patent's Prosecution History

54. I have reviewed the prosecution history for the '461 Patent, which contains a number of relevant statements pertaining to both the deficiencies in the prior art, as well as the benefits of the inventions described and claimed in the '461 Patent.

55. The '461 Patent claims priority to several U.S. provisional applications, including U.S. Application No. 60/907,132, filed on March 22, 2007. Ex. 1001 at 1.

56. During prosecution of the '461 Patent, the Examiner issued a non-final office action on August 29, 2012. Ex. 1002 at 89. In this office action, the Examiner issued the following rejections: (a) rejected original claim 10 under 35 U.S.C. § 112 as indefinite based on a lack of antecedent basis; (b) rejected original claims 1-6, 10-17, 19, and 20 under 35 U.S.C. § 102 as anticipated based on U.S. Patent No. 7,605,496 ("Stevens '496"); and (c) rejected original claims 8 and 9 under 35 U.S.C. § 103 as obvious based on Stevens '496 and U.S. Patent No. 7,791,312 ("Kook"). Ex. 1002 at 90-94. The Examiner also noted allowable subject matter in claims 7 and 18. Ex. 1002 at 94.

57. The Applicant corrected a typographical error to address the § 112 rejection and traversed the prior art rejections. Ex. 1002 at 179-89. The Applicant noted that Stevens '496 failed to describe several elements in the claims, such as the “output power monitor for measuring output power received by the secondary coil” as described in the claims and “a processor for determining an index of power-loss.” Ex. 1002 at 183-84.

58. The Examiner issued another office action that rejected claims 1-6, 10-7, 19, and 20 under 35 U.S.C. § 102 based on Stevens '496; rejected claims 8 and 9 under 35 U.S.C. § 103 based on Stevens '496 and Kook; and indicated claims 7 and 18 as including allowable subject matter. Ex. 1001 at 195-204. The Applicant and Examiner further discussed the application of Stevens '496 in Examiner Interviews on May 21, 2013, and June 12, 2013. Ex. 1002 at 206-10.

59. On June 19, 2013, the Applicant filed amendments to the claims, including then-claim 14 (issued as claim 14). Ex. 1002 at 214-25. The Applicant made remarks distinguishing the claims from Stevens '496 and summarizing the contents of the previously conducted Examiner Interviews. Ex. 1002 at 214-25.

14. (Currently Amended) An inductive power outlet comprising at least one primary coil, for inductively coupling with a secondary coil wired to an electric load, the inductive power outlet further comprising an efficiency monitor comprising:

at least one input power monitor configured to measure input power received by the primary coil from the power supply delivered to the primary coil;

at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil;

at least one processor configured to receive data pertaining to the input power and the output power, the processor further configured to determine an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil;

wherein the index of power-loss comprises at least one of:

an efficiency quotient Q , defined as the ratio of the output power to the input power; and

an efficiency differential Δ , defined as the difference between the output power and the input power.

Ex. 1002 at 218.

60. In response, the Examiner issued a Notice of Allowance on August 30, 2013, and noted that Stevens '496 failed to disclose the claimed invention. Ex. 1002 at 243-49. The Examiner noted the following:

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-9 and 11-20 are allowed.
2. The following is an examiner's statement of reasons for allowance:
3. U. S. Patent No. 7,605,496 to Stevens et al. is the reference closest to the claimed invention. Stevens et al. disclose an efficiency monitor for monitoring power transmission by an inductive power outlet, the inductive power outlet comprising at least one primary coil wired to a power supply, for inductively coupling with a secondary coil wired to an electric load, the efficiency monitor comprising: at least one input power monitor for measuring input power received by the primary coil from the power supply delivered to the primary coil; at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil; and at least one communication channel for communicating the input power and the output power to the processor. However, Stevens et al. do not teach at least one processor for determining an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil; wherein the index of power-loss comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power, and an efficiency differential A , defined as the difference between the output power and the input power; and including all of the other limitations in the respective independent claims.
4. U. S. Patent No. 7,605,496 to Stevens et al. is the reference closest to the claimed invention. Stevens et al. disclose a method for monitoring the efficiency of

power transmission by an inductive power outlet, the inductive power outlet comprising at least one primary coil wired to a power supply, for inductively coupling with a secondary coil wired to an electric load, the method comprising the steps of: measuring the input power delivered to the primary coil received by the primary coil from the power supply; measuring the output power received inductively by the secondary coil from the primary coil; communicating the input power to a processor; communicating the output power to the processor. However, Stevens et al. do not teach and the processor determining an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil; wherein the index of power-loss comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential A , defined as the difference between the output power and the input power; and including all of the other limitations in the respective independent claims.

5. U. S. Patent No. 7,605,496 to Stevens et al. is the reference closest to the claimed invention. Stevens et al. disclose an inductive power outlet comprising at least one primary coil, for inductively coupling with a secondary coil wired to an electric load, the inductive power outlet further comprising an efficiency monitor comprising: at least one input power monitor configured to measure input power received by the primary coil from the power supply; at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil; at least one processor configured to receive data pertaining to the input power and the output power. However, Stevens et al. do not teach the processor further configured to determine an index of

power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil; wherein the index of power-loss comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential A , defined as the difference between the output power and the input power; and including all of the other limitations in the respective independent claims.

Ex. 1002 at 246-48.

C. Overview of the Relied-Upon References

61. The three references relied upon by Petitioner to challenge the patentability of claims 13-18 of the '461 Patent are summarized as follows:

1. Olson (Ex. 1004)

62. U.S. Patent Pub. 2005/0075699 (“Olson”) is entitled “System and Method for Transcutaneous Energy Transfer Achieving High Efficiency.” Olson claims priority to U.S. Provisional Application No. 60/508,110, filed on October 2, 2003. Olson was filed on April 30, 2004, and was published on April 7, 2005.

63. Olson states that “[t]his invention related to implantable medical devices and, in particular, to energy transfer devices, systems and methods for implantable medical devices.” Ex. 1004 ¶ [0001]. Olson describes positional adjustments and frequency adjustments to “allow[], at least in part, the system to

attain an efficiency of energy transfer from the external power source to the implantable medical device of at least thirty percent.” Ex. 1004 ¶ [0019].

64. Olson explains that “[f]or implanted medical devices, the efficiency at which energy is transcutaneously transferred is crucial” because (1) “the inductive coupling, while inductively inducing a current in the secondary coil, also has a tendency to heat surrounding components and tissue,” (2) “it is desirable to limit the amount of time required to achieve a desired charge, or recharge, or an internal power source,” and (3) “amount of charging, or recharging, can be limited by the amount of time required for charging, or recharging.” Ex. 1004 ¶ [0017]. Olson specifically discusses using efficiency measurements to determine “the best location of external antenna 52 and/or rotating core cup assembly.” Ex. 1004 ¶ [0074].

65. Olson further describes calculating an efficiency based on current to a power supply and power “induced in implantable medical device 16.” Figure 14 of Olson, relied upon by Dr. Woods in relation to this description, is reproduced below for reference.

medical device 16. . . . The power in is gauged by the power generated by charging unit 50 and is determined by multiplying the voltage of the internal voltage of charging unit 50 . . . by the current driving external antenna 52.

Ex. 1004 ¶¶ [0074]-[0075].

Paragraph [0112] of Olson discusses “Efficiency of energy transfer.” Dr. Woods stated that paragraph [0112] is consistent with paragraphs [0075]-[0076] and describes the same measurements as in paragraphs [0074]-[0076] of Olson. Ex. 2004 at 23:9-21.

Efficiency of energy transfer is an important measure of effectiveness of energy transfer from primary coil 54 of external antenna 52 to secondary coil 34. Efficiency is measured by dividing the power in, i.e., the power received by secondary coil 34, by the power out, i.e., the power transmitted by primary coil 54. While energy efficiency can be measured at other locations in external antenna 52 and/or implantable medical device 16, for purposes of some embodiments of the present invention it is preferred that efficiency is measured coil-to-coil, i.e., from primary coil 54 to secondary coil 34.

Ex. 1004 ¶ [0112].

2. Stevens (Ex. 1005)

67. PCT Publication No. WO 2005/109597 (“Stevens”) is entitled “Controlling Inductive Power Transfer Systems.” Stevens was filed on May 11,

2005. Stevens claims priority to Great Britain Patent Application No. 0410503.7, filed on May 11, 2004, and Great Britain Patent Application No. 0502775.0, filed on February 10, 2005.

68. Stevens pertains to an inductive power transfer system that determines if there is a substantial parasitic load based on comparing power drawn from the primary unit and power requirement information of the at least one secondary device to a threshold. Ex. 1005 at Abstract. Based on comparing the power requirement information with power drawn from the primary unit with a threshold value, the system determines whether to restrict or stop the inductive power supply. Ex. 1005 at Abstract; 5:5-5:10.

69. Throughout Dr. Woods's declaration and the Petition, it appears that Dr. Woods and Petitioner refer to the original publication page numbers (top of the page) of Stevens rather than the IPR-labeled page numbers (bottom of the page) of Stevens. Dr. Woods clarified during his deposition that he cited the original publication page number (top of the page). Ex. 2004 at 31:5-20.

70. Without conceding the appropriateness of this approach, I also cite to the original publication page numbers instead of the IPR page numbers for the convenience of the Board.

3. Jin (Ex. 1006)

71. U.S. Patent Pub. No. 2002/0057164 (“Jin”) is entitled “Isolation Transformer.” Jin was filed on July 3, 1998 (filed at PCT No. PCT/JP98/03006) and was published on May 16, 2002. Jin claims priority to Japanese Patent Application No. 9-178608, filed on July 3, 1997.

72. Jin states that the objects of the invention are to a) “provide an isolation transformer capable of inhibiting a drop of the coupling conditions between the coils even if the gap between the cores is enlarged,” b) “provide an isolation transformer having an excellent high frequency characteristic an[d] a high transmission efficiency capable of transmitting a large current electric energy instantaneously with a simple structure,” and c) “provide a transmission control apparatus capable of igniting the air bag surely by supplying a current without a delay of time when the ignition of the air bag is required and further capable of achieving signal transmission between the primary side and secondary side of the isolation transformer effectively.” Ex. 1006 ¶¶ [0022]-[0024].

73. To achieve the objects of the invention, Jin recites particular structural elements of an isolation transformer and transmission control apparatus. Ex. 1006 ¶¶ [0025], [0030]-[0032], [0035]. For example, Jin describes an isolation transformer made of primary and secondary cores and primary and secondary coils,

with particular positioning and shaping associated with the primary and secondary coils. Ex. 1006 ¶ [0025].

VII. CLAIM CONSTRUCTION

74. As explained above, I understand that the claim construction begins with the language of the claims themselves, and that the general rule is that claim terms are given their plain and ordinary meaning to a POSITA, in view of the specification and prosecution history of the patent, at the time of the invention.

VIII. DR. WOODS HAS FAILED TO DEMONSTRATE BY A PREPONDERANCE OF THE EVIDENCE THAT ANY CHALLENGED CLAIM IS UNPATENTABLE

75. In this section, I address how Dr. Woods fails to demonstrate, by a preponderance of the evidence, that any challenged claim is unpatentable. Note that my decision not to discuss a particular limitation in detail here is not an indication that I agree that limitation is met by the prior art. Rather, I have elected to focus my opinions on the most evident deficiencies in Dr. Woods's obviousness analysis.

A. Ground 1A: Dr. Woods Fails to Establish that Claims 13-16 and 18 Are Anticipated by Olson

76. As explained below, Dr. Woods has not established anticipation by a preponderance of the evidence with respect to Ground 1A. Olson fails to disclose at least claim limitations [13.1], [13.2], [13.3], [13.4], [14], [15.2], and [17.1]. Because claims 14-18 depend from claim 13, Dr. Woods cannot show that Olson anticipates

any of claims 13-18 for at least the reasons set forth in relation to limitations [13.1], [13.2], [13.3], and [13.4].

1. Dr. Woods Fails to Demonstrate that Olson Anticipates Limitation [13.1]

77. Limitation [13.1] recites “at least one input power monitor configured to measure input power received by the primary coil from the power supply.” Dr. Woods fails to show Olson anticipates limitation [13.1] for at least the following reasons.

78. Dr. Woods specifically relies on a combination of the “current measure block 226” and “microprocessor 212” of Olson to satisfy the “input power monitor” of this limitation. Ex. 1003 ¶ 42. Dr. Woods contends that the current measured by current measure block 226 and the voltage of batteries 160 are used to calculate “power in.” Ex. 1003 ¶¶ 42-44. However, the placement of both current measure block 226 and batteries 160 are such that corresponding current and voltage measurements do not qualify as the input power received by the primary coil from the power supply. Figure 14 of Olson, relied upon by Dr. Woods, is reproduced for reference below.

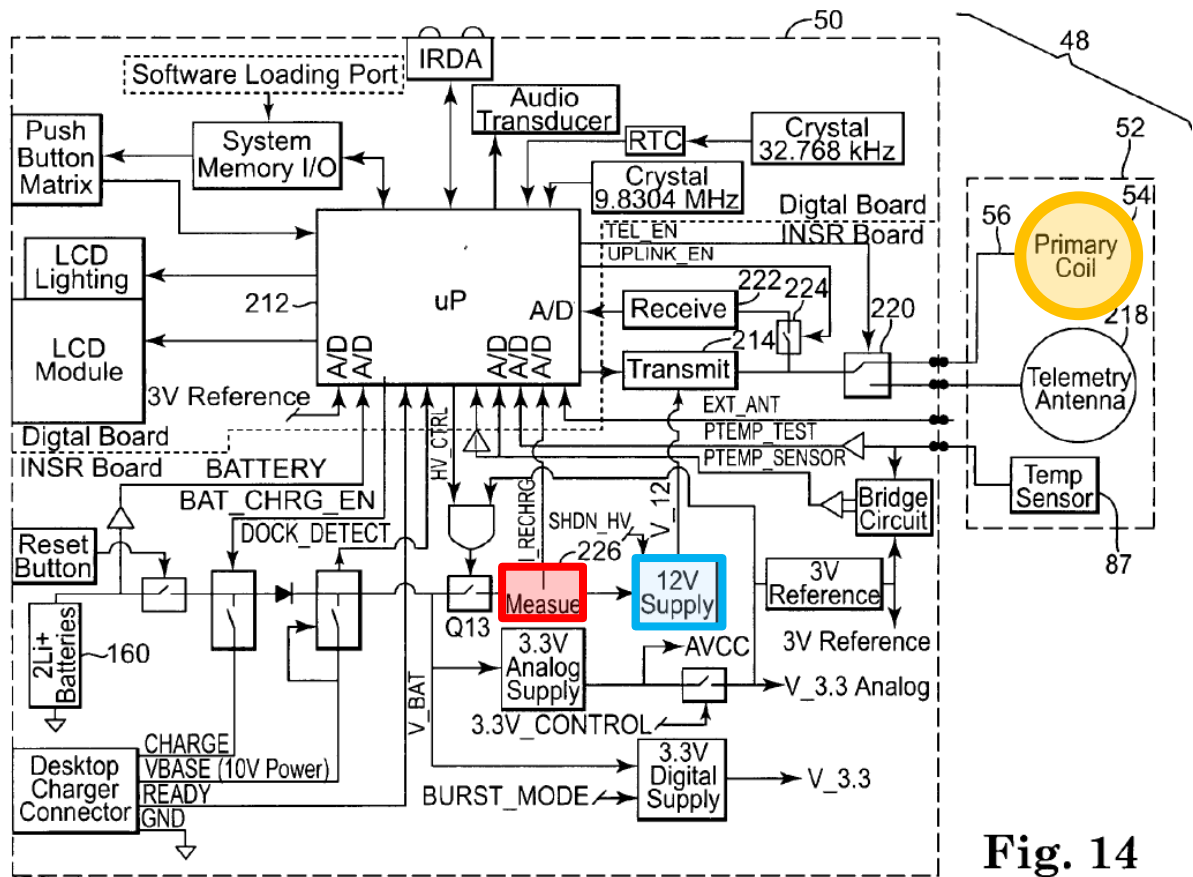


Fig. 14

Ex. 1004 at Fig. 14 (annotations added).

79. For example, current measure block 226 fails to measure current “received by the primary coil from the power supply” as recited in limitation [13.1]. As shown in Figure 14, current measure block 226 instead measures current **into** the twelve volt supply 216, which, in turn, supplies power to **multiple other components**, including a transmit block 214, an electronically controllable switch 220, and a telemetry antenna 218. Ex. 1004 Fig. 14, ¶ [0072]. For example, Olson explicitly states that the twelve volt power supply 216 “suppl[ies] power to transmit

block 214 during power transfer and/or charging **as well as telemetry downlink.”**

Current measure block 226 therefore measures current into multiple other components other than the primary coil of Olson. In other words, current measure block 226 does not measure current and/or power “received by the primary coil from the power supply,” but instead measures power into the twelve volt power supply 216, which powers multiple components other than the primary coil. It should be noted that the 12V power supply 216 is described in Olson as being a switching regulator (paragraph 73), which is a type of DC-DC converter that changes the input voltage (described as being either 7.5V or 12V in paragraph 73) to 12V at the output and, necessarily, also means that the input current is different from the output current, especially if the converter doesn’t operate with 100% efficiency (which no practical converter does). As a result, the power going into the 12V supply is not the same as the power coming out of the 12V supply. For all of these reasons, measuring the power going into the 12V supply is different than measuring the power received by the primary coil, as required by claim [13.1].

80. The ’461 Patent, on the other hand, includes diagrams that are consistent with claim 13 and therefore show a correct method of measuring “input power received by the primary coil from the power supply” as recited in claim 13. For example, Figure 2A of the ’461 Patent shows a current monitor in series with

the primary coil such that the resultant measured current can be used in measuring input power received by the primary coil from the power supply.

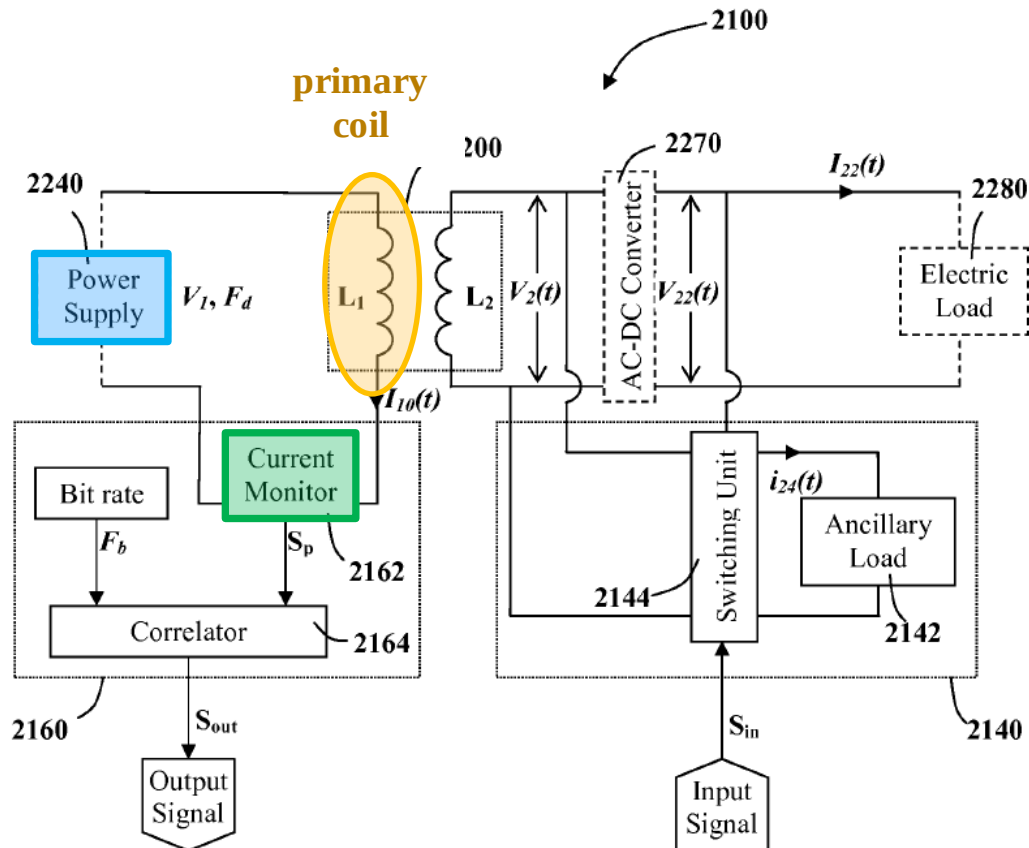


Fig. 2a

Ex. 1001 at Fig. 2a (annotations added). As shown above, the current monitor is positioned such that it can be used to measure input power **received by the primary coil from the power supply**.

81. Olson also fails to describe the correct voltage “measurement” being used to determine power “received by the primary coil.” Olson states that the current measurement from current measure block 226 is used with the voltage of “batteries

82. Current flowing from the batteries to the current measure block 226 passes through multiple switches and a diode as depicted in Fig. 14, each of which would cause a voltage drop (and have power loss) prior to reaching the current measure block 226; as a result, the voltage at the current measuring block would not be the same as at the batteries, nor would it be the same as at the transmitter block or at the primary coil, and thus it's unclear what power is being calculated here. Furthermore, there are numerous other components besides the primary coil that would receive power from batteries 160. For example, microprocessor 212, transmit block 214, telemetry antenna 218 are other components powered by the batteries 160. Ex. 1004 at Fig. 14.

83. Any calculation of power based on these incorrect measurements is not a measurement of input power received by the primary coil from the power supply. Therefore, Olson fails to disclose limitation [13.1].

84. It should be noted that Dr. Woods depends on other passages of Olson to describe where “power in” is gauged. Because Dr. Woods specifically points to “current measure block 226” and “microprocessor 212” as the alleged “input power monitor,” his argument is limited to current measured by the current measure block 226. Additionally, Dr. Woods does not describe any combination rationale for the current measure block 226 with other features of Olson. To the extent these passages

can be considered to describe different “power” measurements than what was described above in relation to the power calculation based on current measure block 226 is addressed for completeness below.

85. Paragraphs [0075]-[0076] of Olson describe that a measurement of “the power out of external charging device 48 divided the power into external charging device 48.” The power into “external charging device 48” or “power in” is different than “input power received by the primary coil from the power supply,” as recited in limitation [13.1]. For example, other language in these paragraphs of Olson confirms that the “power in” measurement is not the same as “input power received by the primary coil from the power supply.” For example, Olson states that “power in is gauged by the power generated by charging unit 50 and is determined by multiplying the voltage of the internal voltage of charging unit 50 e.g., the voltage of a battery or batteries internal to charging unit 50, by the current driving external antenna 52.” Ex. 1004 ¶ [0075]. As described above, the voltage of a battery or batteries internal to charging unit 50 cannot be used to measure “input power received by the primary coil from the power supply.”

86. Similarly, the “current driving external antenna 52” as disclosed by Olson is also an inappropriate basis for measurement for “input power received by the primary coil from the power supply,” as recited in limitation [13.1]. For example,

the external antenna 52 includes components other than the primary coil 54, such as the telemetry antenna. Further, this passage offers no detail as to what component would perform the current measurement or where the measurement is taken. Therefore, these passages of Olson also fail to disclose limitation [13.1].

87. Dr. Woods also cites a passage (paragraph [0112]) of Olson that states that “for purposes of some embodiments of the present invention, it is preferred that efficiency is measured coil-to-coil, e.g., from primary coil 54 to secondary coil 34.” Ex. 1003 ¶ 42. Dr. Woods states that this paragraph is consistent with paragraphs [0075]-[0076] of Olson and describes the same measurements as paragraph [0074]-[0076] of Olson. Ex. 2004 at 23:9-21.

88. In addition, paragraph [0112] of Olson fails to provide **any** detail on how to perform the measurements, including details on what components are used to measure power, how to determine power, or where the “coil-to-coil” measurement is being performed. Dr. Woods did not make any inherency argument in relation to this limitation. Ex. 2004 at 9:19-11:3. Further, if this is considered to be a separate embodiment than the embodiment with the current measure block 226, Dr. Woods did not assert any combination rationale. I also note that Dr. Woods specifically notes Ground 1A as an anticipatory ground and Dr. Woods does not assert any

combinations in relation to this limitation. Ex. 1003 at 21 (“Anticipation Based on Olson (Ground 1A)”).

2. Dr. Woods Fails to Demonstrate that Olson Anticipates Limitation [13.2]

89. Limitation [13.2] recites: “at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil.” Dr. Woods fails to demonstrate that Olson anticipates limitation [13.2] for at least the following reasons.

90. Dr. Woods states that the “telemetry antenna 218” of Olson satisfies the “at least one signal detector” of limitation [13.2]. Ex. 1003 ¶ 45. He further states that “the microprocessor 212 receives ‘by telemetry’ measurement data pertaining to ‘the power induced in implantable device 16.’” Ex. 1003 ¶ 45.

91. Dr. Woods fails to show that the “power induced in implantable device 16” is the “output power received by the secondary coil” of limitation [13.2]. Dr. Woods’s cited paragraphs of Olson fail to describe any detail of how “power induced in implantable device 16” is gauged. For example, paragraph [0052] of Olson only states that the implantable medical device 16 has an internal telemetry coil. Ex. 1004 ¶ [0052]. This passage fails to describe what specific information is being transferred. Paragraph 72 of Olson is similarly deficient regarding what specific information is being communicated to “telemetry antenna 218.” Ex. 1004 ¶ [0072].

92. Only one of Dr. Woods's cited paragraphs, paragraph 75, includes any mention of "power induced in implantable medical device 16." Ex. 1004 ¶ [0072]. But this paragraph simply states that "[t]he power out is gauged by the power induced in implantable medical device 16 and is determined by multiplying the voltage of rechargeable power source 24 by the charging current in implantable medical device 16." This paragraph includes no detail of how or where either voltage or current measurement is performed. For example, this paragraph mentions "charging current in implantable medical device 16" without specifying where the current is measured such that this paragraph would disclose "output power **received by the secondary coil**," as recited in limitation [13.2].

93. Further, power goes through the secondary coil through electronics 26 and potentially "therapy module 28" before going to "rechargeable power source 24. Ex. 1004 Fig. 2, ¶ [0050]. Power measurements at rechargeable power source 24 are therefore different than power measurements "received by the secondary coil" because power is transferred to other components between the secondary coil and the rechargeable power source, where Olson states voltage is measured. On the other hand, claim [13.2] recites a "detector configured to detect signals must detect signals carrying data pertaining to output power **received by the secondary coil**." The '461 Patent shows an example of an output power monitor positioned in relation to a

secondary coil to obtain “data pertaining to output power received **by the secondary coil.**”

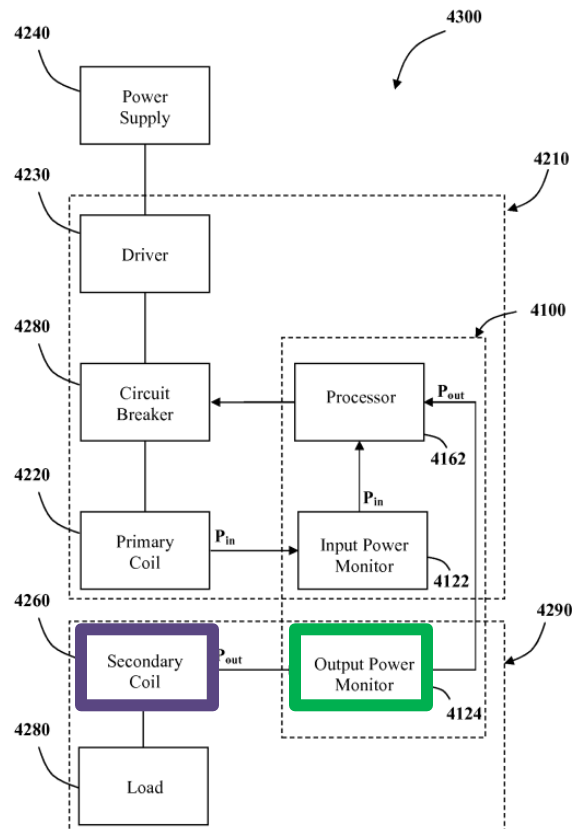


Fig. 5

EX1001 Fig. 5.

94. Therefore, based on Olson’s disclosure, measurements at rechargeable power source 24 are not “output power **received by** the secondary coil,” as recited in limitation [13.2].

3. Dr. Woods Fails to Demonstrate that Olson Anticipates Limitation [13.3]

95. Limitation [13.3] recites: “at least one processor configured to receive data pertaining to the input power and the output power, the processor further configured to determine an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil.” Dr. Woods fails to demonstrate that Olson anticipates limitation [13.3] for the following reasons.

96. Limitation [13.3] is reliant on the “input power” defined in limitation [13.1] and “output power” defined in limitation [13.2]. Input power is defined in the claims with specificity, as power received by the primary coil from the power supply. Output power is also defined in the claims with specificity as “output power received by the secondary coil.”

97. Because limitation [13.3] depends on particular “input power” and “output power” measurements that were previously discussed as **not** anticipated by Olson, Olson does not disclose limitation [13.3] for at least the reasons set forth above in relation to limitations [13.1] and [13.2]. Sections VIII.A.1-VIII.A.2.

98. In other words, because Olson fails to disclose “input power” and “output power” in the first place, Olson further fails to disclose any additional limitation based on the recited “input power” and “output power,” such as a

“processor configured to receive data pertaining to the input power and the output power,” as recited in limitation [13.3]. See supra Sections VII.A.1, VII.A.2.

99. Given the above deficiencies in Olson, Dr. Woods has failed to establish that element [13.3] is anticipated by Olson. Because claims 14-16 and 18 depend on claim 13, Dr. Woods has also failed to establish that any of claims 13-16 and 18 are anticipated by Olson.

4. Dr. Woods Fails to Demonstrate that Olson Anticipates Limitation [13.4]

100. Limitation [13.4] recites: “index of power-loss [that] comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential Δ , defined as the difference between the output power and the input power.” Dr. Woods fails to demonstrate that Olson anticipates limitation [13.4] for the following reasons.

101. Limitation [13.4] is reliant on the “input power” defined in limitation [13.1] and “output power” defined in limitation [13.2]. Input power is defined in the claims with specificity, as power received by the primary coil from the power supply. Output power is also defined in the claims with specificity as “output power received by the secondary coil.”

102. Because limitation [13.4] depends on particular “input power” and “output power” measurements that were previously discussed as **not** anticipated by

Olson, Olson does not disclose limitation [13.4] for at least the reasons set forth above in relation to limitations [13.1] and [13.2]. Sections VIII.A.1-VIII.A.2.

5. Dr. Woods Fails to Demonstrate that Olson Anticipates Limitation [15.2]

103. Claim limitation [15.2] recites: “the inductive power receiver further comprising: at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil.” Dr. Woods fails to demonstrate that Olson anticipates limitation [15.2] for at least the following reasons.

104. Dr. Woods has asserted that, based on Olson, current and voltage **must** be multiplied to produce a power measurement. Ex. 1003 ¶ 42; Ex. 2004 at 12:8-13. While Patent Owner has disagreed that this is the only way power can be determined, Olson explicitly ties a “power measurement” to the product of specific current and voltage measurements. Ex. 1004 ¶ 75 (“The power out is... determined by multiplying the voltage of charging unit 50...by the current driving external antenna 52.”).

105. Olson therefore fails to disclose limitation [15.2] because it fails to disclose any “output power monitor” in the implantable medical device 16 (the alleged “inductive power receiver”) for **measuring** output **power**. Instead, Olson discloses that implantable medical device 16 obtains separate values of the “charging

current in implantable medical device 16” and “voltage of rechargeable power source 24,” and transmits those values to another device without any determination of power preceding the transmittal. Ex. 1004 ¶ [0075]. In other words, Olson fails to disclose that **implantable medical device 16** conducts any **measurement of power** (as required by limitation [15.2]) and instead only describes obtaining² separate values of current and voltage in the implantable medical device 16.

106. The fact that Olson discloses only transmitting measurements of current and voltage separately is clear by several points: (1) the language of paragraph [0075], and (2) the lack of description of a component in the implantable medical device 16 in Olson that would perform such a calculation.

107. The language of paragraph [0075] describes that:

The power out is gauged by the power induced in implantable medical device 16 and is determined by multiplying the voltage of rechargeable power source 24 by the charging current in implantable medical device 16. These **values** are obtained by telemetry from implanted medical device 16.

Ex. 1004 ¶ [0075].

² Olson fails to describe how these “values” are obtained. Ex. 1004 ¶ [0075]. For example, Olson fails to provide any detail of how voltage is **measured** in the implantable medical device 16, and no disclosure of a component in implantable medical device 16 that **measures** voltage, only that the value is somehow obtained.

108. The fact that Olson states that “**values** are obtained by telemetry” implies that **multiple** values (*i.e.*, the current and voltage values) are transmitted rather than a single value (*i.e.*, a measurement of power). Therefore, this passage of Olson supports that the individual values of current and voltage are obtained, and no such power measurement is performed on the implantable medical device 16. Instead, Olson implies that a **different** device performs such a calculation based on the implantable medical device 16 transmitting these separate values of current and voltage. In further confirmation of this, Olson includes no language that indicates that the implantable medical device 16 performs such a power determination and fails to disclose that the implantable medical device 16 includes a component that performs such a power determination. Ex. 1004 ¶ [0075], Figs. 2-3. Dr. Woods also fails to point to any component in Olson that performs the calculation.

109. Because Olson explicitly connects a power determination to the multiplication of current and voltage measurements and does not disclose that the implantable medical device 16 (the alleged “the inductive power receiver”) actually measures output power, Olson fails to disclose limitation [15.2]: “the inductive power receiver, further comprising: at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil.”

110. Further, Olson specifies current and voltage values to be associated with locations that are not relevant to the “output power received inductively by the secondary coil from the primary coil.” Section VIII.A.2. For example, Olson states that the voltage is gauged at the “voltage of a battery or batteries internal to charging unit 50.” Ex. 1004 ¶ [0075]. The voltage at such a location, such as at rechargeable power source 24, is not indicative of power “received by the secondary coil from the primary coil,” because power is lost through several other components, such as “electronics 26” before reaching rechargeable power source 24. Ex. 1004 Fig. 4.

B. Ground 1B: Dr. Woods Fails to Establish That the Combination of Olson in View of Stevens Renders Obvious Claim 17

1. Dr. Woods Fails to Demonstrate That a POSITA Would Combine Olson and Stevens

111. Dr. Woods states that “a POSITA would have been motivated to implement Olson’s charging unit (e.g., charging unit 50) according to Stevens’ suggestion for communicating power information to the primary unit by varying the imposed load using a dummy load, thereby modulating a bit-rate signal, to achieve known benefits at the time.” Ex. 1003 ¶ 64.

112. However, the use of a dummy load in Stevens fails to make sense with the teachings of Olson in the manner suggested by Dr. Woods. The purpose of Olson is to use positional adjustment and frequency adjustment to “attain an efficiency of

energy transfer from the external power source to the implantable medical device of at least thirty percent.” Ex. 1004 at Abstract. To evaluate the efficiency of energy transfer, Olson teaches gauging “power induced in implantable medical device 16” in combination with “power out of external charging device 48.” Ex. 1004 ¶ [0075].

113. Stevens, on the other hand, is concerned with detection of “unwanted parasitic loads.” Ex. 1005 at Abstract. Stevens discusses determining a difference between “power drawn from the primary unit” and “power required by the secondary device” to determine power consumed by a parasitic load rather than power lost as a result of inefficient coil-to-coil coupling. Ex. 1005 at Abstract.

114. When Stevens discusses the use of a dummy load, as discussed by Dr. Woods, this dummy load **represents** the amount of power required by the secondary device and is not a determination of power actually induced in the secondary device. Ex. 1003 ¶ 65; Ex. 1005 at 8:26-28. This is because Stevens teaches various methods of determining parasitic load that are not concerned with determining power induced in the secondary device, but instead concerned with evaluating power requirements of the secondary device. Ex. 1005 at 5:23-28; 8:26-28.

115. The purpose of Olson is to evaluate power induced in the secondary device to determine whether to make positional or frequency adjustments to increase efficiency. Ex. 1004 at Abstract; ¶ [0075]. Therefore, a POSITA would not integrate

Stevens's dummy load that is **representative** of power required by implantable medical device 16 rather than a Olson's method to determine power **induced** in "implantable medical device 16."

116. Stevens states that the dummy loads are attached to preset values, that are merely representative of power requirements or parasitic loads of the secondary device. Ex. 1005 at 23:34-35; 27:13-16. For example, Stevens describes that the dummy load may include a "resistor ladder with an array of switches." Ex. 1005 at 30:13-17. Using the dummy loads to represent power requirements of implantable medical device instead of determining power induced in the medical device 16 would be contrary to the intent of Olson.

2. Dr. Woods Fails to Demonstrate That the Combination of Olson in View of Stevens Renders Obvious Claim Limitation [17.1]

117. Claim limitation [17.1] recites: "The inductive power receiver of claim 15 wherein the transmitter comprises: an ancillary load selectively connectable to the secondary inductive coil, a modulator for modulating a bit-rate signal with an input signal to create a modulated signal." Dr. Woods fails to show that Olson in view of Stevens renders obvious limitation [17.1] for the reasons below.

118. Dr. Woods states that "Stevens' load modulation transmitter would include a modulator for modulating a bit-rate signal with an input signal to create a

modulated signal in order to communicate power requirement information to the primary device using ‘bits.’” Ex. 1003. Therefore, Dr. Woods specifically relies on Stevens’s modulation aspect in relation to communicating **power requirement information** to teach claim limitation [17.1].

119. Dr. Woods fails to provide any rationale to combine in relation to the modulator aspect of Stevens. Ex. 1003 ¶¶ 71-72. Dr. Woods only provides rationale to combine in relation to Olson and Stevens generally. Ex. 1003 ¶¶ 65-70.

120. In relation to the modulator aspect of Stevens, a POSITA would not be motivated to combine this aspect of Stevens with Olson as described by Dr. Woods.

121. Stevens discusses the modulator aspect to communicate information about “power requirement information,” “information about the serial number,” or “other information stored in the secondary device.” Ex. 1005 at 30:13-31:6, 39:27-35. Dr. Woods specifically relies on modulating to “communicate **power requirement information** to the primary device using ‘bits.’” Ex. 1003 ¶ 72.

122. However, Stevens’s power requirement information could not be substituted in Olson for Olson’s efficiency calculation. Stevens’s power requirement information does not relate to power delivered to the secondary coil, but rather the “actual load 46.” Ex. 1005 at Figs. 4, 12, 38:19-20. As stated by Stevens, this measurement is different than power received by the secondary coil 32 because it

“will also reflect any losses in the system” such as losses between the secondary coil 32 and actual load 46. Ex. 1005 at 37:14-15.

123. Further, Dr. Woods specifically relies on the embodiment of Stevens where “the secondary devices are adapted for changing the magnitude of their dummy loads dynamically.” Ex. 1003 ¶ 72. Stevens explains the purpose of “chang[ing] the dummy load dynamically is useful for devices whose ‘friendly parasitic’ load may change.” Ex. 1005 at 20:24-25. As examples of such devices, Stevens provides an example of a self-charging battery connected to **removable** attachments such as a “phone,” “removable camera attachments,” and “cases and speakers.” Ex. 1005 at 30:24-32.

124. Therefore, Stevens describes dynamically changing information for devices that are dissimilar to the device recited in Olson. Olson is specifically directed to energy transfer of “implantable medical devices,” and points out the disadvantages of the “need to explant and re-implant the implantable medical device or a portion of the device.” Ex. 1004 ¶¶ [0001], [0004]. Olson thus describes methods and systems for improving power transfer of implantable medical devices such that there is no need to remove the implantable medical device. Ex. 1003 ¶ [0004].

125. Because Olson is directed to an implanted device that is undesirable to explant, Olson is not directed to a device recited in Stevens that would be commonly

connected/disconnected from “removeable attachments.” Such attachments would require explant of the device, which Olson specifically states is undesirable. Ex. 1003 ¶¶ [0001], [0004].

126. Therefore, there would be no motivation to combine Olson and Stevens to include Stevens’s modulation aspect to communicate load requirement information and parasitic information as stated by Dr. Woods.

C. Ground 2: Dr. Woods Fails to Establish That the Combination of Stevens in View of Olson Renders Obvious Claims 13-18

1. Dr. Woods Fails to Demonstrate That a POSITA Would Combine Stevens and Olson

127. Dr. Woods states that “a POSITA would have been motivated to implement Stevens’ inductive power transfer system according to Olson’s suggestion for calculating a power transfer efficiency ratio, to achieve the known benefits at the time.” Ex. 1003 ¶ 75.

128. However, this is based on a misunderstanding of Stevens’s teachings. While Dr. Woods states that “Stevens suggests an index of power-loss,” Stevens is directed to different goals than Olson and therefore a POSITA would not have been motivated to using Olson’s ratio calculation in Stevens. Ex. 1003 ¶ 75. In this section, I also incorporate by reference my discussion of why a POSITA would not combine Olson and Stevens in Section VIII.B.

129. Stevens is directed to restricting or stopping power supply to prevent heating “parasitic loads” or when “no secondary devices that are present require charge.” Ex. 1005 at 2:1-20, 4:1-12, 4:27-5:10, 5:30-35. Stevens provides different embodiments all directed to “detecting if there is a substantial difference between, on the one hand, a power drawn from the primary unit and, on the other hand, a power required by the secondary device following such detection, the inductive power supply from the primary unit can be restricted or stopped.” Ex. 1003 at 5:30-33.

130. Dr. Woods specifically cites the embodiment of Stevens where:

If the measured power from the power measurement 730 exceeds the sum of the load measures from the secondary devices by more than a shutdown threshold, then the control unit 720 concludes that a substantial parasitic load must be present and places the primary unit in the shutdown mode, as in step S24 in Fig. 11.

Ex. 1005 at 38:34-39:6; Ex. 1003 ¶ 75. This embodiment of Stevens specifically describes comparing the “measured power from the power measurement 730” and “sum of load measures from the secondary devices” with a threshold to determine whether there is a “substantial parasitic load [] present.” Ex. 1003 ¶ 75.

131. On the other hand, Olson is directed to improving power transfer to an implanted medical device by allowing for “positional adjustment” or “frequency

adjustment.” Ex. 1004 ¶¶ [0019]-[0021]. Olson states “the efficiency at which energy is transcutaneously transferred is crucial” for many reasons, including the comfort of a patient and thus “limit[ing] the amount of time required to achieve a desired charge.” Ex. 1004 ¶ [0017]. Olson thus discloses “positional adjustment and frequency adjustment” that allows for “the system to attain an efficiency of energy transfer from the external charger to the implantable medical device of at least thirty percent.” Ex. 1003 ¶ [0020].

132. Olson further describes calculating a “ratio of power out divided by power in” to assist evaluating a proper location of the external charger (including the rotatable core cup assembly and external antenna 52). Ex. 1004 ¶¶ [0076]-[0078]. Olson states that the calculated ratio “can be scaled displayed to patient 18, or a medical professional or other person adjusting rotatable core cup assembly 92 or positioning external antenna 52” so the person can determine a proper location of the external charger. Ex. 1004 ¶¶ [0076]-[0078].

133. Olson’s ratio and Stevens’s comparison of “measured power with a predetermined threshold” are directed to evaluating different issues. In Olson’s case, an ideal ratio is 0.3 or higher, and the external charger will be repositioned to achieve this ratio. Stevens, on the other hand, describes comparing “measured power with a predetermined threshold.” Ex. 1005 at 19:10-13. Stevens states that “if the sum of

the load measures from the secondary devices by more than a shutdown threshold, then the control unit 720 concludes that a substantial parasitic load must be present and places the primary unit in the shutdown mode.” Ex. 1005 at 38:34-39:6. Stevens describes a different goal than Olson because Stevens is directed to comparing values to determine whether an unwanted parasitic load is present and stopping energy transfer based on whether the parasitic load is substantial. Olson, on the other hand, is directed to improving power transfer and not stopping power transfer.

134. Dr. Woods states that Olson’s “ratio” calculation would be desirable over Stevens’s comparison of the measured power, sum of load measures, and a predetermined threshold because it would better detect certain amounts of parasitic loads. Ex. 1003 ¶ 79.

For example, suppose the transmitter is capable of delivering 10 Watts to desired loads, and has a threshold set to detect if 2 Watts or more (20% of the max) are being absorbed by a parasitic load. Suppose the transmitter is only transmitting 1 Watt to the desired loads, because they are nearly fully charged already. The same parasitic load brought into the same proximity to the system would only absorb 0.2 Watts and would not be detected by a protection circuit that relied solely on power differences. However, a circuit that measured transfer efficiency would detect the presence of a parasitic load that was consuming 20% of the transmitted power.

Ex. 1003 ¶ 79.

135. However, Dr. Woods's ratio format is less desirable for evaluating parasitic load because it evaluates relative values instead of absolute values. Parasitic loads are better evaluated as absolute values and using Stevens's methodology of comparison. For example, if the sum of load measures is zero, Stevens's method would lead to a proper determination of the parasitic load and scale appropriately with increasing measured power. On the other hand, using Olson's ratio format, the resultant value would be "zero," regardless of how small or large the parasitic load is.

136. As additional examples, minor parasitic load could be misrepresented as a substantial parasitic load when using the ratio format if very small values comprise the measured power and sum of load measures. Similarly, very large parasitic load could be misrepresented as small parasitic load when using the ratio format if large values comprise the measured power and sum of load measures. It is therefore detrimental to use Olson's ratio format to determine substantial parasitic loss and a POSITA would not be motivated to combine Stevens with Olson to use Olson's ratio format over Stevens's prescribed methodology. A POSITA would better understand "substantial" parasitic loss in terms of absolute values, whereas

use of a ratio format forces a POSITA to know other measurements to determine whether the parasitic loss is substantial or not.

2. Dr. Woods Fails to Demonstrate that Stevens in View of Olson Renders Obvious Limitation [13.1]

137. Limitation [13.1] recites “at least one input power monitor configured to measure input power received by the primary coil from the power supply.” Dr. Woods fails to show that Stevens in view of Olson renders obvious limitation [13.1] for at least the following reasons.

138. Dr. Woods specifically relies on the power measurement unit 100 of Figure 4 or the power measurement unit 730 of Figure 12 in relation to this limitation. Ex. 1003 ¶ 85. Dr. Woods states that the “power measurement unit ‘provides an output representative of the electrical power drawn by the electrical drive unit 14 to the control 16. . . . The power drawn by the electrical drive unit 14 is representative of the power drawn by the primary coil 12.’” Ex. 1003 ¶ 85.

139. But this is an incomplete quotation of Stevens. Stevens explicitly states that the “power drawn by the electrical drive unit is representative of the power drawn by the primary coil 12 and hence also the power drawn by all the secondary devices 30 **plus other losses.**” Ex. 1005 18:9-11.

140. Stevens’s power measurement unit 100 or 730 thus does not **measure** “input power received by the primary coil from the power supply” and instead

merely characterizes power as representative of power drawn by the primary coil and other losses in the system. Ex. 1005 at 18:9-11. Similarly to Olson in Section VIII.A.1, Stevens's power measurement unit is not placed in the correct place to measure input power received by the primary coil from the power supply, and instead measures power **into** the electrical drive unit rather than power "from the power supply." Figure 4 of Stevens is reproduced below for reference:

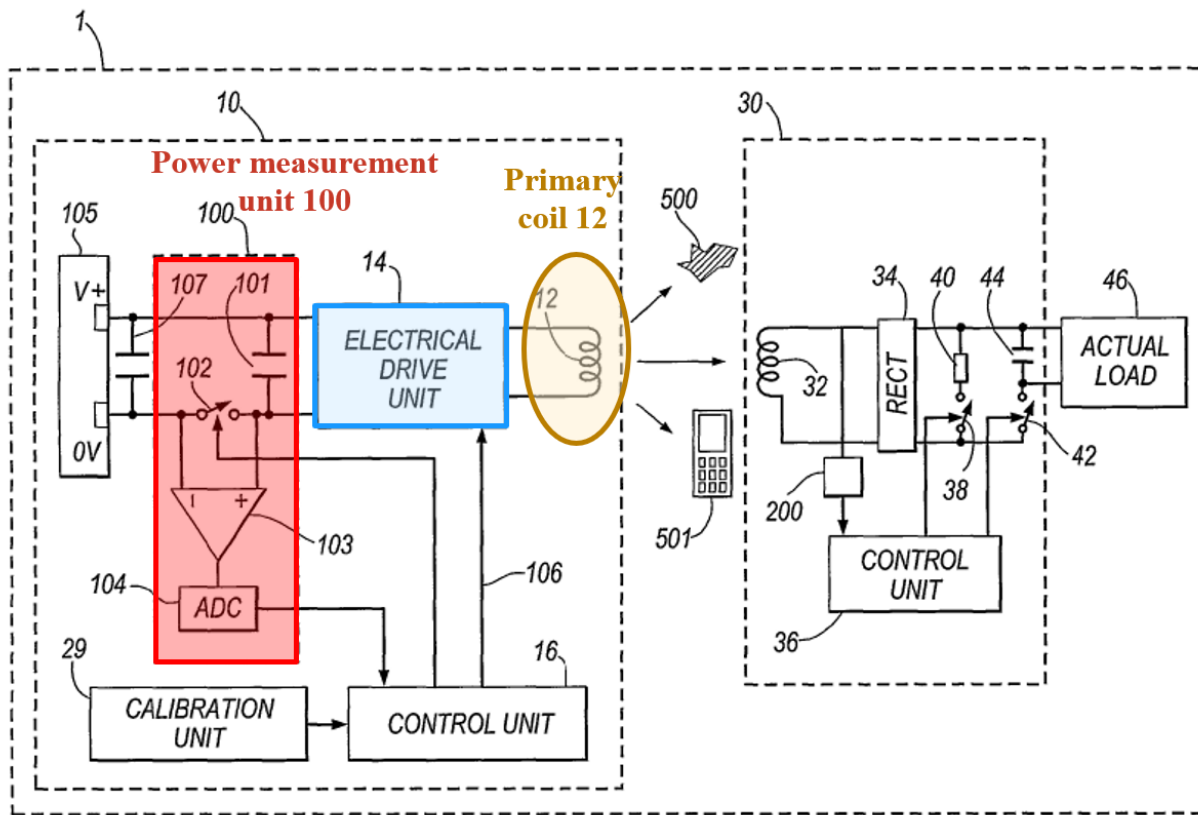


Fig.4

Ex. 1005 at Fig. 4 (annotated).

141. This measurement is not the same, for example, due to losses in components such as the electrical drive unit, as discussed in Stevens. Stevens explicitly states that losses “inevitably occur in the power transfer system” and affect power measurements. Ex. 1005 at 19:13-15. Stevens also notes that “these losses include losses in the primary unit itself” and includes losses in “any other components associated with the primary coil such as the electrical drive unit.” Ex. 1005 at 18:13-18. These losses affect the measurement such that the power measured in Stevens is not power received by the primary coil from the power supply. For all of these reasons, measuring the power going into the electric drive unit is different than measuring the power received by the primary coil, as required by claim [13.1].

142. The '461 Patent, on the other hand, includes diagrams that are consistent with claim 13 and therefore show a correct method of measuring “input power received by the primary coil from the power supply” as recited in claim 13. For example, Figure 2A of the '461 Patent shows a current monitor in series with the primary coil such that the resultant measured current can be used in measuring input power received by the primary coil from the power supply.

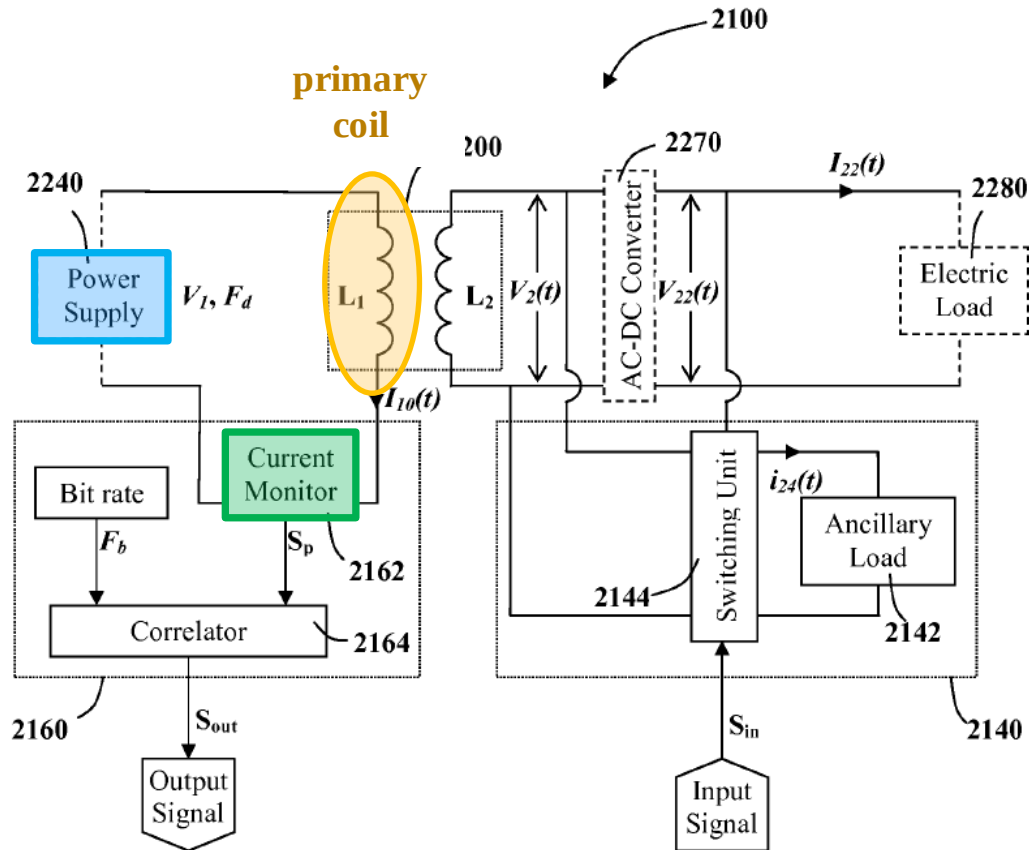


Fig. 2a

Ex. 1001 at Fig. 2a (annotations added). As shown above, the current monitor is positioned such that it can be used to measure input power **received by the primary coil from the power supply**.

143. While Dr. Stevens also relies on the power measurement unit 730 in Figure 12, this embodiment is subject to the same issues as power measurement unit 100 in Figure 4, as Stevens states that “the power measurement unit 730 corresponds generally to the power measurement unit 100.” Ex. 1005 at 38:13-14. Figure 12

cannot cure deficiencies of Figure 4 because Figure 12 of Stevens offers no detail as to where power is measured at all.

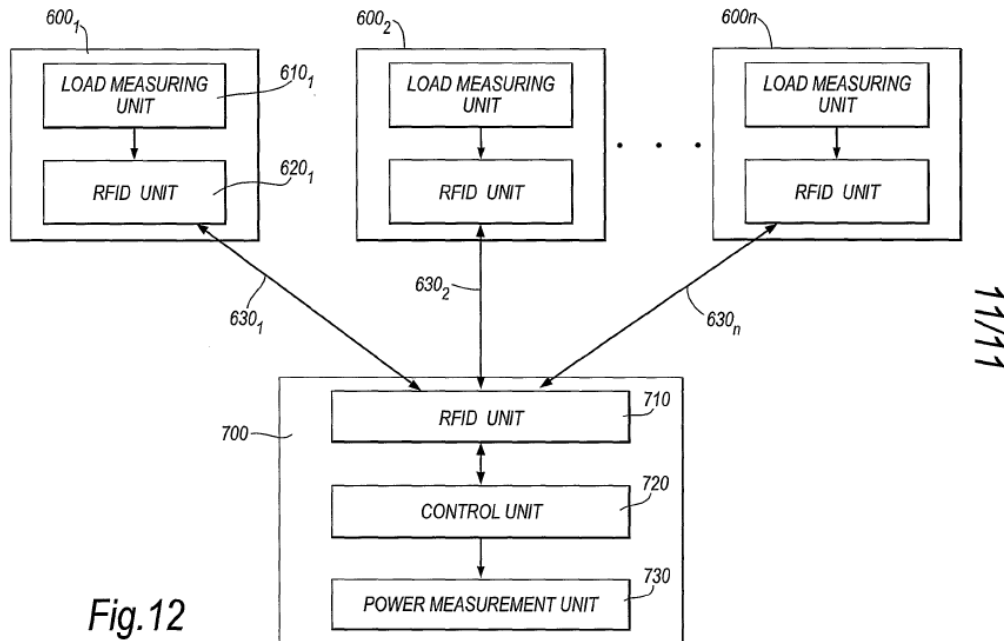


Fig.12

144. Therefore, Stevens fails to disclose limitation [13.1].

145. Olson fails to cure the deficiencies of Stevens. Dr. Woods relies exclusively on Stevens in relation to this limitation. Ex. 1003 ¶ 85; Ex. 2004 at 32:20-22.

146. Therefore, Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious limitation [13.1].

3. Dr. Woods Fails to Demonstrate that Stevens in View of Olson Renders Obvious Limitation [13.2]

147. Limitation [13.2] recites: “at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil.” Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious limitation [13.2] for at least the following reasons.

148. Dr. Woods states that the “RFID unit 710” of Stevens discloses the “at least one signal detector” of limitation [13.2]. Ex. 1003 ¶ 86. Dr. Woods also relies on the “load measure produced by the load measuring unit 610 in each secondary device” to be the “data pertaining to output power received by the secondary coil” in Stevens. Ex. 1003 ¶ 86.

149. Stevens describes the load measure to be a measurement of “the power being supplied to the actual load (46 in Fig. 4) of that secondary device.” Ex. 1005 at 38:19-20. Figure 4 of Stevens is reproduced below for reference.

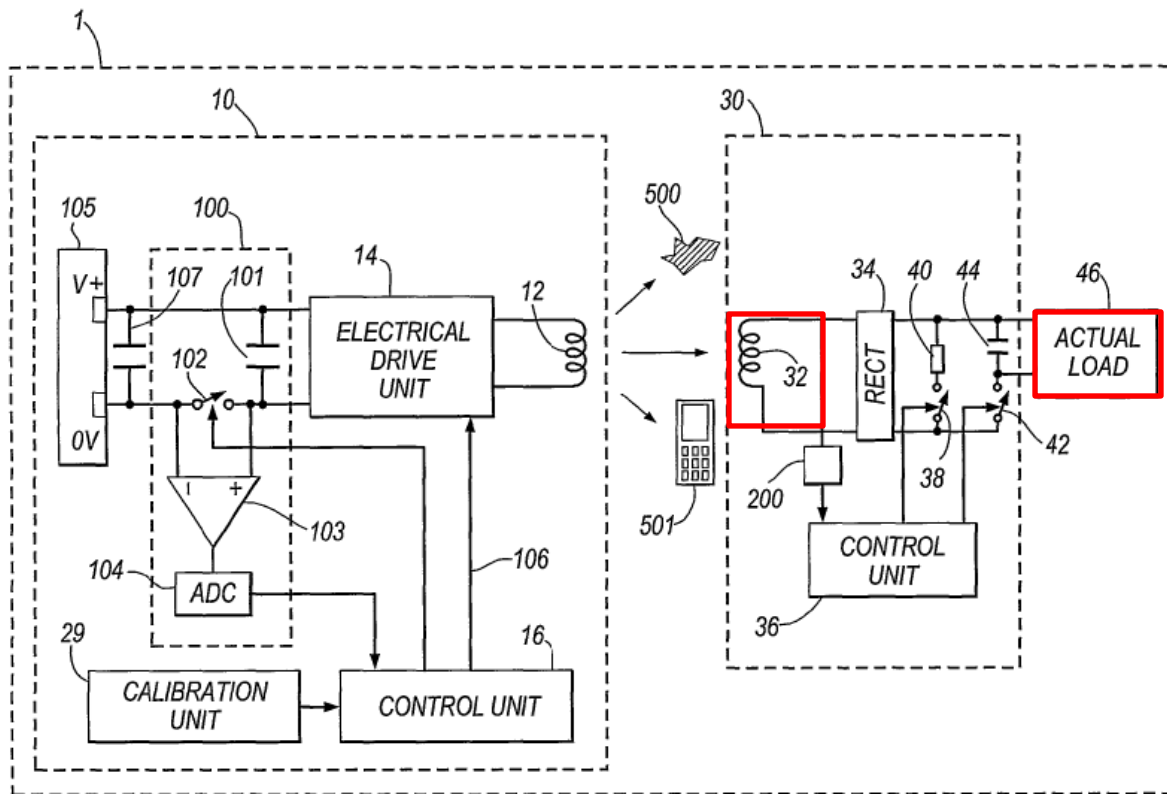


Fig.4

Ex. 1004 Fig. 4 (annotated).

150. As seen in Figure 4, the power being supplied to the actual load 46 is different than “output power received by the secondary coil,” because losses occur between the secondary coil 32 and the actual load 46. Stevens discloses that losses affect power measurements and that losses will “inevitably occur in the power transfer system” and include “losses in the primary unit itself and/or any secondary devices/host objects present.” Ex. 1005 at 19:13-22. Because losses occur

throughout the secondary device, a measurement at “actual load 46” is not indicative of “output power received by the secondary coil,” as recited in element [13.2].

151. Olson fails to cure the deficiencies of Stevens. Dr. Woods relies only on Stevens in relation to this limitation. Ex. 1003 ¶ 86; Ex. 2004 at 33:4-7. Therefore, Dr. Woods’s recited combination of Stevens and Olson fail to disclose or render obvious limitation [13.2].

4. Dr. Woods Fails to Demonstrate that Stevens in View of Olson Renders Obvious Limitation [13.3]

152. Limitation [13.3] recites: “at least one processor configured to receive data pertaining to the input power and the output power, the processor further configured to determine an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil.” Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious limitation [13.3] for at least the following reasons.

153. Limitation [13.3] is reliant on the “input power” and the “output power” defined in limitations [13.1] and [13.2]. Input power is defined in the claims with specificity as “input power received by the primary coil from the power supply.” Output power is defined in the claims with specificity as “output power received by the secondary coil.” Because limitation [13.3] depends on particular “input power” and “output power” measurements that were previously discussed as **not** rendered

obvious by Dr. Woods's recited combination of Stevens and Olson, Stevens and Olson do not render obvious limitation [13.3] for at least the reasons set forth above in relation to limitations [13.1] and [13.2]. Sections VIII.C.2, VIII.C.4.

154. In other words, because Dr. Woods's recited combination of Stevens and Olson fails to disclose or render obvious "input power" and "output power" in the first place, Dr. Woods's recited combination of Stevens and Olson further fails to disclose or render obvious any additional limitation based on the recited "input power" or "output power," such as a "processor configured to receive data pertaining to the input power and the output power," as recited in limitation [13.3]. Sections VIII.C.2, VIII.C.4.

155. Dr. Woods also relies on Olson to disclose this feature. For at least the reasons asserted above in relation to Ground 1, Olson fails to disclose limitation [13.3].

156. Further as described above in relation to Sections VIII.B and VIII.C.1, a POSITA would not be motivated to combine Olson and Stevens because they are directed to different goals. For example, a POSITA would not be motivated to use Olson's "measure of the efficiency of external charging device 48" in combination with Stevens as described by Dr. Woods, because Stevens is not concerned with

determining the efficiency of an inductive coupling. A POSITA would not be motivated to use Stevens's values in Olson's ratio format. Section VIII.C.1.

157. Given the aforementioned deficiencies, Dr. Woods has failed to establish that element [13.3] is rendered obvious by Stevens in view of Olson. Because claims 14-16 and 18 depend on claim 13, Dr. Woods has also failed to establish that any of claims 13-16 and 18 are rendered obvious by Stevens in view of Olson.

5. Dr. Woods Fails to Demonstrate that Stevens in View of Olson Renders Obvious Limitation [13.4]

158. Limitation [13.4] recites: "index of power-loss [that] comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential Δ , defined as the difference between the output power and the input power." Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious limitation [13.4] for the following reasons.

159. Limitation [13.4] is reliant on the "input power" and the "output power" defined in limitations [13.1] and [13.2]. Input power is defined in the claims with specificity, as "input power received by the primary coil from the power supply." Output power is defined in the claims with specificity as "output power received by the secondary coil." However, for the reasons set forth above in relation to limitations [13.1] and [13.2], Dr. Woods fails to establish that Stevens in view of

Olson renders obvious limitations [13.1] and [13.2]. Therefore, Dr. Woods fails to establish that Stevens in view of Olson renders obvious limitation [13.4] based on its reliance on limitations [13.1] and [13.2]. Sections VIII.C.2, VIII.C.3.

160. Dr. Woods relies on Olson to disclose a “ratio of power out divided by power in.” Ex. 1003 ¶ 90. As described above in relation to Section VIII.C.1, a POSITA would not be motivated to combine Stevens and Olson to put Stevens’s values in ratio format. Stevens is directed to determining whether a substantial parasitic load is present. For the reasons discussed above in relation to Sections VIII.B and VIII.C.1, a POSITA would not turn to Olson because Olson is not directed to the same determination, and the ratio format would be disadvantageous compared to Stevens’s methodology.

161. Further, for the reasons set forth above in relation to Ground 1, Olson fails to disclose limitation [13.4].

162. Therefore, Dr. Woods fails to establish that Stevens in view of Olson renders obvious limitation [13.4].

6. Dr. Woods Fails to Demonstrate that Stevens In View of Olson Renders Obvious Limitation [15.2]

163. Claim limitation [15.2] recites: “the inductive power receiver further comprising: at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil.” Dr. Woods fails to

demonstrate that Stevens in view of Olson renders obvious limitation [15.2] for at least the following reasons.

164. Dr. Woods states that Stevens teaches an load measuring unit 610. Ex. 1003 ¶¶ 95-96. However, the load measuring unit 610 of Stevens cannot be the “at least one output power monitor” of limitation [15.2] because its measurement (load measure) is not the “output power received inductively by the secondary coil from the primary coil,” as recited in limitation [15.2].

165. Instead, Stevens discloses that the load measure is a measurement of “the power being supplied to the actual load (46 in Fig. 4) of that secondary device.” Ex. 1005 at 38:19-20. Figure 4 of Stevens is reproduced below for reference.

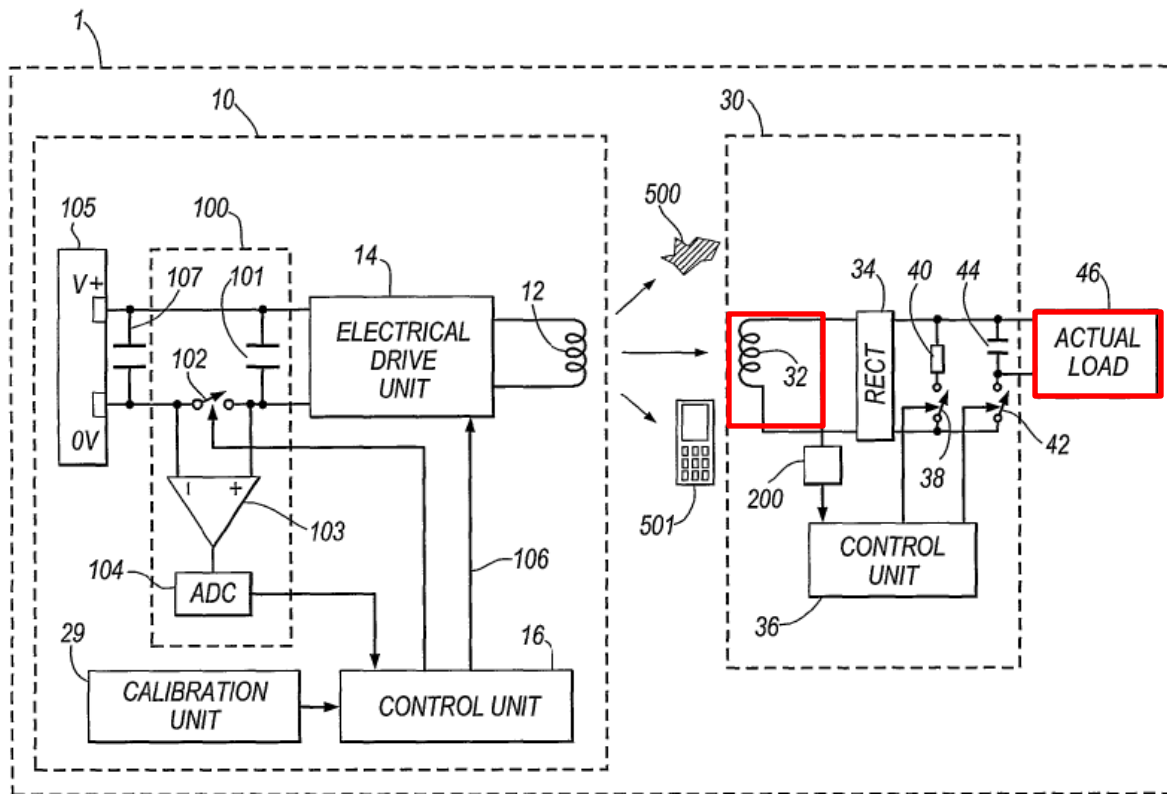


Fig.4

Ex. 1004 Fig. 4.

166. As seen in Figure 4, the power being supplied to the actual load 46 is different than “output power received by the secondary coil,” and instead measures power after the power has been received by the secondary coil and delivered to other components before reaching actual load 46. Ex. 1005 at Fig. 4. Losses occur between the secondary coil 32 and the actual load 46 such that the power supplied to the actual load 46 is different than output power received by the secondary coil 32. Stevens confirms that losses affect power measurements and states that these losses

will “inevitably occur in the power transfer system” and include “losses in the primary unit itself and/or any secondary devices/host objects present.” Ex. 1005 at 19:13-22.

167. Stevens therefore fails to disclose or render obvious limitation [15.2]. Dr. Woods exclusively relies on Stevens in relation to this limitation. Ex. 1003 ¶¶ 93-94; Ex. 2004 at 34:10-13.

168. Therefore, Dr. Woods’s recited combination of Stevens and Olson fails to disclose or render obvious limitation [15.2].

7. Dr. Woods Fails to Demonstrate that Stevens In View of Olson Renders Obvious Claims 14-18

169. Claim limitations 14-18 depend from claim limitation 13. Therefore, for at least the reasons set forth above in relation to claim 13 and general motivation to combine, Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious claims 14-18.

170. Dependent claims 16-18 further depend from claim 15. Therefore, for the additional reasons set forth in relation to claim 15, Dr. Woods fails to demonstrate that Stevens in view of Olson renders obvious claims 16-18. Section VIII.C.6.

D. Ground 3: Dr. Woods Fails to Establish That the Combination of Stevens in View of Jin Renders Obvious Claims 13-18

1. Dr. Woods Fails to Demonstrate That a POSITA Would Combine Stevens and Jin

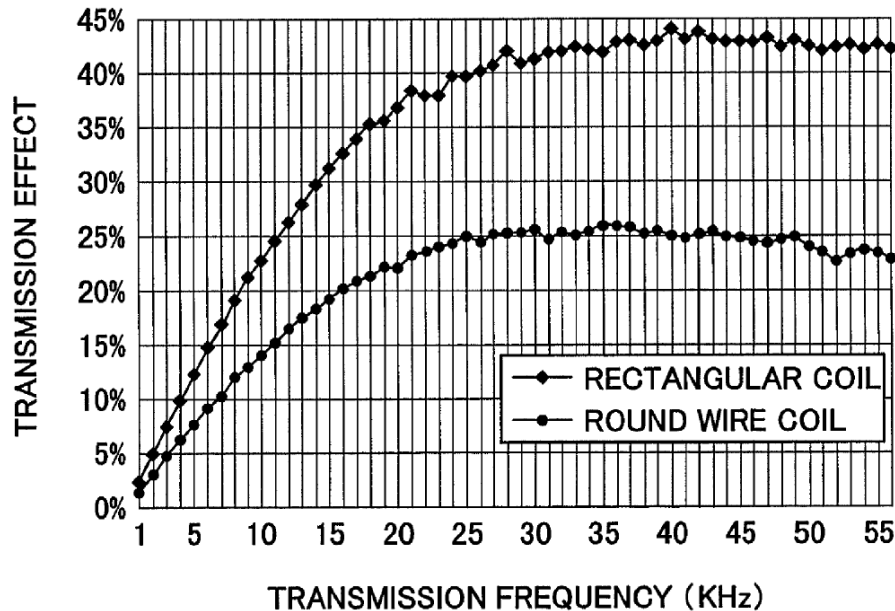
171. Dr. Woods states that “a POSITA would have been motivated to implement Stevens’ inductive power transfer system according to Jin’s suggestion for calculating a transfer efficiency ratio, to achieve the known benefits at the time.” Ex. 1003 ¶ 104. Dr. Woods states that Stevens “suggests an index of power-loss” but Jin “expressly discloses determining an index of power-loss.” Ex. 1003 ¶ 104.

172. However, this is based on a misunderstanding of Stevens’s and Jin’s teachings. While Dr. Woods states that “Stevens suggests an index of power-loss,” Stevens is directed to determining whether a substantial parasitic load is present to determine whether to reduce or cut off power, while Jin describes improving transmission efficiency based on changing the shape of a wire. Ex. 1005 at Abstract; Ex. 1006 ¶¶ [0093]-[0095]. Stevens and Jin are therefore directed to different goals and a POSITA would not be motivated to turn to Jin to “expressly disclose determining an index of power-loss.” I also incorporate by reference my discussion of why Stevens is not directed to determining efficiency but determining parasitic loads in Grounds 1 and 2. Sections VIII.B, VIII.C.1.

173. As described in Sections VIII.B and VIII.C.1, Stevens is directed to restricting or stopping power supply to prevent heating “parasitic loads” or when “no secondary devices that are present require charge.” Ex. 1005 at 2:1-20, 4:1-12, 4:27-5:10, 5:30-35. Stevens provides different embodiments all directed to “detecting if there is a substantial difference between, on the one hand, a power drawn from the primary unit and, on the other hand, a power required by the secondary device . . . following such detection, the inductive power supply from the primary unit can be restricted or stopped.” Ex. 1003 at 5:30-33.

174. On the other hand, Jin is directed to providing particular structures of isolation transformers. Ex. 1006 ¶¶ [0025], [0030]-[0032], [0035]. When Jin discloses “transmission efficiency,” this is specifically for testing the coupling condition between the coils for a rectangular wire versus a round wire. Ex. 1006 ¶¶ [0092]-[0095]. Jin specifically describes evaluating transmission efficiency of a rectangular wire compared to a round wire “irrespective of transmission frequency” and in relation to the Figure 3, reproduced below.

FIG. 3



175. Jin offers no additional details regarding transmission efficiency, such as where “effective current value of secondary side,” “effective voltage,” and “effective current value of primary side,” are measured, or any component that are used to perform the measurements or perform the calculations. Ex. 1006 ¶¶ [0093]-[0095]. Instead, Jin only describes transmission efficiency in relation to “a result of test for comparing the shielding effect of the rectangular wire coil with that of the round wire coil.” Ex. 1006 ¶ [0092].

176. Thus, a POSITA would not be motivated to combining Jin and Stevens in relation to the transmission efficiency aspect. Jin’s transmission efficiency calculation is specifically discussed in relation to evaluating whether a of wire

(rectangular versus round) has better transmission efficiency, while Stevens is directed to determination of a substantial parasitic load.

177. In addition, Dr. Woods fails to address why using Stevens's values in a ratio format such as Jin's transmission efficiency calculation would be advantageous. As described above in relation to Section VIII.C.1, a ratio format is undesirable for the values of Stevens that Dr. Woods cites for power in and power out. These values of Steven are meant for evaluating parasitic load, and parasitic load is better gauged based on absolute values rather than relative values, as this is exactly what Stevens teaches.

178. For example, if the sum of load measures is zero, Stevens's method would lead to a proper determination of the parasitic load and scale appropriately with increasing measured power. On the other hand, using Jin's ratio format, the resultant value would be "zero," regardless of how small or large the parasitic load is.

179. As additional examples, minor parasitic load could be misrepresented as a substantial parasitic load when using the ratio format if very small values comprise the measured power and sum of load measures. Similarly, very large parasitic load could be misrepresented as small parasitic load when using the ratio format if large values comprise the measured power and sum of load measures. It is

therefore detrimental to use Jin's ratio format to determine substantial parasitic loss and a POSITA would not be motivated to combine Stevens with Jin to use Jin's ratio format over Stevens's prescribed methodology. A POSITA would better understand "substantial" parasitic loss in terms of absolute values, whereas use of a ratio format forces a POSITA to know other measurements to determine whether the parasitic loss is substantial or not.

2. Dr. Woods Fails to Demonstrate that Stevens in View of Jin Renders Obvious Limitation [13.1]

180. Limitation [13.1] recites: "at least one input power monitor configured to measure input power received by the primary coil from the power supply." Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.1] for at least the following reasons.

181. Dr. Woods relies exclusively on Stevens and the rationale described in relation to Ground 2. Ex. 1003 ¶ 110; Ex. 2004 at 32:20-22. Therefore, for at least the same reasons presented above in relation to Ground 2, Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.1]. Section VIII.C.2.

3. Dr. Woods Fails to Demonstrate that Stevens in View of Jin Renders Obvious Limitation [13.2]

182. Limitation [13.2] recites: “at least one signal detector configured to detect signals carrying data pertaining to output power received by the secondary coil.” Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.2] for at least the following reasons.

183. Dr. Woods relies exclusively on Stevens and the rationale described in relation to Ground 2. Ex. 1003 ¶ 111; Ex. 1004 at 33:4-7. Therefore, for at least the same reasons presented above in relation to Ground 2, Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.2]. Section VIII.C.3.

4. Dr. Woods Fails to Demonstrate that Stevens in View of Jin Renders Obvious Limitation [13.3]

184. Limitation [13.3] recites: “at least one processor configured to receive data pertaining to the input power and the output power, the processor further configured to determine an index of power-loss indicative of the efficiency of an inductive coupling between the primary coil and the secondary coil.” Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.3] for at least the following reasons.

185. Limitation [13.3] is reliant on “input power” defined in limitation [13.1] and the “output power” defined in limitation [13.2]. Input power is defined in the claims with specificity as “input power received by the primary coil from the power supply.” Output power is defined in the claims with specificity as “output power received by the secondary coil.” Because limitation [13.3] depends on particular “input power” and “output power” measurements that were previously discussed as **not** rendered obvious by Dr. Woods’s recited combination of Stevens and Jin, Stevens and Jin do not render obvious limitation [13.3] for at least the reasons set forth above in relation to limitations [13.1] and [13.2]. Sections VIII.C.2, VIII.C.3, VIII.D.2, VIII.D.3.

186. In other words, because Dr. Woods’s recited combination of Stevens and Jin fails to disclose or render obvious “input power” and “output power” in the first place, Dr. Woods’s recited combination of Stevens and Jin further fails to disclose or render obvious any additional limitation based on the recited “output power,” such as a “processor configured to receive data pertaining to the input power and the output power,” as recited in limitation [13.3]. Sections VIII.C.2, VIII.C.3, VIII.D.2, VIII.D.3.

187. Dr. Woods also relies on Jin to disclose this feature. Ex. 1003 ¶ 113. Dr. Woods states that even if Stevens does not “explicitly disclose” this claimed type

of “index of power-loss,” Jin does disclose this “according to a ratio of the output power to the input power.” However, as described above in relation to Sections VIII.C.1 and VIII.D.1, a POSITA would not be motivated to incorporate the explicit ratio format of Jin using values from Stevens. Sections VIII.D.1; VIII.C; VIII.B.1.

188. Given the aforementioned deficiencies, Dr. Woods has failed to establish that element [13.3] is rendered obvious by Stevens in view of Jin. Because claims 14-16 and 18 depend on claim 13, Dr. Woods has also failed to establish that any of claims 13-16 and 18 are rendered obvious by Stevens in view of Jin.

5. Dr. Woods Fails to Demonstrate that Stevens in View of Jin Renders Obvious Limitation [13.4]

189. Limitation [13.4] recites: “index of power-loss [that] comprises at least one of: an efficiency quotient Q , defined as the ratio of the output power to the input power; and an efficiency differential Δ , defined as the difference between the output power and the input power.” Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious limitation [13.4] for the following reasons.

190. Dr. Woods relies on Jin’s transmission efficiency to disclose this limitation and the combination rationale described in Section XI.B. For the reasons asserted above in relation to Section VIII.D.2, a POSITA would not be motivated to use Jin’s transmission efficiency in combination with Stevens’s system. For

example, Jin's ratio format would be disadvantageous for Stevens's purpose in determining parasitic load. Section VIII.D.2

191. Further, limitation [13.4] is reliant on the "input power" and the "output power" defined in limitations [13.1] and [13.2]. Input power is defined in the claims with specificity as "input power received by the primary coil from the power supply." Output power is defined in the claims with specificity as "output power received by the secondary coil." However, for the reasons set forth above in relation to limitations [13.1] and [13.2], Dr. Woods fails to establish that Stevens in view of Jin renders obvious limitations [13.1] and [13.2]. Sections VIII.C.2, VIII.C.3., VIII.D.2, VIII.D.3. Therefore, Dr. Woods fails to establish that Stevens in view of Jin renders obvious limitation [13.4] based on its reliance on limitations [13.1] and [13.2].

192. Therefore, Dr. Woods fails to establish that Stevens in view of Jin renders obvious limitation [13.4].

6. Dr. Woods Fails to Demonstrate that Stevens In View of Jin Renders Obvious Limitation [15.2]

193. Claim limitation [15.2] recites: "the inductive power receiver further comprising: at least one output power monitor for measuring output power received inductively by the secondary coil from the primary coil." Dr. Woods fails to

demonstrate that Stevens in view of Jin renders obvious limitation [15.2] for at least the following reasons.

194. Dr. Woods relies on the same rationale asserted above in relation to Ground 2 to state that Stevens discloses this limitation. Ex. 1003 ¶ 116. Dr. Woods therefore fails to demonstrate that Stevens in view of Jin renders obvious limitation [15.2] for at least the same reasons asserted above in relation to Ground 2. Section VIII.C.6.

195. Therefore, Dr. Woods's recited combination of Stevens and Jin fails to disclose or render obvious limitation [15.2].

7. Dr. Woods Fails to Demonstrate that Stevens In View of Jin Renders Obvious Claims 14-18

196. Claim limitations 14-18 depend from claim limitation 13. Therefore, for at least the reasons set forth above in relation to claim 13 and general motivation to combine, Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious claims 14-18. Sections VIII.D.1-VIII.D.5.

197. Dependent claims 16-18 further depend from claim 15. Therefore, for the additional reasons set forth in relation to claim 15, Dr. Woods fails to demonstrate that Stevens in view of Jin renders obvious claims 16-18. Section VIII.D.5.

IX. RESERVATION OF RIGHTS

198. In addition to the opinions and evidence expressed herein, I reserve the right to rebut any arguments made or evidence presented in response to this declaration, or to address the specific prior art references asserted in the Petition. I also reserve the right to supplement this declaration based on further investigation or analysis.

X. CONCLUSION

199. I hereby 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 and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the patent which is under review in this proceeding.

Executed this 21st day of May, 2025, in San Diego, CA.

By:

A handwritten signature in black ink, appearing to read "P. Mercier", with a stylized initial "P" and a checkmark-like flourish at the end.

Patrick Mercier

Appendix A

Patrick P. Mercier

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Co-Director, Center for Wearable Sensors
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University of California, San Diego
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Professional Highlights

- Currently leading a ~20-person group undertaking high-impact research spanning multiple domains, from near-zero-power integrated circuits, power management, energy harvesting, neural interfaces, wearable physiochemical sensors, RFICs and RF systems, and beyond
- Over 220 peer-reviewed publications, including 30 *ISSCC* papers, 37 *JSSC* papers, and several papers in high-impact journals such as *Science*, *Nature Biotechnology*, *Nature Biomedical Engineering*, *Nature Electronics*, *Nature Communications*, *Advanced Science*, *Energy and Environmental Science*, and more
- Recognized as one of the top contributors of all time at the 2023 *IEEE International Solid-State Circuits Conference (ISSCC)*
- Co-founder and co-director of the successfully industry-supported UCSD Center for Wearable Sensors
- Site Director of the successfully industry/NSF-supported IUCRC Power Management Integration Center, partnered with Dartmouth College
- Multiple young investigator awards: DARPA YFA, NSF CAREER, Beckman YIA
- ISSCC Jack Kilby Award for Outstanding Student Paper
- Over \$40MM in research fundraising to date
- UCSD-wide Academic Senate Teaching Award, and two ECE department teaching awards
- IEEE Fellow, Class of 2025
- ISSCC Executive Committee member; former ISSCC, VLSI, and CICC TPC member
- Startup co-founder (Traq), board member (QuantalRF), and scientific advisory board member (Nanovision and NeuroVigil)
- 24 issued US patents

Education

Ph.D. **Massachusetts Institute of Technology**, Electrical Engineering, June 2012

Thesis title: *Communication and Power Delivery Architectures for Personal Medical Devices* (GPA: 5.0/5.0)

Advisor: Anantha P. Chandrakasan

- S.M. **Massachusetts Institute of Technology**, Electrical Engineering, June 2008
Thesis title: *An All-Digital Transmitter for Pulsed Ultra-Wideband Communication* (GPA: 5.0/5.0)
Advisor: Anantha P. Chandrakasan
- B.Sc. **University of Alberta**, Electrical and Computer Engineering, May 2006
GPA: 4.0/4.0

Related Experience

University of California, San Diego

Vice Chair, Electrical and Computer Engineering (2024-present)
Professor, Electrical and Computer Engineering (2023-present)
Site Director, Power Management Integration Center (2021-present)
Associate Professor, Electrical and Computer Engineering (2018-2023)
Co-Founder/Co-Director, Center for Wearable Sensors (2014-present)
Assistant Professor, Electrical and Computer Engineering (2012-2018)

Expert Witness

Providing expert technical advice, reports, and depositions on a variety of patent litigation cases (2020-present)

NeuroVigil

Scientific Advisory Board Member (2020-present)

Nanovision

Scientific Advisory Board Member (2019-present)

Quantal RF

Board Member (2018-2024)

Traq / Mouthsense Inc.

Co-Founder/Scientific Advisor (2016-present)

Mercier Engineering

Owner, providing engineering and technical expertise to technology companies. (2013-present)

Massachusetts Institute of Technology, Microsystems Technology Laboratory, *Research Assistant* (2006-2012)

Intel Corporation, Circuits Research Lab, *Graduate Technical Intern* (2008)

Selected Honors and Awards

- **IEEE Fellow** – awarded to less than 0.1% of voting members in the IEEE Solid-State Circuits Society – Class of 2025
- **Teacher of the Year Award** – Jacobs School of Engineering at UC San Diego Annual Best Teacher Award Selected by Ballot of the Students – 2023

- **IEEE International Solid-State Circuits Conference (ISSCC) Author-Recognition Award** – Awarded to authors who have contributed more than 20 papers to ISSCC – 2023
- **San Diego County Engineering Council Outstanding Engineer Award** – Awarded annually to a single local engineer who has made significant technical contributions to their society – 2020
- **National Academy of Engineering Frontiers of Engineering Speaker** – A competitive invitation-only event for those who have demonstrated accomplishment in engineering research and technical work with recognizable contributions to advancing the frontiers of engineering – 2019
- **IEEE Solid-State Circuits Society Distinguished Lecturer** – Nominated to deliver invited lectures at local chapters and regional meetings across the world for a two-year term – 2019
- **NSF CAREER Award** – The National Science Foundation’s most prestigious awards in support of early-career faculty – 2018
- **Biocom Catalyst Award** – Awarded to ten academics, entrepreneurs, investors, corporate leaders, and business advisers under 40 years old who are igniting innovation and growth in the San Diego and Los Angeles life sciences industry – 2017
- **IEEE Senior Member** – Elected for showing significant performance over a 10+ year career – 2017
- **Moore Inventor Fellow Finalist** – Selected as a top-10 fellow amongst >200 other applicants at top US universities; received \$25k award – 2017
- **UCSD Academic Senate Distinguished Teaching Award** – Awarded yearly to five distinguished teachers across all departments at UCSD (totaling ~2200 senate members – i.e., the top 0.2% of teachers). First winner in the ECE department since Jack Wolf in 1999. Received 2016
- **DARPA Young Faculty Award** – Awarded to young faculty members who propose high-impact, high-risk research programs – 2015
- **Beckman Young Investigator Award** – Awarded to eight junior faculty members across the US for innovating research within the chemical and biological sciences – 2015
- **Hellman Fellowship Award** – Awarded to junior faculty members who show capacity for great distinction in their research and creative activities – 2014
- **Graduate Teaching Award** – Awarded annually to one (of ~50) faculty in the UCSD ECE department for outstanding teaching and service – 2013
- **Jack Kilby Award** – One awarded per year for outstanding student paper at the *International Solid-State Circuits Conference (ISSCC)* – received 2010
- **Intel Foundation Ph.D. Fellowship** – awarded to 26 applicants across the US – 2009
- **Post Graduate Scholarship** – Natural Sciences and Engineering Council of Canada (NSERC) – 2007, 2009
- **Best Presentation Award**, Microsystems Technology Lab Annual Research Conference – 2008, 2010
- **Julie Payette Postgraduate Research Fellowship** – Awarded to the top 24 Master’s NSERC applicants in Canada – 2006
- **APEGGA Medal** – Highest undergraduate GPA in Electrical Engineering – 2006
- **Atco Electric Centennial Award** – March 2005
- **Schlumberger Scholarship** in Electrical Engineering – 2004, 2005

Other Awards and Recognitions

- **IEEE Custom Integrated Circuits Conference (CICC) 2025** – Best Paper Award Finalist
- **IEEE International Solid-State Circuits Conference (ISSCC) Student Research Preview Poster Award** – 2024
- **IEEE Solid-State Circuits Society (SSCS) Outstanding Reviewer Reward** – 2024.
- **IEEE ISCAS Women in Circuits and Systems (WiCAS)** – Runner Up Paper Award – 2023.
- **IEEE International Symposium on Circuits and Systems (ISCAS)** – Best Runner Up Paper – 2023.
- **Qualcomm Innovation Fellowship (QIF) 2023** – Winner
- **IEEE Applied Power Electronics Conference (APEC)** – Outstanding Presentation Award 2023 – “A Series/Parallel Magnetic-Less Step-Down Converter Based on Piezoelectric Resonators”
- **IEEE Brain Technical Community and IEEE Solid-State Circuits Society** – Brain-Related Best Paper Award 2021 – “An Optically-Addressed Nanowire-Based Retinal Prosthesis with 73% RF-to-Stimulation Power Efficiency and 20nC-to-3[^]C Wireless Charge Telemetry” presented at ISSCC 2021.
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A -105dB THD 87dB-SNDR VCO-based Sensor Front-end Enabled by Background-Calibrated Differential Pulse Code Modulation”
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A 4.4 μ W -92/-90.3dBm Sensitivity Dual-mode BLE/Wi-Fi Wake-up Receiver”
- **Qualcomm Innovation Fellowship (QIF) 2020** – Winner
- **IEEE EMBS Workshop on Brain, Mind and Body – Cognitive Neuroengineering for Health and Wellness 2019** – Third place poster award
- **IEEE Custom Integrated Circuits Conference (CICC) 2019** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2018** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2015** – Outstanding Student Paper Award Nominee
- **Qualcomm Innovation Fellowship (QIF) 2014** – Finalist

List of Publications

BOOKS

- [1] S. Ha, C. Kim, P.P. Mercier, G.C. Cauwenberghs, **High-Density Integrated Electrocortical Neural Interfaces**, Elsevier Academic Press, 2019, 187 pages.
- [2] M.M. Hella and P.P. Mercier (eds), **Power Management Integrated Circuits**, CRC Press, 2016, 329 pages.
- [3] P.P. Mercier and A.P. Chandrakasan (eds), **Ultra-low-power Short-Range Radios**, Springer, 2015, 394 pages.

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- [1] F. Laiwalla, V.W. Leung, J. Lee, P. Mercier, P. Asbeck, R. Rao, L. Larson, A. Nurmikko, “Next Generation Microscale Wireless Implant System for High-Density, Multi-areal, Closed-Loop Brain Computer Interfaces,” in **Brain-Computer Interface Research**, C. Guger et al. (eds.), Springer Nature Switzerland, 2021.
- [2] S. Ha, C. Kim, H. Wang, Y.M. Chi, P.P. Mercier, G. Cauwenberghs, “Low-power integrated circuits for wearable electrophysiology,” in **Wearable Sensors – Fundamentals, Implementation and Applications 2nd Edition**, E. Sazonov, Ed., Academic Press, 2021.
- [3] L.G. Salem and P.P. Mercier, “Recursive Switched-Capacitor DC-DC Converters,” in **Power Management Integrated Circuits**, M.M. Hella and P.P. Mercier, Eds., CRC Press, 2016.
- [4] D. Lee and P.P. Mercier, “Introduction to Ultra Low Power Transceiver Design,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
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- [1] N.S.K. Fathy, R. Vatsyayan, A.M. Bourhis, S.A. Dayeh, P.P. Mercier, “A TDMA Neural Recording SoC With IIR-RLS Adaptive Filters for 83.4 dB Artifact Suppression Across 256 Channels,” *IEEE Journal of Solid-State Circuits*, 2025.
- [2] D. Valencia, P.P. Mercier, A. Alimohammad, “An Efficient Brain-Switch for Asynchronous Brain-Computer Interfaces,” *IEEE Transactions on Biomedical Circuits and Systems*, vol. 19, no. 1, pp. 130-141, Feb. 2025.
- [3] W.-C.B. Liu, G. Pillonnet, P.P. Mercier, “An Integrated Dual-Side Series/Parallel Piezoelectric Resonator-Based DC–DC Converter,” *IEEE Journal of Solid-State Circuits*, vol. 59, no. 12, pp. 4162-4174, Dec. 2024.
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TUTORIALS

- [1] P.P. Mercier, "Enabling Standards-Compliant Wireless Communications at >100x Lower Power," *Tutorial Presented at the International Microwave Symposium (IMS)*, Atlanta, GA (virtual due to COVID-19), Jun. 2021.
- [2] P.P. Mercier, "Interface Circuits for Wearable and Implantable Sensing Systems," *Tutorial presented at the IEEE International Solid-State Circuits Conference (ISSCC)*, San Francisco, CA, Feb. 2020.
- [3] P. P. Mercier, "Physiochemical Interface Circuits for Wearable and Implantable Sensing Systems," *IEEE Solid-State Circuits Society ISSCCedu online mini-course*, San Francisco, CA, Feb. 2020.
- [4] P.P. Mercier, "Building Li-ion-compatible DC-DC Converters in Scaled CMOS," *IEEE Solid-State Circuits Society CICCedu online mini-course*, Austin, TX, Apr. 2019.
- [5] P.P. Mercier, "Power Management for the Internet-of-Things," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.
- [6] P.P. Mercier, "Nanowatt wake-up radios: exploring power and sensitivity trade-offs," *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Philadelphia, PA, June 2018.
- [7] P.P. Mercier, "Design of Low-Power Wake-up Radios for IoT Applications," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, San Diego, CA, April 2018.

- [8] P.P. Mercier, “Unawareables: new wearable sensors and circuits for unobtrusive health and fitness monitoring,” *Tutorial presented at the IEEE European Solid-State Circuits Conference (ESSCIRC)*, Leuven, Belgium, Sep. 2017.
- [9] P.P. Mercier, “Improving Battery-Life of Deeply Duty-Cycled IoT Nodes via Ultra-Low-Power Wake-up Receivers,” *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.
- [10] P.P. Mercier, “Ultra-Low-Power RC Oscillators,” *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.

INVITED ABSTRACTS, PRESENTATIONS, AND POSTERS

- [1] P.P. Mercier, “Unaware-ables: Low-Power, Robust, and Useful Wearable Devices”, *Presented at the IEEE International Microwave Symposium*, Denver, CO, Jun. 2022.
- [2] P.P. Mercier, “Energy-Efficient Power Management Circuits for IoT and Wearable Devices,” *Keynote presentation at the IEEE Sensors Interface Meeting*, Veldhoven, The Netherlands, May 2022.
- [3] P.P. Mercier, “Energy Harvesting and Self-Powered Sensing for Miniaturized IoT and “Unawareable” Devices,” *Presented at the PSMA International Energy Harvesting Workshop (EnerHarv)*, Raleigh, NC, Apr. 2022.
- [4] P.P. Mercier, “Enabling Low-Power yet Standards Compatible Wireless Communication via Wake-up Receivers and Backscatter Circuits for the IoT,” *Presented as an IEEE SSCS Society-wide Webinar*, Jan. 2022.
- [5] P.P. Mercier, “Energy Harvesting and Self-Powered Sensing for Next-Generation “Unawareables” and IoT,” *Presented at the Sensors Converge Conference*, (virtual due to COVID-19), Sep. 2021.
- [6] P.P. Mercier, “Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawareables,” *IEEE Solid-State Circuits Society Distinguished Lecture at Oregon IEEE Solid-State Circuits Society local chapter*, Hillsboro, OR (virtual due to COVID-19), Jun 2021.
- [7] P.P. Mercier, “Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unawareables”, *Presented at the International Symposium on Advanced Sensor Technology*, Seoul, Korea (virtual due to COVID-19), Mar. 2021.
- [8] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Northern Virginia Section*, (virtual due to COVID-19), Oct. 2020.
- [9] P.P. Mercier, “Hybrid Converters for Mobile and IoT Applications,” *Presented at the Integrated Power Conversion and Power Management Conference (PwrSoC)* (virtual due to COVID-19), Nov. 2020.
- [10] P.P. Mercier, “Low-Power Communication Circuits and Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Princeton Central Jersey Section*, (virtual due to COVID-19), Nov. 2020.
- [11] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *Presented at the 2020 RFID Conference*, (virtual due to COVID-19), Oct. 2020.
- [12] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Utah Section*, (virtual due to COVID-19), Oct. 2020.

- [13] P.P. Mercier, "Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications," *IEEE Solid-State Circuits Society Distinguished Lecture at the Advanced Circuits Research Center in Israel*, (virtual due to COVID-19), July 2020.
- [14] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Beijing IEEE Solid-State Circuits Society local chapter*, (virtual due to COVID-19), May 2020.
- [15] P.P. Mercier, "Low-Power Wireless Systems: Opportunities and Challenges," *Presented at the DARPA MTO Offsite Planning Meeting on the U.S.S. Midway*, San Diego, CA, Dec. 2019.
- [16] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Scotland and UK IEEE Solid-State Circuits Society local chapter*, Edinburgh, UK, Sep. 2019.
- [17] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Maryland/Virginia/DC IEEE Solid-State Circuits Society and Circuits and Systems local chapter*, College Park, MD, Sep. 2019.
- [18] P.P. Mercier, "Ultra-low-power integrated circuits enabling next-generation IoT applications," *Presented at the National Academy of Engineering Frontiers of Engineering event*, San Diego, CA, Jun. 2019.
- [19] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the San Diego IEEE Solid-State Circuits Society local chapter*, San Diego, CA, May. 2019.
- [20] P.P. Mercier, "Unwearables: Addressing Sensor, Circuit, and Energy Harvesting Challenges in Next-Generation Wearable Devices," *Presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.
- [21] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwearables," *Presented at the DARPA Actuation, Sensing, and Control for Rapid Injury Response Workshop*, Arlington, VA, Apr. 2019.
- [22] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwearables," *Presented at the University of Southern California*, Los Angeles, CA, Nov. 2018.
- [23] P.P. Mercier, "Unwearables: new wearable sensors, circuits, and analytics for unobtrusive monitoring," *Presented at the SEMI MEMS & Sensors Executive Congress*, Napa, CA, Nov. 2018.
- [24] P.P. Mercier, "Ultra-small near-zero-power radios, implants, and sensing systems," *Presented at the DARPA Microsystems Exploratory Council Millimeter-Scale Wirelessly Powered Sensors Workshop*, Los Angeles, CA, Jul. 2018.
- [25] P. P. Mercier, "Wearable Sensors", *Presented at the US Marine Corps Innovation Event*, La Jolla, CA, Feb. 2018.
- [26] P.P. Mercier, "The Next Industrial Revolution: IoT, Wearables, and AI," *Presented at the Next Business Forum*, Seoul, South Korea, Nov. 2017.
- [27] P.P. Mercier, "Global Hubs for Innovative Ecosystems in Biotechnology," *Presented at the Stevanato Innovation Day*, San Diego, CA, Jun. 2017.
- [28] P.P. Mercier, "Non-Invasive Blood Alcohol Monitoring," *Presented at the Biomedical Technology Exhibition, sponsored by the American Institute for Medical and Biological Engineering (AIMBE) in partnership with the Congressional Research and Development Caucus and the Congressional Robotics Caucus*, Capitol Hill, Washington, DC, May 2017.

- [29] P.T. Theilman, J. Warchall, P. Mercier, H. Garudari, "Work Towards a Fieldable Multi-Channel EEG System for Continuous Monitoring," in *Proc. IEEE International Symposium on Circuits and Systems (ISCAS)*, Baltimore, MD, May 2017.
- [30] P.P. Mercier, "Beyond Activity Tracking: next-generation wearable and implantable sensor technologies" *Presented at the SPIE Defense and Commercial Sensing Conference*, Anaheim, CA, Apr. 2017.
- [31] D.A. Hall, H. Jiang, P.-H. Wang, L. Gao, P. Sen, Y.-H. Kim, G. Rebeiz, P.P. Mercier, "A 10nW Wake-up Radio with -60dBm Sensitivity," in *Government Microcircuit Applications & Critical Technology Conference (GOMACTech)*, Reno, NV, Mar. 2017.
- [32] P.P. Mercier, "Physiochemical Sensor Technologies and Ultra-Low-Power Integrated Circuits for Next-Generation "Unawearables" Systems," *Invited Seminar at the Microsystems Technology Lab at MIT*, Cambridge, MA, Dec. 2016.
- [33] P.P. Mercier, "Transcutaneous Power of Single-Chip Implants," *Presented at the Sensors Global Summit*, La Jolla, CA, Dec. 2016.
- [34] D. Ahn, P.P. Mercier, "A 200-kHz/6.78-MHz Wireless Power Transmitter Featuring Concurrent Dual-Band Operation," in *Proc. IEEE International SoC Design Conference (ISOC)*, Jeju, South Korea, Oct. 2016. DOI: 10.1109/ISOC.2016.7799763
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- [36] P.P. Mercier, "Wearables: an opportunity for healthcare?," *Presented at the 5G Connected Healthcare Workshop*, La Jolla, CA, May 2016.
- [37] P.P. Mercier, "New Circuit Topologies & Techniques for High-Efficiency Power Conversion in Compact Form Factors," *Invited seminar presented at UCLA and Intel Corporation*, Apr. 2016.
- [38] P.P. Mercier, "Energy-Efficient Wearable Sensors," *Presented at the UCSD Orthopaedic Surgery Research Conference*, April 2016.
- [39] P.P. Mercier and L.G. Salem, "Multi-Ratio Switched-Capacitor DC-DC Converters for Power Management Applications," *Presented at the International Symposium on Quality Electronic Design*, Santa Clara, CA, Mar. 2016.
- [40] P.P. Mercier, "Energy-Harvesting for Autonomous Operation of Low-Power Wireless Sensors," *Presented at the Sensors Global Summit*, La Jolla, CA, Nov. 2015.
- [41] P.P. Mercier, "Enabling energy-autonomous wearable and implantable sensors through energy harvesting and near-zero-power electronics," *Presented at the KAIST-UCSD Joint Symposium on Wearable Devices*, Daejeon, Korea, Oct. 2015.
- [42] P.P. Mercier, "Enabling wide output voltage range switched-capacitor DC-DC converters," *Presented at a SRC/SONIC eWorkshop*, Jun. 2015.
- [43] P.P. Mercier, "Next generation switched-capacitor DC-DC converter topologies," *Presented the at the CMOS Emerging Technologies Research Symposium*, Vancouver, BC, May 2015.
- [44] P.P. Mercier, "Harvesting small amounts of power to enable miniaturized sensors," *Presented at the Trillion Sensors Summit*, La Jolla, CA, Nov. 2014
- [45] P.P. Mercier, "Efficient on-chip power conversion for energy harvesting and low-power mobile applications," *Presented at the International Power Supply On Chip Workshop*, Boston, MA, Oct. 2014.
- [46] P.P. Mercier, "A Tutorial on Wireless Power Transfer and Miniaturized DC/DC Power Converters," *Presented at SPAWAR Systems Center Pacific*, San Diego, CA, June 2014.

- [47] P.P. Mercier, "New Advances in Wearable Devices, Biosensors, and Analytics", Panelist at the *Digital Health Forum of San Diego: The Future of Wearable Technologies in Healthcare*, La Jolla, CA, June 2014.
- [48] P.P. Mercier, "Breaking down power barriers: efficient and miniaturized energy management and energy harvesting," *Presented at the Huawei Power Summit*, San Diego, CA, May 2014.
- [49] P.P. Mercier S. Bandyopadhyay, A.C. Lysaght, K.M. Stankovic, A.P. Chandrakasan, "Powering Wireless Devices from the Biologic Battery in the Inner-Ear," *IEEE International SoC Conference*, Irvine, CA, Oct. 2013.
- [50] P.P. Mercier and V. Sridharan, "Low-Power Transmitters for Body-Area Networks," *IEEE Symposium on Power Amplifiers for Wireless Communication*, La Jolla, CA, Sep. 2013.
- [51] P.P. Mercier, "Powering a 2.4 GHz Radio from the Biologic Battery in the Inner-Ear," *Presented at the CMOS Emerging Technologies Symposium*, Whistler, BC, Canada, Jul. 2013.
- [52] P.P. Mercier, "Electrochemical energy harvesting from the inner-ear," *Presented at the INC-IEM Neuroengineering Seminar Series*, La Jolla, CA, Mar. 2013.
- [53] A.C. Lysaght, P.P. Mercier, S. Bandyopadhyay, A.P. Chandrakasan, and K.M. Stankovic, "Endocochlear Potential Powered Electronics" *Associated for Research in Otolaryngology Annual MidWinter Meeting*, vol. 36, Baltimore, MD, Feb., 2013.
- [54] P.P. Mercier, "Enabling study and control of insects through extreme miniaturization of wireless electronics," *Presented at Burapha Univeristy*, Chonburi Province, Thailand, Dec., 2012.
- [55] P.P. Mercier, "nW Energy Harvesting: What can it do for you?," *Presented at the Office of Naval Research Power and Energy Systems 6.1 Program Review*, San Diego, CA, Nov. 2012.
- [56] P.P. Mercier, "Ultra-Low-Power Radios for Miniaturized Sensing Systems," *Presented at the Center for Wireless Communications Semiannual Research Review*, La Jolla, CA, Nov. 2012.
- [57] P.P. Mercier, "Zero-Leakage Electronics and Opportunities in Miniaturized Wireless Systems," *Presented at the Center for Magnetic Recording Research Review*, La Jolla, CA, Oct. 2012.
- [58] P.P. Mercier, "Cyborg Insects and Autonomous Sensors: How Efficient Radios can Enable the Next Generation of Connectivity," *Presented at the Qualcomm Research Center*, San Diego, CA, Oct. 2012.
- [59] A. Paidimarri, P. Nadeau, P.P. Mercier, and A. Chandrakasan, "Ultra-low Power FBAR-based Multi-Channel Transceivers," *Presented at the ISSCC Student Research Preview*, San Francisco, CA, Feb. 2012.
- [60] P.P. Mercier, "Self-Powered Personal Microsystems for Medical Monitoring Applications," *Presented at TechConnect World*, Boston, MA, Jun. 2011.
- [61] P.P. Mercier, "Attaining Extreme Energy Efficiency in Body-Area Networks Using Electronic Textiles," *Presented at the MEDRC Next Generation Medical Electronic Systems Workshop*, Cambridge, MA, May, 2011.
- [62] P.P. Mercier, "Connected Health for Remote Patient Monitoring," *Presented at the MTL Annual Research Conference (MARC)*, Cambridge, MA, Jan. 2010.
- [63] P.P. Mercier, "Personal Medical Connectivity: Research Overview," *Presented at the Intel Digital Health Group*, Hillsboro, OR, Oct. 2009.
- [64] P.P. Mercier, "Energy Efficient Pulsed-UWB for Miniaturized Flying Vehicles," *Presented at the CMOS Emerging Technologies Workshop*, Banff, AB, Canada, Feb. 2009.
- [65] P.P. Mercier, "An Energy-Efficient UWB Transmitter with Dual Capacitively-Coupled Digital Power Amplifiers," *Presented at the Center for Integrated Circuits and Systems*, Cambridge, MA, Apr. 2008.

- [66] P.P. Mercier, "A 22pJ/pulse All-Digital UWB Transmitter in 90nm CMOS," *Presented at the International Solid-State Circuits Conference (ISSCC) Student Forum*, San Francisco, CA, Feb. 2008.
- [67] P.P. Mercier, "Fully Integrated Pulsed-UWB Transceivers for Small Lightweight Flying Vehicles," *Presented at the MTL Annual Research Conference (MARC)*, Waterville Valley, MA, Jan. 2008.
- [68] P.P. Mercier, "Cost Modeling for Vertically Integrated Chip Sets," *Presented at the CMOS Emerging Technologies Workshop*, Banff, AB, Canada, Jul. 2006.

ISSUED PATENTS

- [1] J. Wang, P. Mercier, "Salivary Biosensors and Biofuel Cells," U.S. Patent 11,980,462, May 14, 2024.
- [2] J. Wang, P. Mercier, A.F. Yeknami, S. Imani, "Self-Powered Biosensors," U.S. Patent 11,633,134, Apr. 25, 2023.
- [3] P.-H. Wang, P. Mercier, "BLE and/or WiFi Compliant and Blocker-Resilient Wake-up Receiver and Method," U.S. Patent 11,570,709, Jan 31, 2023.
- [4] H. Wang, P. Mercier, "Near Zero Power Fully Integrated Digital Conversion, Sensors, and Sensing Methods," U.S. Patent 11,444,633, Sep. 13, 2022.
- [5] S. Amin, P. Mercier, "Li-ion-compatible fully-integrated hybrid converter," U.S. Patent 11,356,017, Jun. 7, 2022.
- [6] P. Mercier, H. Wang, "Stabilized voltage and current reference generator and circuits," U.S. Patent 11,334,105, May 17, 2022.
- [7] J. Wang, P. Mercier, "Flexible epidermal multimodal health monitor," U.S. Patent 11,122,982, Sep. 21, 2021.
- [8] X. Wang, P. Mercier, "Low Power Transmitter Oscillator Circuits and Methods," U.S. Patent 10,897,240, Jan. 19, 2021.
- [9] P. Mercier, H. Wang, "Near Zero Power Charging to Digital Converter, Sensors, and Sensing Methods," U.S. Patent 10,877,439, Dec. 29, 2020.
- [10] C. Kim, G. Cauwenberghs, P.P. Mercier, S. Ha, J. Park, A. Akinin, "Resonant Regulating Rectifier with an Integrated Antenna," U.S. Patent 10,873,215, Dec. 22, 2020.
- [11] P. Mercier, D. Ahn, "Wireless Power Transfer Device and Method with Dual-Frequency Operation," U.S. Patent 10,855,115, Dec. 1, 2020.
- [12] P.-H. Wang, H. Jiang, D. Hall, P. Mercier, "Low Power Wake-up Receiver," U.S. Patent 10,804,946, Oct. 13, 2020.
- [13] C.-K. Cheng, P. Mercier, S.-H. Weng, "Electrical Wearable Capacitive Biosensor and Noise Artifact Suppression Method," U.S. Patent 10,729,379, Aug. 4, 2020.
- [14] J. Wang, A.J. Bandodkar, P. Mercier, "Non-invasive and Wearable Chemical Sensors and Biosensors," U.S. Patent 10,722,160, Jul. 28, 2020.
- [15] S. Ha, G. Cauwenberghs, C. Kim, J. Park, P.P. Mercier, A. Akinin, H. Wang, C.H. Maier, "Radio Frequency Powered Adiabatic Stimulation with Energy Replenishment," U.S. Patent 10,716,948, Jul 21, 2020.
- [16] T. Nguyen, H. Garudadri, P. Mercier, A. Boothroyd, C. Mackersie, "External Device Leveraged Hearing Assistance and Noise Suppression Device, Method and Systems," U.S. Patent 10,701,495, Jun. 30, 2020.

- [17] J. Park, P. Mercier, “Low power magnetic field body area network,” U.S. Patent 10,623,112, Apr. 14, 2020.
- [18] J. Wang, P. Mercier, “Salivary biosensors and biofuel cells,” U.S. Patent 10,595,759, Mar. 24, 2020.
- [19] L.G. Salem, P.P. Mercier, “Switched capacitor DC-to-DC converter and power conversion control methods,” U.S. Patent 10,374,511, Aug. 6, 2019.
- [20] L.G. Salem, P.P. Mercier, “Multi-level adiabatic charging methods, devices and systems,” U.S. Patent 10,348,300, Jul. 9, 2019.
- [21] L.G. Salem, J.F. Buckwalter, P.P. Mercier, “Switched Capacitor House of Cards Power Amplifier,” U.S. Patent 10,333,477, Jun. 25, 2019.
- [22] L.G. Salem, P.P. Mercier, “Successive approximation digital voltage regulation methods, devices and systems,” U.S. Patent 10,224,944, Mar. 5, 2019.
- [23] K. Stankovich, A. Chandrakasan, P. Mercier, S. Bandyopadhyay, A. Lysaght, “Energy Extraction,” U.S. Patent 9,369,005, Jun. 14, 2016.
- [24] P.P. Mercier and A.P. Chandrakasan, “Multi-Taped Inductively-Coupled Charging System,” U.S. Patent 9,293,942, Mar. 22, 2016.

Teaching Experience

University of California, San Diego

La Jolla, CA

Instructor

Spring 2020: ECE 165 – Digital Integrated Circuits (92% instructor rating – **even during fully virtual instruction due to COVID-19**)

Fall 2019: ECE 203 – Biomedical Integrated Circuits and Systems (94% instructor rating – **TA won the best ECE TA Award**)

Spring 2019: ECE 165 – Digital Integrated Circuits (96% course rating)

Fall 2018: ECE 203 – Biomedical Integrated Circuits and Systems (95% instructor rating)

Winter 2018: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Winter 2018: ECE 203 – Biomedical Integrated Circuits and Systems (91% instructor rating)

Spring 2017: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Spring 2017: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2016: ECE260A - VLSI Digital System Algorithms and Architectures (93% instructor rating)

Spring 2015: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from an 82 student class – ECE dept. record**)

Winter 2015: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2014: ECE260A - VLSI Digital System Algorithms and Architectures (87% instructor rating)

Spring 2014: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from a 77 student class – ECE dept. record**)

Winter 2014: ECE 203 – Biomedical Integrated Circuits and Systems (98% instructor rating)

Spring 2013: ECE 283 – Biomedical Integrated Circuits and Systems (99% instructor rating)

Winter 2013: ECE 165 – Digital Integrated Circuits (94% instructor rating)

Massachusetts Institute of Technology

Cambridge, MA

Teaching Assistant

Spring 2010: MIT EECS Course 6.776 – High Speed Communication Circuits.

IPR2024-00996

Powermat Ex. 2003

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Funding

Energy-Efficient Microsystems Lab

As PI of the Energy-Efficient Microsystems Lab, I have raised over \$40MM for research at UCSD from the following sources:

- DARPA
- NIH
- NSF
- The Arnold and Mabel Beckman Foundation
- Semiconductor Research Corporation
- ONR
- iARPA
- Army Research Lab
- KETI
- NextFlex
- The Fetzer Franklin Fund
- The Hellman Foundation
- Samsung
- Qualcomm
- Dockon Inc.
- Mouthsense Inc.
- Peregrine Semiconductor
- IMA Life North America
- Moore Foundation
- University of California Multi-Campus Research Programs and Initiatives
- California Energy Commission
- The UCSD Center for Brain Activity Mapping
- The UCSD Center for Wireless Communications (corporate sponsored)
- The UCSD Center for Wearable Sensors (corporate sponsored)
- The Power Management Integration Center (corporate sponsored)

UC San Diego Center for Wearable Sensors

As co-director of the Center for Wearable Sensors, I have been instrumental in fundraising over \$7MM from corporate partners, with the bulk of this funding used to support collaborative

efforts across six engineering departments, the School of Medicine, and the Department of Visual Arts.

Power Management Integration Center

As Site Director of the Power Management Integration Center, I have help recruit corporate members to support research at both UCSD and at Dartmouth College.

Service

Journal service

- Guest Editor – *IEEE Open Journal of the Solid-State Circuits Society (OJ-SSCS) Special Issue on Low-Power RF Circuits and Systems (2023)*
- Guest Editor – *IEEE Journal of Solid-State Circuits* Special Issue on the 2018 *International Solid-State Circuits Conference (ISSCC) (2018)*
- Associate Editor – *IEEE Solid-State Circuits Letters* (2017-2023)
- Associate Editor – *IEEE Transactions on Biomedical Circuits & Systems* (2013-2023)
- Associated Editor – *IEEE Transactions on VLSI* (2015-2017)
- Guest Editor – *IEEE TBioCAS Special Issue on the 2014 International Solid-State Circuits Conference (ISSCC) (December, 2014)*
- Guest Editor – *IEEE TBioCAS Special Issue on the 2013 International Solid-State Circuits Conference (ISSCC) (December, 2013)*

Conference service

- Executive Committee member – Demo Chair – *IEEE International Solid-State Circuits Conference (ISSCC) (2022-present)*
- Technical Program co-Chair – *IEEE Sensor Interfaces Meeting (2022-2024)*
- Subcommittee Chair – Power Management – *IEEE Custom Integrated Circuits Conference (CICC) (2021-2023)*
- Technical Program Committee member – *IEEE VLSI Circuits Symposium (2018-2022)*
- International Technical Program Committee member – *IEEE International Solid-State Circuits Conference (ISSCC) Technology Directions subcommittee (2017-2022)*
- Technical Program Committee member – *IEEE Custom Integrated Circuits Conference (CICC) (2017-2023)*
- Technical program committee – *IEEE Biomedical Circuits and Systems Conference (BioCAS) (2014-2015)*
- Session chair – *International Symposium on Low-Power Electronics and Design (ISLPED) (2014)*
- Technical program committee - *CMOS Emerging Technologies Research Symposium (2013-2016)*

Peer reviewer (2009-present)

- *IEEE Journal of Solid-State Circuits (JSSC)*
- *IEEE Transactions on Circuits and Systems I (T-CAS I)*
- *IEEE Transactions on Circuits and Systems II (T-CAS II)*
- *IEEE Transactions on Microwave Theory and Techniques (T-MTT)*
- *IEEE Sensors Journal*
- *IEEE Transaction on Power Electronics*

- *Journal of Low Power Electronics and Applications (JLPEA)*
- *IET Circuits, Devices & Systems*
- *IEEE International Conference on Ultra-Wideband (ICUWB)*
- *IEEE Transactions on Biomedical Circuits & Systems (TBioCAS)*
- *IEEE Transactions on Biomedical Engineering (TBME)*
- *IEEE International Conference on Circuits and Systems (ISCAS)*
- *IEEE Biomedical Circuits and Systems Conference (BioCAS)*
- *IEEE Journal of Emerging and Selected Topics in Power Electronics*
- *IEEE Transactions on Industrial Electronics*
- *Nature Nanotechnology*
- *Advanced Materials*
- *Nature Biomedical Engineering*
- *Science Advances*

Grant review service

- NSF SenSE panel reviewer (July 2020)
- NSF ECCS panel reviewer (February 2019)
- NSF ECCS panel reviewer (January 2018)
- NSF ECCS panel reviewer (March 2015)
- ARL ARL Director's Research Initiative (DRI) reviewer (June 2015)

UCSD Campus-wide Service

- Chair, Academic Senate Faculty Affairs Committee (2024-present)
- Co-Director – *Center for Wearable Sensors* – including 23 faculty across four engineering departments, the School of Medicine, and Arts and Humanities (Department of Visual Arts). Funding comes from the membership of 6-10 corporate partners. (2014-present)
- Site Director – *Power Management Integration Center* – includes 5 faculty across multiple engineering departments. Funding comes from the membership of 8-12 corporate partners. (2021-present)
- Vice Chair Academic Senate Faculty Affairs Committee (2023-2024)
- Chair, UCSD Academic Senate Awards Committee (2020-2022)
- Member, UCSD Academic Senate Awards Committee (2018-2020)
- Member, Office of Research Affairs Center Launch Review Panel. (2017-2018)
- Member, UCSD School of Public Health Advisory Committee (2017-2019)
- UCSD representative on Capitol Hill – presented to congressional staffers via an event hosted by the American Institute for Medical and Biological Engineering, then met, alongside UCSD's Executive Director of Government Research Relations, with the offices of three San Diego Congressmen and one California Senator to discuss research at UCSD. (2017)
- Faculty representative, Campus-wide commencement ceremony (2017)
- Organizer & presenter, KAIST-UCSD Symposium on Micro/Nanotechnologies and Electronics for Next-Generation Mobile, Wearable, and IoT Systems, Deajeon, Korea (2015)
- Faculty representative, Welcome Week Convocation Ceremony (2013)

UCSD ECE Departmental Service

- Vice Chair, ECE Department (2024-present)
- Member, Faculty search committee, Systems Focus (2024)
- Adhoc committee member, faculty review files (2x in 2024)
- Chair, ECE Faculty Awards Committee (2023-present)

- Chair, ECE Admissions Steering Committee (2020-2022)
- Member, ECE Admissions Committee (2019-present)
- Medical Devices and Systems curriculum advisor (2018-2020)
- ECE 50th Anniversary planning committee (2015-2016)
- MS Exam committee (2014-present)
- Alumni Initiative (2014-2020)
- Undergraduate/Graduate Affairs and Student Award Nomination committee (2012-2014)
- Medical Devices and Systems curriculum director (2013-2014)
- Medical Devices and Systems Ad-hoc committee - responsible for creating a new program in this area (2012-2013)

Co-Chair, Microsystem Technology Lab Annual Research Conference (2011)

Annual research conference with over 200 academic and industrial attendees. Responsible for steering committee leadership and conference organization including: solicitation of papers, managing paper edits, keynote speaker invitation, opening and closing remarks, and general planning. Created interactive attendee activities to solicit social and technical engagement amongst industry members and students. Cited by a high-ranking industry member as “the best student run conference in the country”.

Broader Impacts & Outreach

- Presented a webinar at BioXTech, a country-wide club founded and run by high school women interested in the intersection of biology and technology, and answered questions about technology and gave career advice (2023)
- Featured in the publication entitled “Building Blocks for Better Science: Case Studies in Low-Cost and Open Tools for Science”, which describes my work in low-cost COVID-19 symptoms monitoring devices (2020)
- Guest instructor at Hands-on-Technology summer camp at Wangenheim Middle School focused on accelerating the understanding of computer science in elementary and school-aged children (2014-present)
- Directly mentored ten B.S., M.S., and Ph.D. students from historically underrepresented backgrounds, including two high school students (2012-present)
- Directly mentored two high school students from historically underrepresented backgrounds (2013, and 2016-2017)
- Keynote speaker at ENSPIRE: one of the largest outreach at UCSD, where over 300 middle-school children visit UCSD to learn about higher education and engineering (Feb. 2015)

Press Articles

Prof. Mercier’s work across several different projects and his expert opinion have been featured in hundreds of press articles and in other forms of media (e.g., TV and radio). A few select articles/videos are shown below.

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Appendix B

EXPERT WITNESS PRIOR ENGAGEMENTS

Professor Patrick P. Mercier, Ph.D.
Mercier Engineering | San Diego, CA
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Case: Shaun Flanenry v. Evolve Skateboards
Case Number: No. 84375-COA
Court: Court of Appeals of Nevada
Expert witness for: Plaintiff
First retained: June 2021
Scope of work: Wrote an expert witness rebuttal report
Deposed or testified?: No
Case status: Closed

Case: Charles Hwang v Test Rite Products Corporations et al.
Case Number: No. 2:22-cv-01259
Court: Central District of California
Expert witness for: Defendant
First retained: September 2022
Scope of work: Studied patents and prepared technical questions for a witness deposition
Deposed or testified?: No
Case status: Closed

Case: Bel Power Solutions Inc v. Monolithic Power Systems Inc
Case Number: No. 6:21-CV-655-ADA
Court: US Western District of Texas Waco Division
Expert witness for: Defendant
First retained: March 2022
Scope of work: Wrote a claim construction brief
Deposed or testified?: No
Case status: Uncertain

Case: Powermat Technologies Ltd. V. Anker Innovations Ltd.
Case Number: 5:23-cv-00052-RWS and other related cases (e.g., IPRs)
Court: US District Court for the Eastern District of Texas Texarkana Division
Expert witness for: Plaintiff
First retained: January 2024
Scope of work: Wrote expert witness rebuttal and IPR reports, testified in depositions
Deposed or testified?: Yes, deposed twice – once for district court case, once for IPR
Case status: Ongoing

Case: Masimo Corp., et al. v. Apple Inc.
Case Number: 8:20-cv-00048-JVS (JDEx)
Court: US District Court, Central District of California, Southern Division
Expert witness for: Defendant
First retained: June 2024
Scope of work: In progress, but so far involved in multiple expert witness reports and deposition/trial prep for invalidity and non-infringement
Deposed or testified?: Not yet
Case status: Ongoing

Case: Powermat Technologies Ltd. V. Belkin International, Inc.
Case Number: 2:24-CV-02595-AH-PVC
Court: US District Court for the Central District of California
Expert witness for: Plaintiff
First retained: November 2024
Scope of work: Wrote an expert declaration in support of claim construction
Deposed or testified?: Yes, deposed
Case status: Ongoing

Case: Samsung Electronics Co., Ltd.; Samsung Electronics American, Inc. v. Ouraring, Inc.
Case Numbers: PGR2024-00030 and other related IPRs and cases
Venue: United States Patent and Trademark Office IPR
Expert witness for: Defendant
First retained: February 2025
Scope of work: Preparing of expert witness declaration for IPR
Deposed or testified?: Not yet
Case status: Ongoing

Case: Vampire Labs LLC v. Apple Inc.
Case Number: 1:24-cv-013770DII
Venue: US District Court for the Western District of Texas, Austin Division
Expert witness for: Defendant
First retained: May 2025
Scope of work: Expert witness work to include report writing, deposition, and trial
Deposed or testified?: Not yet
Case status: Ongoing