

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WHOOOP, INC.

Petitioner,

v.

OMNI MEDSCI, INC.,

Patent Owner.

U.S. Patent No. 10,874,304

Case No. IPR2025-01584

DECLARATION OF IGOR EFIMOV, PH.D.

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I, Igor Efimov, declare as follows:

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been retained on behalf of Omni MedSci, Inc., (“Omni” or “Patent Owner”) as an independent expert to provide this declaration concerning the technical subject matter relevant to U.S. Patent No. 10,874,304 (“the ’304 Patent”) (Ex. 1001) in connection with an *inter partes* review (“IPR”) petition filed by WHOOP, Inc. (“Petitioner”).

3. I am being compensated at my standard hourly rate of \$700 per hour for the time I spend on this matter. My compensation is not based on the content of my opinions or the resolution of this matter, and I have no financial or other interest in this proceeding.

4. I understand that Omni is asserting the ’304 Patent against Whoop, Inc., in a related matter currently pending in the United States District Court for the District of Delaware (the “Delaware Case”).

5. I also understand that Omni is asserting the ’304 Patent against Samsung Electronics Co., Ltd., and others, in a related matter currently pending in the United States District Court for the Eastern District of Texas (the “Texas Case”).

6. I further understand that the Defendants in the Texas Case have filed an IPR petition challenging the ’304 Patent in IPR2025-01251 (“the Samsung ’304

IPR”). I have offered certain opinions regarding the ’304 Patent and the grounds in the Samsung ’304 IPR in a declaration dated November 12, 2025 (Ex. 2031 in Samsung ’304 IPR). Ex. 2053. Certain content in this declaration may overlap with content in my declaration in the Samsung ’304 Patent IPR. For example, the Overview of the ’304 Patent (Section V in this declaration) is the same or substantially the same in both declarations.

7. In this declaration, I offer opinions relating to the ’304 Patent, claim construction, the references in the Petition, and the declaration of Petitioner’s expert Dr. Mercier. The substance and bases of my opinions appear below.

I. BACKGROUND AND QUALIFICATIONS

8. In formulating my opinions, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly herein.

9. I am currently a Professor of Biomedical Engineering and a Professor of Medicine (Division of Cardiology) at Northwestern University, Chicago, Illinois. Prior to my tenure at Northwestern University, I was the Alisann and Terry Collins Professor of Biomedical Engineering at The George Washington University, Washington, D.C., where I also served as Founding Chair of the Department of Biomedical Engineering from 2015 to 2019. Before that, from 2004 to 2015, I served as the Lucy & Stanley Lopata Distinguished Professor of Biomedical Engineering at Washington University, in Saint Louis, Missouri. I was also a Professor of

Medicine, Professor of Radiology, and Professor of Cell Biology & Physiology at the Washington University School of Medicine. I also served on the faculty of the Department of Cardiology of the Cleveland Clinic Foundation (1994-2000) and the Department of Biomedical Engineering of Case Western Reserve University (2000-2004), Cleveland, Ohio.

10. My research focuses on the physiological mechanisms of cardiovascular disease and the development of diagnostic and therapeutic bioelectronics for heart rhythm disorders, heart failure, and vascular dysfunction. My laboratory develops implantable, wearable, and optical sensing and imaging systems for real-time physiological diagnostics and device-based therapy. These systems incorporate semiconductor light sources, photodiodes, and spectroscopic analysis.

11. I received my Master of Science degree in experimental nuclear physics from the Moscow Institute of Physics and Technology, USSR, in 1986. In 1992, I received a Ph.D. in Biophysics from the Moscow Institute of Physics and Technology after completing a doctoral study on the mechanisms of sudden cardiac death due to ventricular arrhythmias. I completed my postdoctoral training in 1992-1994 in the fields of fast fluorescent imaging / optical mapping, cardiac electrophysiology, and arrhythmia at the University of Pittsburgh in Pittsburgh, Pennsylvania. Then, I started my independent cardiac research career in the

Department of Cardiology at the Cleveland Clinic Foundation (1994-2000), where I established an NIH-funded laboratory. Cleveland Clinic has been consistently ranked the #1 Cardiology program nationwide by U.S. News & World Report since 1994.

12. For the past 25 years, I have taught undergraduate and graduate courses in Biomedical Engineering, including courses relating to quantitative physiology, applied bioelectricity, biomedical optics, biosignal acquisition and analysis, light-tissue interaction, physiology of the heart, introduction to biomedical engineering, clinical cardiovascular engineering, and cardiovascular engineering and technology. In these and other courses, I taught sections on engineering and physiological principles of cardiac electrophysiology, arrhythmia, and electrocardiography. Many of my trainees are currently working at leading national medical device companies, including Medtronic, Abbott, and Boston Scientific, developing novel cardiac antiarrhythmic therapies, diagnostics, and sensing devices.

13. I have also mentored over 30 clinical fellows and postdoctoral research fellows, many of whom are currently professors, cardiologists, cardiac and vascular surgeons, and clinical engineers throughout the national and world Universities and hospitals, including Harvard University, MA; University of California, CA; Ohio State University, OH; University of Wisconsin, WI; University of Fukuoka, Japan;

University of Bordeaux, France; University of Brno, Czech Republic; Imperial College London, UK; etc.

14. I have published a book in 2009 on cardiac bioelectric diagnostics and therapy (Efimov I.R., Kroll, M.W., Tchou, P.J., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2009. ISBN 978-0-387-79402- 0), and I have published a second updated edition of this book in 2021 (Efimov I.R., Ng F.S., Laughner J.I., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2nd Edition. 2021. ISBN 978-3-030-63354-7). These volumes address optical imaging technology and electrophysiological principles of diagnosis and therapy, providing novel approaches to the treatment of cardiac arrhythmias using implantable devices, percutaneous ablation therapies, machine learning, and other approaches.

15. Most of my 300+ peer-reviewed publications focus on cardiac electrophysiology, biomedical optics, device development, the physiological mechanisms of cardiac arrhythmias, and their diagnostics and therapy. In collaboration with Professor John A. Rogers from Northwestern University, we have developed a novel implantable, interventional, and wearable electronics platform for monitoring cardiac electrophysiology, optical image mapping, diagnosis of heart rhythm disorders due to brady- and tachyarrhythmias, and antiarrhythmic therapy. Several high-impact publications have been published on that subject recently in

leading scientific journals. For example, our recent paper on novel bioresorbable electronics platform (Choi YS, Yin RT, Pfenniger A, Koo H, Avila R, Lee KB, Chen SW, Lee G, Li G, Qiao Y, Murillo-Berlitz A, Kiss A, Han S, Lee SM, Li C, Xie Z, Chen YY, Burrell A, Geist B, Jeong H, Kim J, Yoon HJ, Banks A, Kang SK, Zhang ZJ, Haney CR, Sahakian AV, Johnson D, Efimova T, Huang Y, Trachiotis GD, Knight BP, Arora RK, Efimov IR, Rogers JA. Fully implantable and bioresorbable cardiac pacemakers without leads or batteries. *Nature Biotechnology*, June 28, 2021, <https://doi.org/10.1038/s41587-021-00948-x>.) was featured by over 150 international news outlets reaching at least 12 million listeners/viewers from 5 continents, including PBS, Guardian, and NIH Research Matters (NIH Director's office online publication).

16. Another 2025 publication in *Nature* (Zhang Y, Rytkin E, Zeng L, Kim JU, Tang L, Zhang H, Mikhailov A, Zhao K, Wang Y, Ding L, Lu X, Lantsova A, Aprea E, Jiang G, Li SG Seo, Wang T, Wang J, Liu J, Gu J, Liu F, Bailey K, L YFL, Burrell A, Pfenniger A, Ardashev A, Yang T, Liu N, Lyu Z, Purwanto NS, Ying Y, Lu Y, Hoepfner C, Melisova A, Gong J, Jeong J, Choi J, Hou A, Nolander R, Bai W, Jin SH, Ma Z, Torkelson JM, Huang Y, Ouyang W, Arora RK, Efimov IR, Rogers JA. Millimetre-scale, bioresorbable optoelectronic systems for electrotherapy. *Nature*, 2025, 640 (8057), 77-86.) was recognized among the Best Inventions of 2025 by the Time.

17. I have also delivered 400+ invited lectures at prestigious professional conferences and leading Universities worldwide, most of them on biomedical imaging, semiconductor-based light emission, optical coupling through tissue, wireless control architectures, cardiac arrhythmias and therapy. On 2025/11/09, I presented at the annual sessions of the American Heart Association “New sensors for the future: bringing dreams to reality.” Other presentations in 2025 included “Millimeter-scale Bioresorbable Stimulator (milli-pacemaker)”, European Section Meeting of the International Academy of Cardiovascular Sciences. Prague, Czechia, 2025/11/04; “Millimeter-scale Bioresorbable Stimulator”, RASA Europe conference, Berlin, Germany, 2025/11/1; “Cardiovascular Conformal Bioresorbable Devices”, Abbott, 2025/10/21; “Heart-AI interface: Soft Bioresorbable Devices”, Cardiology Grand Rounds, University of Rochester Medical Center, Rochester, NY, 2025/09/10; “Heart-AI interface: novel bioelectronic therapy for heart rhythm disorders”, Department of Internal Medicine Grand Rounds at the University of Iowa Carver College of Medicine, Iowa City, IA, 2025/09/04; “Bioelectronics for Neurocardiology: Leducq Foundation Update”, Lyric, University of Bordeaux, France, 2025/08/27; “Bioresorbable transient electronics”, Abbott, 2025/06/16; “Bioresorbable transient electronics”, Heart Rhythm Society, San Diego, CA, 2025/04/27; “Bioresorbable milli-pacemaker: transient arrhythmia therapy”, Ralph Lazarra Lecture Award, Heart Rhythm Society, San Diego, CA, 2025/04/24;

“Selective p38 γ silencing by rationally designed siRNA for mitigating anthracycline cardiotoxicity”, Lurie Cancer Center, Feinberg School of Medicine, Northwestern University, Chicago, IL, 2025/04/22; “Transient bioelectronics for cardiovascular tissue engineering and medicine”, Department of Biomedical Engineering, University of Alabama at Birmingham, AL, 2025/04/18; “Cardiac bioelectronics for heart rhythm disorders”, Leiden University Medical Center, Leiden, Netherlands, 2025/01/21.

18. In 2021-2025, I served as the Editor-in-Chief of Cardiovascular Engineering and Technology, a journal of the Biomedical Engineering Society, published by Springer Nature. I was responsible for reviewing and decision-making of approximately 250-300 manuscripts submitted for publication, including biomedical imaging, medical devices, cardiac electrophysiology, signal processing, arrhythmia therapy, etc.

19. I have served on the editorial board of the American Journal of Physiology: Heart and Circulatory Physiology and Heart Rhythm Journal, where I manage and make decisions on manuscripts related to biomedical sensing and imaging, cardiac electrophysiology and electrotherapy. I have served or currently am serving on many editorial boards of other leading cardiac journals, where I review papers on biomedical imaging technique, cardiac electrophysiology and arrhythmia. These journals include Circulation Research, Heart Rhythm, Journal of

Cardiac Electrophysiology, Journal of Molecular and Cellular Cardiology, American Journal of Physiology, IEEE Transactions in Biomedical Engineering, Experimental Physiology, etc. I regularly review papers on biomedical imaging, cardiovascular physiology and arrhythmia for Nature, Science, Proceedings of the National Academy of Science, Circulation, and other leading journals.

20. I have served on numerous national and international expert panels, which consider grant applications from the leading experts in the field of biomedical optics, diagnostic sensing, cardiac electrophysiology, and defibrillation from many countries, including the USA, the European Union, Canada, the UK, France, Switzerland, Germany, the Netherlands, Russia, Australia, New Zealand, South Africa, Singapore, etc. From 2009-2013, I served as a chartered member of the leading US panel at the National Institutes of Health, the Electrical Signaling, Transporters and Arrhythmia (ESTA) Study section, which is the major funding source for leading US bioinstrumentation investigators. I have also served on many international panels that consider policy, research, and funding decisions in the field of biomedical sensing, cardiac electrophysiology and therapy in numerous countries from most continents. For example, I served on The Expert Panel on the Medical and Physiological Impacts of Conducted Energy Weapons, the Council of Canadian Academies.

21. My research on biomedical imaging and electronics has been funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health and other federal and private foundations without interruptions since 1998, with an average of approximately \$1M per year during recent years. I am also funded by the American Heart Association, National Science Foundation, Leducq Foundation, etc.

22. I have been designing and developing medical devices and diagnostic systems for more than twenty-five years. My inventions and patent portfolio include methods for low-voltage cardiac defibrillation, optical and electrical biosensors, cardiac and neural stimulators, and hybrid optoelectronic systems for tissue monitoring and physiological diagnostics. Many of these devices integrate semiconductor light sources, photodetectors, and optical mapping technologies. For example, I am the inventor or co-inventor on several patents and patent applications, including “Systems and Methods for Triple-Parametric Optical Mapping” (U.S. Pat. App. Pub. No. 2023/0085578), “Distributed Neuromorphic Computing for High-Definition Bioelectric Diagnostics and Therapy” (U.S. Patent No. 11,701,002), and “High-Resolution Multi-Function and Conformal Electronics Device for Diagnosis and Treatment of Cardiac Arrhythmias” (PCT/US18/16499). With the support of NIH funding, I have invented a method for low-voltage defibrillation of cardiac arrhythmias by effectively unpinning anatomical reentry (U.S. Patent No. 8,175,702), a method for cardiac pacing using the inferior nodal extension (U.S.

Patent No. 8,391,995), and a method and device for low-energy termination of atrial tachyarrhythmias (U.S. Patent No. 8,509,889). I founded Cardialen, Inc. to develop clinical defibrillators based on this method, which received over \$30M in venture and NIH funding. Cardialen was acquired in 2022.

23. I have received many awards in recognition of my research and innovation in the field of bioengineering and diagnostic device development. For example, I was elected to the United States National Academy of Inventors in 2019; and I have received the 2021 Distinguished Scientist Award and the 2025 Ralph Lazzara Lectureship Award from the leading clinical cardiac electrophysiology professional association – the Heart Rhythm Society. In 2025, I was elected to the American Academy of Sciences and Letters.

24. A more detailed listing of my credentials is set forth in my curriculum vitae (Ex. 2047).

II. MATERIALS CONSIDERED

25. In forming the opinions set forth herein, I have considered and relied upon my education, knowledge of the relevant field, and my experience. I have also reviewed and considered the '304 Patent (Ex. 1001) and the '304 Patent's file history (Ex. 1002), and at least the following additional materials.

- Petition for *Inter Partes* Review of the '304 Patent (Paper 1) ("Petition");

- Declaration of Patrick Mercier, PhD, in Support of Petition for Inter Partes Review of U.S. Patent No. 10,874,304 (Ex. 1003);
- U.S. Patent No. 9,651,533 (Ex. 1004);
- U.S. Patent No. 10,517,484 (Ex. 1005);
- Docket Sheet for *Omni MedSci, Inc. v. WHOOP, Inc.*, No. 1:25-cv-00140 (D. Del.) (Ex. 1006);
- Docket Sheet for *Omni MedSci, Inc. v. Samsung Elecs., et al.*, No. 2:24-cv-01070 (E.D. Tex.) (Ex. 1007);
- Final Written Decision, *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916, Paper No. 39 (P.T.A.B. Oct. 14, 2020) ('533 IPR) (Ex. 1008);
- Federal Circuit Summary Affirmance, *Omni MedSci, Inc. v. Apple Inc.*, No. 21-1229, 2022 WL 2062168 (Fed. Cir. June 8, 2022) ('533 IPR) (Ex. 1009);
- Patent Owner's Notice of Appeal, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453 (P.T.A.B. Apr. 11, 2025) (Ex. 1010);
- First Final Written Decision, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453, Paper No. 22 (P.T.A.B. Aug. 3, 2022) ('484 IPR) (Ex. 1011);

- Federal Circuit Decision, *Apple Inc. v. Omni MedSci, Inc.*, No. 23-1034, 2024 WL 3084509 (Fed. Cir. June 21, 2024) ('484 IPR) (Ex. 1012);
- Second Final Written Decision, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453, Paper No. 26 (P.T.A.B. Feb. 14, 2025) ('484 IPR) (Ex. 1013);
- Docket Sheet for *Omni MedSci, Inc. v. Apple Inc.*, No. 25-1646 (Fed. Cir.) (Second Federal Circuit Appeal, '484 IPR) (Ex. 1014);
- Petition, *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916, Paper No. 1 (P.T.A.B. Apr. 10, 2019) ('533 IPR) (Ex. 1015);
- Institution Decision, *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916, Paper No. 16 (P.T.A.B. Oct. 18, 2019) ('533 IPR) (Ex. 1017);
- Patent Owner Response, *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916, Paper No. 23 (P.T.A.B. Jan. 31, 2020) (Ex. 1018);
- Petition, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453, Paper No. 1 (P.T.A.B. Jan. 22, 2021) ('484 IPR) (Ex. 1021);
- Institution Decision, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453, Paper No. 7 (P.T.A.B. Aug. 6, 2021) ('484 IPR) (Ex. 1023);
- Patent Owner Response, *Apple Inc. v. Omni MedSci, Inc.*, IPR2021-00453, Paper No. 10 (P.T.A.B. Nov. 12, 2021) ('484 IPR) (Ex. 1024);

- U.S. Patent No. 9,241,676 (Lisogurski) (Ex. 1027);
- U.S. Patent Application Publication No. 2005/0049468 (Carlson) (Ex. 1028);
- U.S. Patent No. 8,175,667 (Debreczény) (Ex. 1029);
- U.S. Patent No. 6,304,767 (Soller) (Ex. 1030);
- U.S. Patent No. 8,108,036 (Tran) (Ex. 1031);
- U.S. Patent Application Publication No. 2012/0197093 (Valencell-093) (Ex. 1032);
- Joseph D. Bronzino, *The Biomedical Engineering Handbook* (1995) (Ex. 1033);
- Patel et al., “A Review of Wearable Sensors and Systems with Application in Rehabilitation,” *Journal of Neuroengineering & Rehabilitation* (2012) (Ex. 1034);
- A. Omre, “Bluetooth Low Energy: Wireless Connectivity for Medical Monitoring,” *Journal of Diabetes Science & Technology* (Mar. 2010) (Ex. 1035);
- P. Baum et al., “Strategic Intelligence Monitor on Personal Health Systems, Phase 2: Market Developments - Remote Patient Monitoring and Treatment, Telecare, Fitness/Wellness and mHealth,” JRC

Scientific and Policy Reports of the European Commission (2013) (Ex. 1036);

- M. Kranz et al., “The Mobile Fitness Coach, Towards individualized skill assessment using personalized mobile devices,” *Pervasive and Mobile Computing* (June 2012) (Ex. 1037);
- M. Swan, “Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0,” *Journal of Sensor and Actuator Networks* (2012) (Ex. 1038);
- Rauf Adil, “The Usage of Tablets in the HealthCare Industry,” *Healthcare IT News* (last accessed Sept. 4, 2025) (Ex. 1040);
- Remote Deposition of Duncan Leo MacFarlane, Ph.D., P.E., *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916 (P.T.A.B. Apr. 16, 2020) (Ex. 1041);
- Curriculum Vitae of Patrick Mercier, PhD (Ex. 1042);
- Docket Sheet for *Omni MedSci, Inc. v. Apple Inc.*, No. 4:19-cv-05924 (N.D. Cal.) (Ex. 1043);
- J. G. Webster, *Design of Pulse Oximeters* (1997) (Ex. 1045);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01250 (P.T.A.B. Aug. 5, 2025) (’533 IPR) (Ex. 1050);

- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01251 (P.T.A.B. Aug. 5, 2025) ('304 IPR) (Ex. 1051);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01252 (P.T.A.B. Aug. 5, 2025) ('455 IPR) (Ex. 1052);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01253 (P.T.A.B. Aug. 5, 2025) ('790 IPR) (Ex. 1053);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, PGR2025-00064 (P.T.A.B. Aug. 5, 2025) ('790 PGR) (Ex. 1054);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01254 (P.T.A.B. Aug. 5, 2025) ('475 IPR) (Ex. 1055);
- Petition, *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, PGR2025-00063 (P.T.A.B. Aug. 5, 2025) ('475 PGR) (Ex. 1056);
- U.S. Patent No. 11,160,455 (Ex. 1058);
- U.S. Patent No. 12,193,790 (Ex. 1059);
- U.S. Patent No. 12,268,475 (Ex. 1060);
- Omni MedSci, Inc.'s Corrected Opening Brief, *Omni MedSci, Inc. v. Apple Inc.*, No. 25-1646, Dkt. 17 (Fed. Cir. Sept. 11, 2025) (Ex. 1061);
- Scheduling Order, *Omni MedSci, Inc. v. Whoop, Inc.*, No. 1:25-cv-00140 (D. Del.) (November 10, 2025) (Ex. 2034);

- Statutory Disclaimer of U.S. Patent No. 10,874,304 dated November 11, 2025 (Ex. 2048);
- Joint Claim Construction and Prehearing Statement, *Omni MedSci, Inc. v. Samsung Electronics Co. Ltd. et al.*, 2:24-cv-01070-JRG-RSP (E.D. Tex.) (Nov. 21, 2025) (Ex. 2049);
- *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00914, Paper 13 (PTAB Nov. 6, 2019) (Ex. 2050);
- Petition for *Post Grant* Review of Patent No. 12,193,790 (Paper 1) (Ex. 2051);
- Pretto JJ, Roebuck T, Beckert L, Hamilton G., Clinical use of pulse oximetry: *Official guidelines from the Thoracic Society of Australia and New Zealand*, *Respirology* (2014) 19:38–46 (Ex. 2052);
- Declaration of Igor Efimov (Exhibit 2031), *Samsung Elecs. Co. et al. v. Omni MedSci, Inc.*, IPR2025-01251 (P.T.A.B. Nov. 12, 2025) ('304 IPR) (Ex. 2053);
- Statutory Disclaimer of U.S. Patent No. 10,874,304 dated January 2, 2026 (Ex. 2054).

26. I have also considered any materials cited in this declaration to the extent they are not expressly listed above. My review of these materials was

informed by my education, my work experience, and my experience designing medical devices.

27. I reserve the right to supplement my opinions or express additional opinions should additional and/or presently unknown information about this matter become known by me at a later date.

III. LEGAL STANDARDS

28. As a technical expert, I am not offering any legal opinions. Rather, I am offering technical assessments and opinions. In rendering my analysis, I have been informed by counsel regarding various legal standards for determining patentability. I have applied those standards in forming my technical opinions expressed in this declaration.

A. Level of Ordinary Skill in the Art

29. I understand that the claims and specification of a patent are addressed to and intended to be read by others of skill in the art to which the patent pertains, or to which the patent is most nearly connected, at the time of the filing of the patent application.

30. I understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to be aware of all of the pertinent art. The person of ordinary skill is not an automaton, and may be able to fit together the teachings of multiple prior art references employing ordinary creativity and the

common sense that familiar items may have obvious uses beyond their primary purposes.

31. I understand that multiple factors should be used to decide the skill of the POSITA, including: the types of problems encountered in the art, prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the education level of active workers in the field.

B. Claim Construction

32. The patent claims describe the invention made by the inventor and describe what the patent owner owns and what the owner may prevent others from using. I understand that an independent claim sets forth all the requirements that must be met to be covered by that claim. I further understand that a dependent claim does not itself recite all of the requirements of the claim but refers to another claim and incorporates all of the requirements of the claim to which it refers.

33. I understand that claim construction is the process by which the scope and meaning of terms used in the claims of a patent is determined. I understand that the goal of this process is to give claim terms the ordinary and customary meaning they would have had to a POSITA at the time of the invention, after reading the patent and its prosecution history.

34. I understand that the patent specification may reveal a special definition given to a claim term by the patentee that differs from the plain and ordinary meaning it would otherwise have to a POSITA. In such cases, I understand that the patentee's definition usually controls.

35. I understand that the prosecution history of a patent can inform the meaning of some claim language and that the prosecution history must be considered when construing the claims.

36. I understand that extrinsic evidence, such as dictionaries, treatises, and expert opinions, may also be considered to understand the technology at issue and the way in which claim terms would be understood by a POSITA in the relevant timeframe.

C. Anticipation

37. I understand that anticipation analysis is a two-step process. The first step is to determine the meaning and scope of the asserted claims. Each claim must be viewed as a whole, and it is improper to ignore any element of the claim. For a claim to be anticipated under U.S. patent law: (1) each and every claim element must be identically disclosed, either explicitly or inherently, in a single prior art reference; (2) the claim elements disclosed in the single prior art reference must be arranged in the same way as in the claim; and (3) the identical invention must be disclosed in the single prior art reference, in as complete detail as set forth in the claim. Where even

one element is not disclosed in a reference, the anticipation contention fails. Moreover, to serve as an anticipatory reference, the reference itself must be enabled, i.e., it must provide enough information so that a person of ordinary skill in the art can practice the subject matter of the reference without undue experimentation.

38. I understand that where a prior art reference fails to explicitly disclose a claim element, the prior art reference inherently discloses the claim element only if the prior art reference must necessarily include the undisclosed claim element. Inherency may not be established by probabilities or possibilities. The fact that an element may result from a given set of circumstances is not sufficient to prove inherency.

D. Obviousness

39. I understand that a patent claim is invalid under 35 U.S.C. § 103 only if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in that art. An obviousness analysis requires consideration of four factors: (1) scope and content of the prior art relied upon to challenge patentability; (2) differences between the prior art and the claimed invention; (3) the level of ordinary skill in the art at the time of the invention; and (4) the objective evidence of non-obviousness, such as commercial success, unexpected results, the failure of others to achieve the results of the invention, a

long-felt need which the invention fills, copying of the invention by competitors, praise for the invention, skepticism for the invention, or independent development.

40. I understand that a prior art reference is proper to use in an obviousness determination if the prior art reference is analogous art to the claimed invention. I understand that a prior art reference is analogous art if at least one of the following two considerations is met. First, a prior art reference is analogous art if it is from the same field of endeavor as the claimed invention, even if the prior art reference addresses a different problem and/or arrives at a different solution. Second, a prior art reference is analogous art if the prior art reference is reasonably pertinent to the problem faced by the inventor, even if it is not in the same field of endeavor as the claimed invention.

41. Furthermore, I understand that a claim may be obvious in view of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be supplied by the knowledge or common sense of one of ordinary skill in the relevant art.

42. I further understand that a reconstructive hindsight approach to this analysis, i.e., the improper use of post-invention information to help perform the selection and combination, or the improper use of the listing of elements in a claim as a blueprint to identify selected portions of different prior art references in an attempt to show that the claim is obvious, is not permitted. In other words, one

should avoid using the challenged patent as a guide through the prior art references, combining the right references in the right way so as to achieve the result of the claims at issue. Instead, one must put oneself in the place of a person of ordinary skill at the time the invention was made and consider only what was known before the invention was made and not consider what was only known after the invention was made.

43. I also understand that when considering the obviousness of a patent claim, one must consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand that a teaching, suggestion, or motivation may be found explicitly or implicitly: (1) in the prior art; (2) in the knowledge of those of ordinary skill in the art; or (3) from the nature of the problem to be solved. I also understand that the motivation to combine references may include logic, judgment, and common sense, but that any such motivation to combine references must still avoid the improper application of hindsight or reliance on the patentee's disclosure of his invention as found in the patent specification, drawings, and claims.

44. I understand that it must also be shown that one having ordinary skill in the art at the time of the invention would have had a reasonable expectation that a modification or combination of one or more prior art references would have succeeded.

45. I understand that obviousness should be considered in light of the problems known to the person having ordinary skill in the art and the complexity of the alternatives for solving the problems. That individual elements of the claimed invention are disclosed in the prior art is not alone sufficient to reach a conclusion of obviousness.

46. While certain combinations of the prior art might be “obvious to try,” I understand that any obvious to try analysis will not render a patent invalid unless it is shown that the possible combinations are: (1) sufficiently small in number so as to be reasonable to conclude that the combination would have been selected; and (2) such that the combination would have been believed to be one that would produce predictable and well understood results.

47. I understand that each alleged prior art reference in a proposed obviousness combination must be evaluated in its entirety, i.e., including those portions that would argue against obviousness, and must be considered for everything that it teaches, not simply the described invention or a preferred embodiment. I understand that it is impermissible to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art, or to ignore portions of the reference that argue against obviousness. I also understand that all of the supposed prior art to be combined as

proposed must also be evaluated as a whole and should be evaluated for what they teach in combination as well as separately.

48. I also understand that if the teachings of a prior art reference would lead one skilled in the art to make a modification that would render that prior art device, system, or method inoperable, then such a modification would generally not be obvious. I also understand that if a proposed modification would render the prior art device, system, or method unsatisfactory for its intended purpose, then there is strong evidence that no suggestion or motivation existed at the time of the subject invention to make the proposed modification.

49. I understand that it is improper to combine references where the references teach away from their combination. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. It is also my understanding that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. I understand that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought

by the applicant or would no longer achieve the intended purpose(s) of the references being modified or combined.

E. Dependent Claims

50. I understand that a dependent claim incorporates each and every limitation of the claim from which it depends. Thus, my understanding is that if a prior art reference or combination of prior art references fails to render obvious an independent claim, then that prior art reference or combination of prior art references also necessarily fails to render obvious all dependent claims that depend from the independent claim.

IV. LEVEL OF SKILL IN THE ART

51. I understand that the level of ordinary skill in the relevant art at the time of the invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures found in the prior art, and the reasons one of ordinary skill in the art may have for combining references.

52. I have reviewed the definition of the level of ordinary skill in the art proposed in the Petition, which is:

A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention (December 2012) would have had good working knowledge of optical sensing techniques and their applications, and familiarity with optical system design and signal processing techniques. EX1003 ¶25. The POSITA would have an undergraduate degree in engineering (electrical, mechanical, biomedical, or optical) or a related field of study, along with relevant experience studying or

developing physiological monitoring devices (e.g., non-invasive optical biosensors) in industry or academia. *Id.* Lack of professional experience can be remedied by additional education, and vice versa. *Id.*

Petition at 14; Ex. 1003 at ¶ 25.

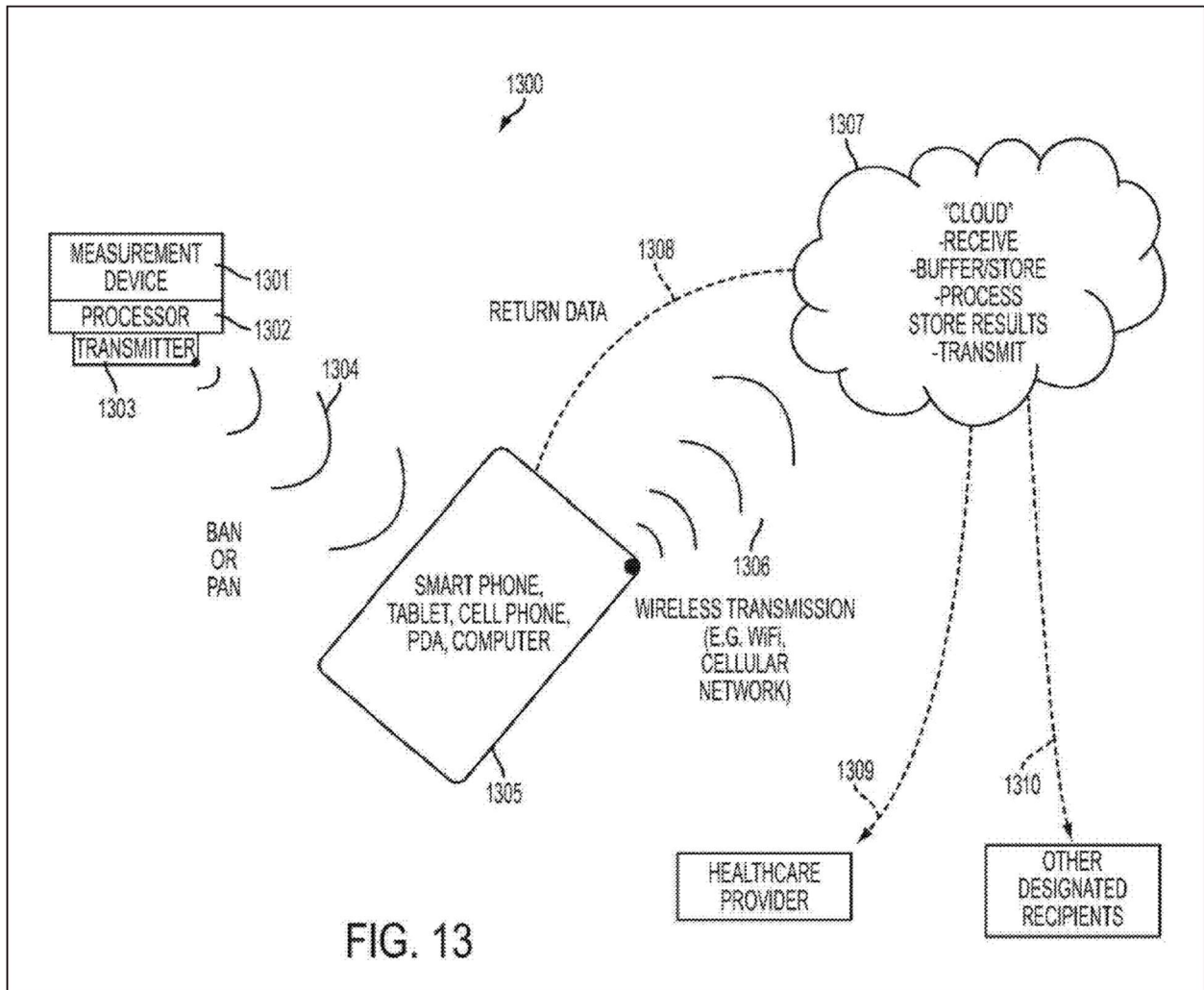
53. For purposes of this declaration, I have applied Petitioner's proposed definition in my analysis. I reserve the right to identify a differing level of skill in the art for the '304 Patent should an IPR be instituted.

54. As of the relevant time period of December 2012, I was at least a person of ordinary skill in the art through my education and experience under the definition Petitioner has proposed. I am also familiar with individuals having this level of skill in the relevant timeframe and am capable of addressing the issues from the perspective of such a person, and I have done so in this declaration.

V. OVERVIEW OF THE '304 PATENT

55. The '304 Patent, in some embodiments, provides a comprehensive system for optical measurement and data management, combining optical signal acquisition, processing, wireless transmission, and cloud-based storage and computation to enable non-invasive physiological monitoring and data analytics. Ex. 1001 at Abstract.

56. An exemplary physiological measurement or blood constituent monitoring system is depicted in FIG. 13:



Ex. 1001 at FIG. 13, 33:45-50; 34:58-61. The exemplary system depicted in Figure 13 includes a measurement device 1301, a personal device 1305 such as a smartphone or tablet, and a cloud server 1307. Ex. 1001 at 33:45-50; 34:58-61.

57. In addition to physiological monitoring, the '304 Patent describes identification capabilities by applying algorithmic analysis to spectral data acquired from multiple wavelengths. The patent discloses that “pattern matching algorithms and other software and mathematical methods [may be used] to identify the blood

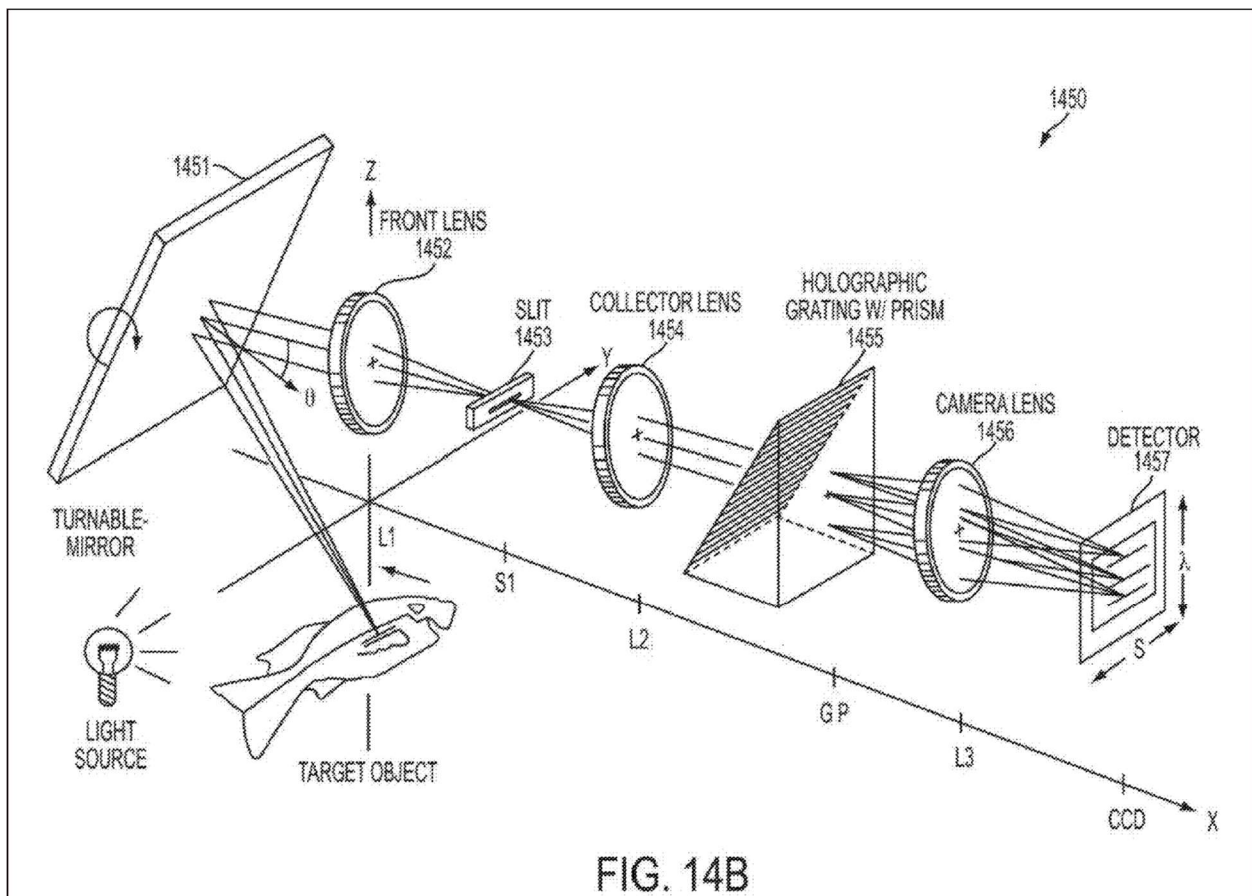
constituents of interest.” Ex. 1001 at 35:17-19. It further teaches that “the spectrum may be correlated with a library of known spectra to determine the overlap integrals, and a threshold function may be used to quantify the concentration of different constituents.” Ex. 1001 at 35:19-23.

58. The ’304 Patent states that “many other constituents in the blood also have signatures in the near-infrared, so spectroscopy and pattern matching, often called spectral fingerprinting, is required to distinguish the glucose with sufficient confidence.” Ex. 1001 at 4:58–62. The ’304 Patent also explains that the “selection of the constituent of interest may be improved using a number of techniques” including “mathematical modeling and signal processing methodologies,” “multiple linear regression, partial least squares, and principal component regression (PCR).” Ex. 1001 at 20:7-17.

59. The ’304 Patent further describes identifying other materials and biological constituents using optical techniques in the short-wave infrared (SWIR) range. It explains that “the SWIR covers the wavelength range for nonlinear combinations of stretching and bending modes as well as the first overtone of C–H stretching modes.” Ex. 1001 at 20:41–43. “Thus, for example, glucose and ketones among other substances may have unique signatures in the SWIR.” Ex. 1001 at 20:43-45. Moreover, “many solids have distinct spectral signatures in the SWIR, so

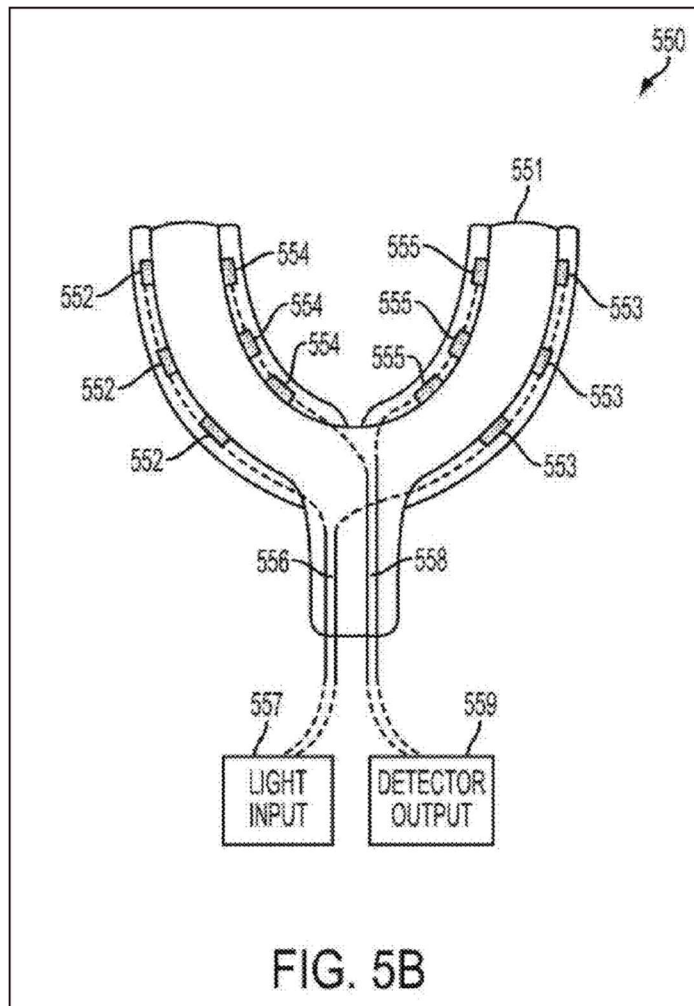
particular solids may be identified using stand-off detection or remote sensing.” Ex. 1001 at 20: 45-49.

60. The '304 Patent describes a reflective surface. The claims state that “the measurement system further comprises a reflective surface to receive and redirect at least some of the at least a portion of the analysis output beam reflected or transmitted from the sample.” Ex. 1001 at 36:60-67. For example, the '304 Patent discloses that as illustrated in FIG. 14B (reproduced below), “the input light may be directed first by a tunable mirror 1451.” Ex. 1001 at 31:6-9.



Ex. 1001 at FIG. 14B.

61. The '304 Patent also specifies a distinct spatial arrangement of light sources and detectors along arcs. Representative claims recite that “the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc” Ex. 1001 at 37:6-13. As illustrated in FIG. 5B (reproduced below) of the '304 Patent, as an example, “the mouth guard may have one or more light source input ports 552, 553 and one or more detector output ports 554, 555.”



Ex. 1001 at FIG. 5B.

62. Independent claims 1, 11, and 19 of the '304 Patent, which I understand are the challenged independent claims, are reproduced below with the identifiers used in the Petition and Dr. Mercier's declaration for ease of reference:

[1.pre]	A measurement system comprising:
1[a]	a light source comprising a plurality of semiconductor sources that are configured to generate an output optical beam with one or more optical wavelengths, the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources;
1[b]	a measurement device configured to:
1[c]	receive a portion of the output optical beam, and
1[d]	deliver an analysis output beam to a sample;
1[e]	a receiver configured to:
1[f]	receive and process at least a portion of the analysis output beam reflected or transmitted from the sample,
1[g]	generate an output signal representing at least in part a non-invasive measurement on blood contained within the sample,
1[h]	synchronize to the light source,
1[i]	capture light while the semiconductor sources are off and convert the captured light into a first signal,
1[j]	capture light while at least one of the semiconductor sources is on and convert the captured light into a second signal, the captured light including at least a part of the at least a portion of the analysis output beam reflected or transmitted from the sample, and
1[k]	the measurement system further configured to improve the signal-to-

	noise ratio by differencing the first signal and the second signal;
1[l]	a smart phone or tablet comprising a wireless receiver, a wireless transmitter, a display, a microphone, a speaker, one or more buttons or knobs, a microprocessor and a touch screen, the smart phone or tablet configured to:
1[m]	receive and process at least a portion of the output signal,
1[n]	store and display the processed output signal, and
1[o]	transmit at least a portion of the processed output signal over a wireless transmission link; and
1[p]	a cloud configured to:
1[q]	receive, over the wireless transmission link, an output status comprising the at least a portion of the processed output signal,
1[r]	process the received output status to generate processed data, and
1[s]	store the processed data.

11[pre]	A measurement system comprising:
11[a]	a wearable measurement device for measuring one or more physiological parameters, including a light source comprising a plurality of semiconductor sources that are configured to generate an output optical beam with one or more optical wavelengths;
11[b]	the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources;
11[c]	the wearable measurement device configured to receive a portion of the output optical beam and to deliver an analysis output beam to a sample;
11[d]	the wearable measurement device further comprising a receiver

	configured to:
11[e]	receive and process at least a portion of the analysis output beam reflected or transmitted from the sample,
11[f]	generate an output signal representing at least in part a non-invasive measurement on blood contained within the sample,
11[g]	synchronize to the light source,
11[h]	capture light while the semiconductor sources are off and convert the captured light into a first signal,
11[i]	capture light while at least one of the semiconductor sources is on and convert the captured light into a second signal, the captured light including at least a part of the at least a portion of the analysis output beam reflected or transmitted from the sample,
11[j]	wherein the measurement system is further configured to improve the signal-to-noise ratio by differencing the first signal and the second signal;
11[k]	a smart phone or tablet comprising a wireless receiver, a wireless transmitter, a display, a microphone, a speaker, one or more buttons or knobs, a microprocessor and a touch screen, the smart phone or tablet configured to receive and process at least a portion of the output signal, to store and display the processed output signal, and to transmit a portion of the processed output signal over a wireless transmission link; and
11[l]	a cloud configured to receive over the wireless transmission link an output status comprising the at least a portion of the processed output signal, to process the received output status to generate processed data and to store the processed data, and wherein the cloud is capable of storing a history of at least a portion of the received output status over a specified period of time.

19[pre]	A wearable device for use with a smart phone or tablet, the wearable
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	device comprising:
19[a]	a measurement device including a light source comprising a plurality of semiconductor sources for measuring one or more physiological parameters, the measurement device configured to:
19[b]	generate, by modulating at least one of the semiconductor sources having an initial light intensity, an input optical beam having one or more optical wavelengths, and
19[c]	receive and to deliver a portion of the input optical beam to tissue, wherein the tissue reflects at least a portion of the input optical beam delivered to the tissue;
19[d]	the measurement device further comprising a receiver configured to:
19[e]	capture light while the semiconductor sources are off and convert the captured light into a first signal, and
19[f]	capture light while at least one of the semiconductor sources is on and convert the captured light into a second signal, the captured light including at least a portion of the input optical beam reflected from the tissue;
19[g]	synchronize to the modulation of the at least one of the semiconductor sources;
19[h]	the measurement device further configured to improve a signal-to-noise ratio of the input optical beam reflected from the tissue by:
19[i]	differencing the first signal and the second signal, and
19[j]	increasing the light intensity relative to the initial light intensity from at least one of the semiconductor sources;
19[k]	the measurement device further configured to generate an output signal representing at least in part a non-invasive measurement on blood contained within the tissue;
19[l]	the wearable device configured to communicate with the smart phone or tablet, the smart phone or tablet comprising a wireless receiver, a

	wireless transmitter, a display, a voice input module, a speaker, and a touch screen; and
19[m]	the smart phone or tablet configured to:
19[n]	receive and to process at least a portion of the output signal,
19[o]	store and display the processed output signal, and
19[p]	transmit at least a portion of the processed output signal over a wireless transmission link.

VI. PROSECUTION HISTORY OF THE '304 PATENT

63. I have reviewed and analyzed the prosecution history of the '304 Patent. I understand that the '304 Patent issued from U.S. Patent Application No. 16/669,794, which was filed on October 31, 2019.

64. I understand that U.S. Patent Application No. 16/669,794 claims priority to U.S. Patent Application No. 14/651,367, which was filed on December 17, 2013 and issued as U.S. Patent No. 9,500,635.

65. I understand that the '304 Patent also claims priority to: provisional application No. 61/747,477, filed on December 31, 2012; provisional application No. 61/754,698, filed on January 21, 2013; provisional application No. 61/747,472, filed on December 31, 2012; provisional application No. 61/747,553, filed on December 31, 2012; provisional application No. 61/747,485, filed on December 31, 2012; and provisional application No. 61/747,487, filed on December 31, 2012.

66. I understand that Patent Owner disclaimed claims 1-3, 11, 14, 19, 20, 25, and 27 of the '304 Patent. Ex. 2048; Ex. 2054. To the extent any of my analysis or discussion herein refers to limitations in any of these disclaimed claims, that analysis or discussion applies to all claims that depend from the disclaimed claim (whether directly or indirectly).

VII. CHALLENGED CLAIMS

67. I understand that the Petition challenges claims 1-27 of the '304 Patent. Petition at 12.

68. I am informed and understand that Patent Owner has statutorily disclaimed claims 1-3, 11, 14, 19, 20, 25, and 27 of the '304 Patent. Ex. 2048; Ex. 2054. Accordingly, I have been asked to address the remaining challenged claims, which include claims 4–10, 12–13, 15-18, 21–24, and 26 (“the challenged claims”)

VIII. CLAIM CONSTRUCTION

69. Petitioner and Dr. Mercier construe the “identification of an object” term to mean “to recognize or establish an object as being a particular thing.” Petition at 12-13; Ex. 1003 at ¶ 298. As discussed below, I apply this construction in this declaration. Petitioner contends that the remaining terms in the challenged claims of the '304 Patent do not require construction. Petition at 12-13. Unless otherwise noted, I have applied the plain and ordinary meaning of those terms in the '304 Patent as they would be understood by a POSITA.

70. I am informed and understand that, pursuant to the Scheduling Order dated November 10, 2025, in the Delaware Case, Invalidity Contentions are due on January 21, 2026; the parties will exchange their proposed claim constructions by February 4, 2026; and the opening claim construction briefs are due on April 13, 2026. Ex. 2034, 2, 6. In other words, as of the date of this declaration, the parties have not formally proposed claim constructions in the Delaware Case.

71. I am informed and understand that the parties to the Texas Case have proposed certain claim constructions for the '304 Patent. Ex. 2049, 2, 11-12.

A. Prior Claim Constructions by the Board

72. Independent claim 1 of the '304 Patent recites “a light source comprising a plurality of semiconductor sources that are configured to generate an output optical beam with one or more optical wavelengths, the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources.” Ex. 1001 at 36:15-22. Independent claim 11 of the '304 Patent recites “a light source comprising a plurality of semiconductor sources that are configured to generate an output optical beam with one or more optical wavelengths; the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources.” Ex. 1001 at 37:41-48. Independent claim 19 of the '304 Patent recites “a light source

comprising a plurality of semiconductor sources for measuring one or more physiological parameters.” Ex. 1001 at 38:64-66. Dependent claim 20 recites “wherein the light source is configured to further improve the signal-to-noise ratio of the input optical beam reflected from the tissue by increasing a pulse rate of at least one of the plurality of semiconductor sources from an initial non-zero pulse rate.” Ex. 1001 at 39:41-40:2.

73. I understand that in a prior IPR involving U.S. Patent No. 9,651,533, which is related to the '304 Patent, the Board construed the phrase “a light source comprising a plurality of semiconductor sources that are light emitting diodes ... configured to increase signal-to-noise ratio by ... increasing a pulse rate of at least one of the plurality of semiconductor sources” to mean “a light source containing two or more light emitting diodes (semiconductor sources), wherein at least one of the light emitting diodes is capable of having its pulse rate increased to increase a signal-to-noise ratio.” Ex. 1008 at 10-12.

74. Dependent claims 9, 12, and 26 of the '304 Patent recite “wherein the measurement system is at least in part configured for selection or identification of an object.” Ex. 1001 at 37:29-30, 38:27-28, 40:33-34. I understand that in a prior IPR involving U.S. Patent No. 10,517,484, which is related to the '304 Patent, the Board construed the phrase “to identify an object” to mean “to recognize or establish an object as being a particular thing.” Ex. 1011 at 8-10; Ex. 1013 at 3. I have been

asked to apply the Board’s construction to the phrase “identification of an object” in claims 9, 12, and 26 of the ‘304 Patent.

75. Independent claim 19 of the ‘304 Patent recites “modulating at least one of the semiconductor sources having an initial light intensity.” Ex. 1001 at 39:1-2. I understand that in a prior IPR involving U.S. Patent No. 9,861,286, which is related to the ‘304 Patent, the Board construed the term “modulating at least one of the LEDs” to mean “varying the amplitude, frequency, or phase of the light produced by at least one of the LEDs to include information.” Ex. 2050 at 10.

76. For purposes of this declaration, I have been asked to apply the Board’s constructions for these terms in my analysis of the grounds in the Petition.

B. Claim Constructions in the Texas Case

77. I understand that the parties to the Texas Case have exchanged proposed claim constructions, but that the court has not yet construed the claims. I reserve the right to amend or supplement my opinions based on any claim constructions in the Texas Case.

78. I understand that the parties in the Texas Case have proposed an agreed construction for the term “beam” in claims 11, 14, 19, and 20 of the ‘304 Patent which is “photons or light transmitted to a particular location in space.” Ex. 2049, 2. The same phrase also appears in claims 1-3 of the ‘304 Patent. For purposes of this

declaration, I have been asked to apply this construction for this term in my analysis of the grounds in the Petition.

79. I understand that the parties have proposed the following constructions for the terms “modulating” / “modulation” in claim 19 of the ’304 Patent in the Texas Case (Ex. 2049, 11-12):

Patent Owner’s Construction	Petitioner’s Construction
“[vary/varying/the varying of] the amplitude, frequency, or phase of the light produced”	“[varying/the varying of] the amplitude, frequency, or phase of the light produced by . . . to include information”

80. My opinions regarding Grounds 1-6 as set forth in this declaration would not change regardless of which of the competing constructions noted above is adopted. I reserve the right to update my opinions should the district court or the Board issue claim constructions for these terms/phrases (or any other term or phrase in the ’304 Patent).

81. I understand that the parties have proposed the following constructions for the term “modulating at least one of the semiconductor sources having an initial light intensity” in claim 19 of the ’304 Patent in the Texas Case (Ex. 2049, 11-12):

Patent Owner's Construction	Petitioner's Construction
No construction necessary apart from the construction of “modulating” / “modulation”	“varying the amplitude, frequency, or phase of the light produced by at least one of the semiconductor sources having an initial light intensity to include information”

82. My opinions regarding Grounds 1-6 as set forth in this declaration would not change regardless of which of the competing constructions noted above is adopted. I reserve the right to update my opinions should the district court or the Board issue claim constructions for these terms/phrases (or any other term or phrase in the '304 Patent).

C. “Selection or Identification of an Object”

83. Dependent claims 9, 12, and 26 of the '304 Patent recite “wherein the measurement system is at least in part configured for *selection or identification of an object*, and wherein the measurement system is configured to improve a signal-to-noise ratio of the selection or identification by applying regression signal processing methodologies or multivariate techniques.” EX1001, 37:29-34, 38:27-32, 40:33-38 (emphasis added).

84. With respect to identification of an object and selection of an object, the '304 Patent specification discloses:

In addition, it may be advantageous to use pattern matching algorithms and other software and mathematical methods to ***identify the blood constituents of interest***. In one embodiment, the spectrum may be correlated with a library of known spectra to determine the overlap integrals, and a threshold function may be used to quantify the concentration of different constituents. This is just one way to perform the signal processing, and many other techniques, algorithms, and software may be used and would fall within the scope of this disclosure.

One of the issues in measuring a particular blood constituent is the interfering and overlapping signal from other blood constituents. The ***selection of the constituent of interest*** may be improved using a number of techniques. For example, a higher light level or intensity may improve the signal-to-noise ratio for the measurement. Second, mathematical modeling and signal processing methodologies may help to reduce the interference, such as multivariate techniques, multiple linear regression, and factor-based algorithms, for example. For instance, a number of mathematical approaches include multiple linear regression, partial least squares, and principal component regression (PCR). Also, various mathematical derivatives, including the first and second derivatives, may help to accentuate differences between spectra. In addition, by using a wider wavelength range and using more sampling wavelengths may improve the ability to discriminate one signal from another.

EX1001, 35:17-44 (emphasis added).

85. Thus, the '304 Patent describes “selection of the constituent of interest” (e.g., as opposed to other blood constituents) after “identif[ying] the blood constituents of interest.” Thus, the claimed “selection” of an object first requires an identification of the object and a selection of that identified object.

IX. OVERVIEW OF ASSERTED GROUNDS AND REFERENCES IN THE PETITION

A. Petitioner’s Obviousness Grounds

86. I understand that Petitioner and Dr. Mercier assert that claims 1-27 of the '304 Patent are obvious under 35 U.S.C. § 103 based on six (6) separate Grounds, as set forth in the table below (Ex. 1003 at ¶78; Petition at 12):

Ground	Claims	Asserted Reference(s)					
1	1, 11, 19–20, 25	Lisogurski	Carlson				
2	3	Lisogurski	Carlson	Debreczeny			
3	2, 14, 27	Lisogurski	Carlson		Valencell-093		
4	4–8, 10, 15–18, 21–24	Lisogurski	Carlson			Soller	
5	12–13, 26	Lisogurski	Carlson				Tran
6	9	Lisogurski	Carlson			Soller	Tran

B. Summary of Asserted References

87. I understand that Grounds 1-6 assert various combinations of the following references: “Lisogurski” (Ex. 1027), “Carlson” (Ex. 1028), “Debreczeny” (Ex. 1029), “Valencell-093” (Ex. 1032), “Soller” (Ex. 1030), and “Tran” (Ex. 1031).

Petition at 9-12; Ex. 1003 at ¶78. Specifically, I understand that Grounds 1-6 rely on Lisogurski in various combinations with Carlson, Debreczeny, Valencell-093, Soller, and/or Tran. Petition at 9-12; Ex. 1003 at ¶78.

88. Herein, I refer to these alleged prior art references individually or in various combinations (depending on context) as the “the asserted reference[s].” Below are brief summaries of the asserted references.

1. Lisogurski (Ex. 1027)

89. U.S. Patent No. 9,241,676 (“Lisogurski”) describes a non-invasive physiological monitoring system using pulse oximetry to measure blood oxygen saturation and related parameter. Ex. 1027 at 3:61-4:5. The system is illustrated in Figures 3 and 1:

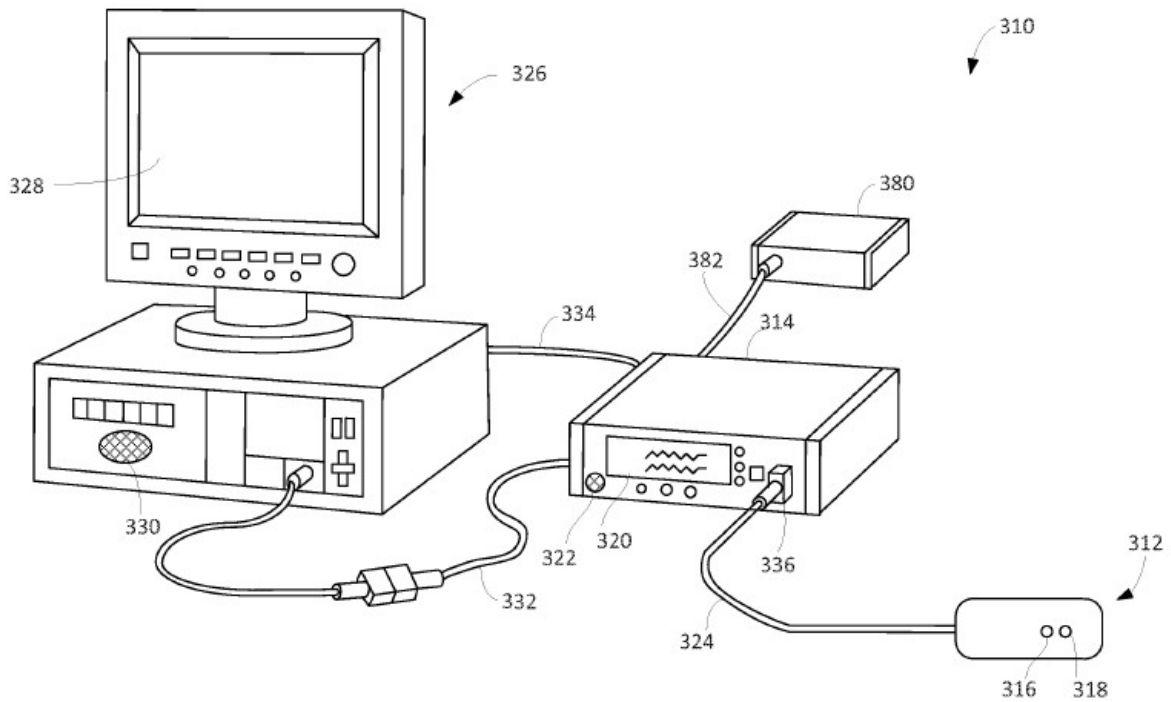


FIG. 3

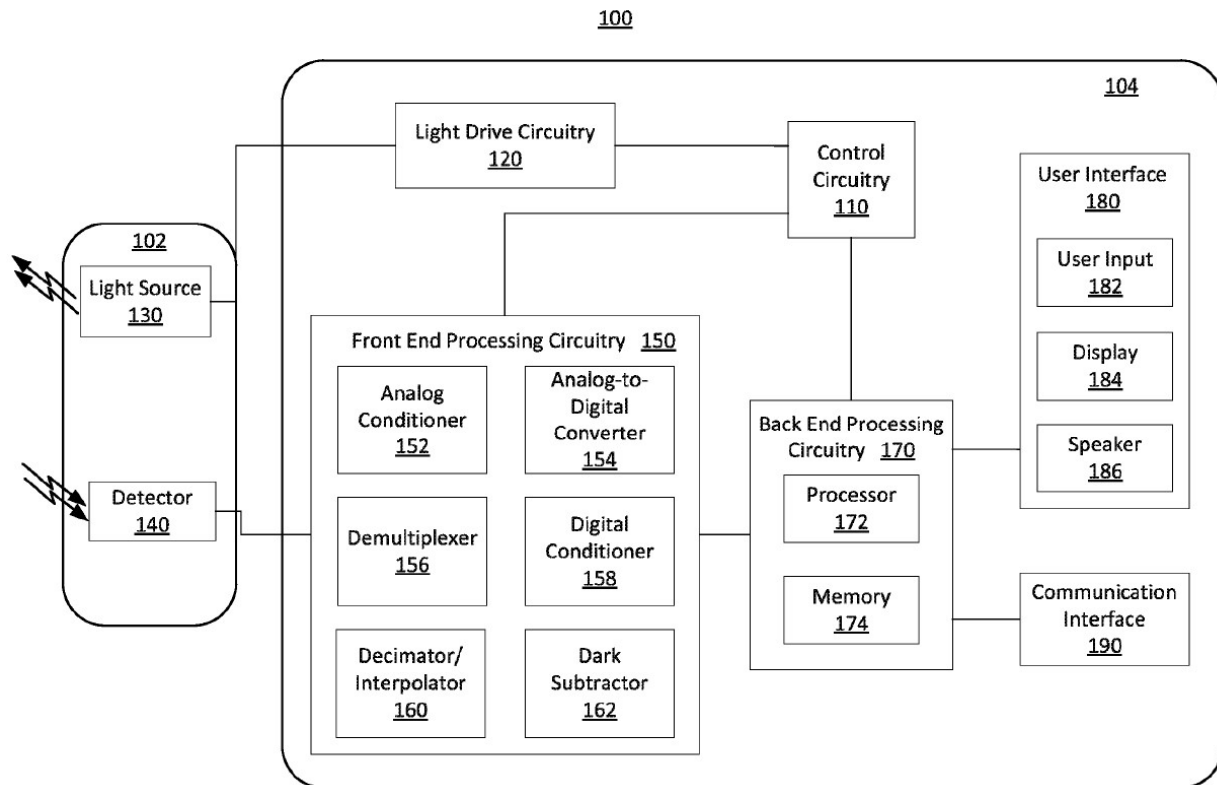


FIG. 1

Ex. 1027 at FIGS. 3, 1. The wearable portion is sensor unit 312, while the other components of the system, such as monitors 314, 326 and calibration device 380, are configured to perform data calculations, display information, and calibrate the system, respectively. Ex. 1027 at 17:54-18:15, 18:32-67.

90. The system uses semiconductor emitters at different wavelengths to illuminate tissue, and a photodetector receives light and converts it into an electrical signal. Ex. 1027 at 4:42-62; 10:48-64. Front end processing circuitry 150 processes the electronic signal. Ex. 1027 at 12:42-49. Then, “[p]rocessor 172 may receive and process physiological signals received from front end processing circuitry 150. For example, processor 172 may determine one or more physiological parameters based on the received physiological signals.” Ex. 1027 at 14:60-64. Based on known differences in wavelength absorption of oxyhemoglobin or deoxyhemoglobin, the system compares the intensities at the different wavelengths to estimate blood oxygen saturation. Ex. 1027 at 24:58-25:5.

2. Carlson (Ex. 1028)

91. U.S. Patent Application Publication No. 2005/0049468 A1 (“Carlson”) describes an optical pulse oximeter for non-invasive measurement of pulsation and blood oxygen saturation. Ex. 1028 at ¶ [0002]. Carlson describes an ear-clip form factor. Ex. 1028 at ¶¶ [0048]-[0049]. This form factor is illustrated in Figures 1 and 2:

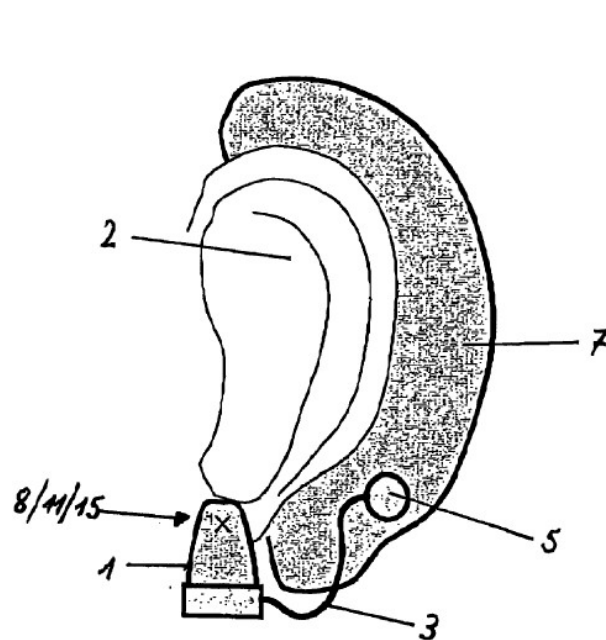


Figure 1

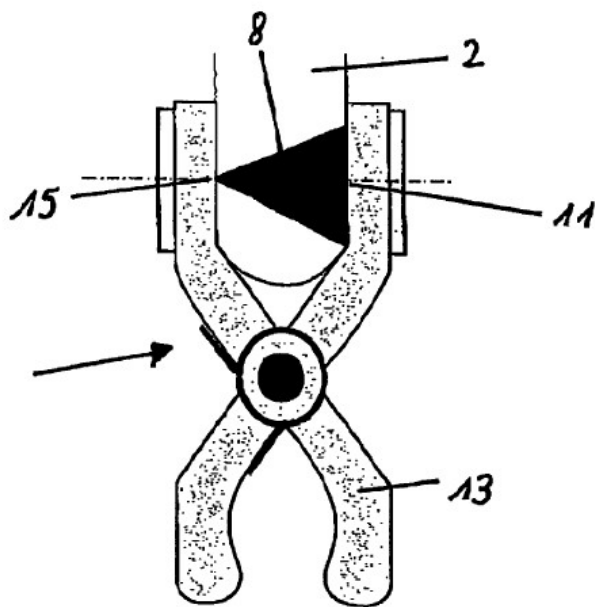


Figure 2

Ex. 1028 at FIGS. 1-2.

92. Carlson describes optical and/or electronic means to improve signal-to-noise and signal-to-background performance by using beam shaping optical elements, such as diffractive or refractive lenses, to direct light into tissue and a photon detecting element. Ex. 1028 at ¶¶ [0010], [0013]-[0014]. Carlson also discloses the use of “optical wavelength filters” for filtering light to a particular range of wavelengths before it reaches a photo detecting element. Ex. 1028, [0026], [0062]. Finally, Carlson describes module packaging arrangements integrating these optical elements. Ex. 1028 at ¶¶ [0041], [0062], FIG. 6c.

3. Debreczeny (Ex. 1029)

93. U.S. Patent No. 8,175,667 (“Debreczeny”) describes a pulse oximeter sensor that includes “a first, second and third source of electromagnetic radiation,” where “the first and third sources of electromagnetic radiation are symmetrically oriented about an axis” relative to a photodetector. Ex. 1029 at Abstract; 2:51-3:6. Debreczeny further discloses that the first and third sources have emission spectra that “overlap at their half power level or greater” and “correspond to a center wavelength in the range of 650 to 670 nm.” Ex. 1029 at 2:57–60; 5:45–67.

4. Valencell-093 (Ex. 1032)

94. U.S. Patent Appl. Pub. No. 2012/0197093 (“Valencell-093”) describes “apparatus and methods for attenuating environmental interference.” Ex. 1032 at Abstract. Valencell-093 explains that “a medium (e.g., physiological material of a subject), having a region of interest, is monitored via a sensor module having at least one energy emitter for interrogating the medium with energy to generate an energy response associated with the medium.” Ex. 1032 at ¶ [0005].

95. Valencell-093 further describes that “[t]he sensor module includes an optical emitter, a detector, a motion/position sensor, a filter, and at least one processor that controls operations of the optical emitter, detector, and/or filter.” Ex. 1032 at ¶ [0012]. Valencell-093 additionally states that “[o]utput from the

motion/position sensor is associated with the motion or position between the housing and ear of the subject.” Ex. 1032 at ¶ [0012].

5. Soller (Ex. 1030)

96. U.S. Patent No. 6,304,767 (“Soller”) describes a “measurement of blood hematocrit (Hct)” – “the volume percent of red blood cells in a blood sample.” Ex. 1030 at 1:17-20. Hematocrit is measured with “non-invasive optical and mathematical method... with an accuracy of approximately 99%” and the “accuracy results from the complete analysis provided by the new optical method, which measures blood hematocrit by quantifying a plurality of red blood cell constituents.” Ex. 1030 at 1:49-52. Hematocrit is determined by “processing the optical spectrum with a mathematical model” that relates “optical properties of the plurality of red blood cell constituents to known blood hematocrit.” Ex. 1030 at 1:58-62. In one aspect, Soller “features a fiber optic device for determining blood hematocrit including an array of light sources...attached to a mount and a fiber optic cable ...for delivering radiation to the sample.” Ex. 1030 at 3:16-22. Further, Soller is directed to using reference detectors in addition to reflectance detectors, with the goal of using the reference detectors to measure and account for variations in LED intensity. EX1030, 2:27-33, 2:58-63, 17:42-48.

6. Tran (Ex. 1031)

97. U.S. Patent No. 8,108,036 (“Tran”) describes a patient heart monitoring system that includes wireless nodes forming a wireless mesh network. Ex. 1031, Abstract, 3:3-13, 8:29-33. The system also includes a wearable appliance adapted to communicate with the wireless nodes and a statistical analyzer to determine a heart attack or stroke attack. Ex. 1031, Abstract, 3:3-13. The wearable appliance may include sensors and non-invasively measure, for example, blood pressure. Ex. 1031, 4:62-65, 9:23-30.

X. OPINIONS ON GROUNDS IN THE PETITION

98. I understand that Petitioner has asserted obviousness in Grounds 1-6, as summarized above in Section IX.A, which collectively challenge claims 1-27 of the '304 Patent, described above in Section VII. Petition at 12.

99. As noted above, I am informed and understand that Patent Owner has statutorily disclaimed claims 1-3, 11, 14, 19, 20, 25 and 27 of the '304 Patent. Ex. 2048; Ex. 2054. It is my opinion that none of the remaining challenged claims 4–10, 12, 13, 15-18, 21–24, and 26 of the '304 Patent are obvious over the asserted prior art in any of Grounds 1-6. The remaining grounds are identified below:

Ground	Claims	Asserted Reference(s)					
		Lisogurski	Carlson			Soller	
4	4–8, 10, 15–18, 21–24						
5	12–13, 26						Tran
6	9					Soller	Tran

A. Ground 1: Obviousness Based on Lisogurski and Carlson (Claims 1, 11, 19, 20, 25)

100. I understand that Petitioner and Dr. Mercier argue for Ground 1 that claims 1, 11, 19, and 20 of the '304 Patent are obvious over Lisogurski and Carlson. Petition at 22-55; Ex. 1003 at ¶¶ 119-239. Because Patent Owner has disclaimed claims 1, 11, 19, 20, and 25 of the '304 Patent, I understand that Ground 1 is moot, and I have not been asked to render any opinions regarding Ground 1. Ex. 2048; Ex. 2054.

B. Ground 2: Obviousness Based on Lisogurski, Carlson and Debreczeny (Claim 3)

101. I understand that Petitioner and Dr. Mercier argue for Ground 2 that claim 3 of the '304 Patent is obvious over Lisogurski, Carlson and Debreczeny. Petition at 55-59; Ex. 1003 at ¶¶ 240-244. Because Patent Owner has disclaimed claim 3 of the '304 Patent, I understand that Ground 2 is moot, and I have not been asked to render any opinions regarding Ground 2. Ex. 2048.

C. Ground 3: Obviousness Based on Lisogurski, Carlson and Valencell-093 (Claims 2, 14, 27)

102. I understand that Petitioner and Dr. Mercier argue for Ground 3 that claims 2, 14, and 27 of the '304 Patent are obvious over Lisogurski, Carlson and Valencell-093. Petition at 59-64; Ex. 1003 at ¶¶ 245-254. Because Patent Owner has disclaimed claims 2, 14 and 27 of the '304 Patent, I understand that Ground 3 is moot, and I have not been asked to render any opinions regarding Ground 3. Ex. 2048; Ex. 2054.

D. Ground 4: Obviousness Based on Lisogurski, Carlson and Soller (Claims 4–8, 10, 15–18, 21–24)

103. Petitioner and Dr. Mercier argue for Ground 4 that claims 4–8, 10, 15–18, and 21–24 of the '304 Patent are obvious over Lisogurski, Carlson and Soller. Petition at 64-74; Ex. 1003 at ¶¶ 255-287. I disagree for at least the reasons provided below.

1. Claims 4-6, 15-16, and 21-22

104. Claim 1 recites a “measurement system comprising: a light source comprising a plurality of semiconductor sources ... [and] a receiver” Ex. 1001 at 36:15-26. Dependent claim 4 further recites, “the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc.” Ex. 1001 at 37:6-9. Claims 5 and 6 depend on claim 4. Ex. 1001 at 37:10-13.

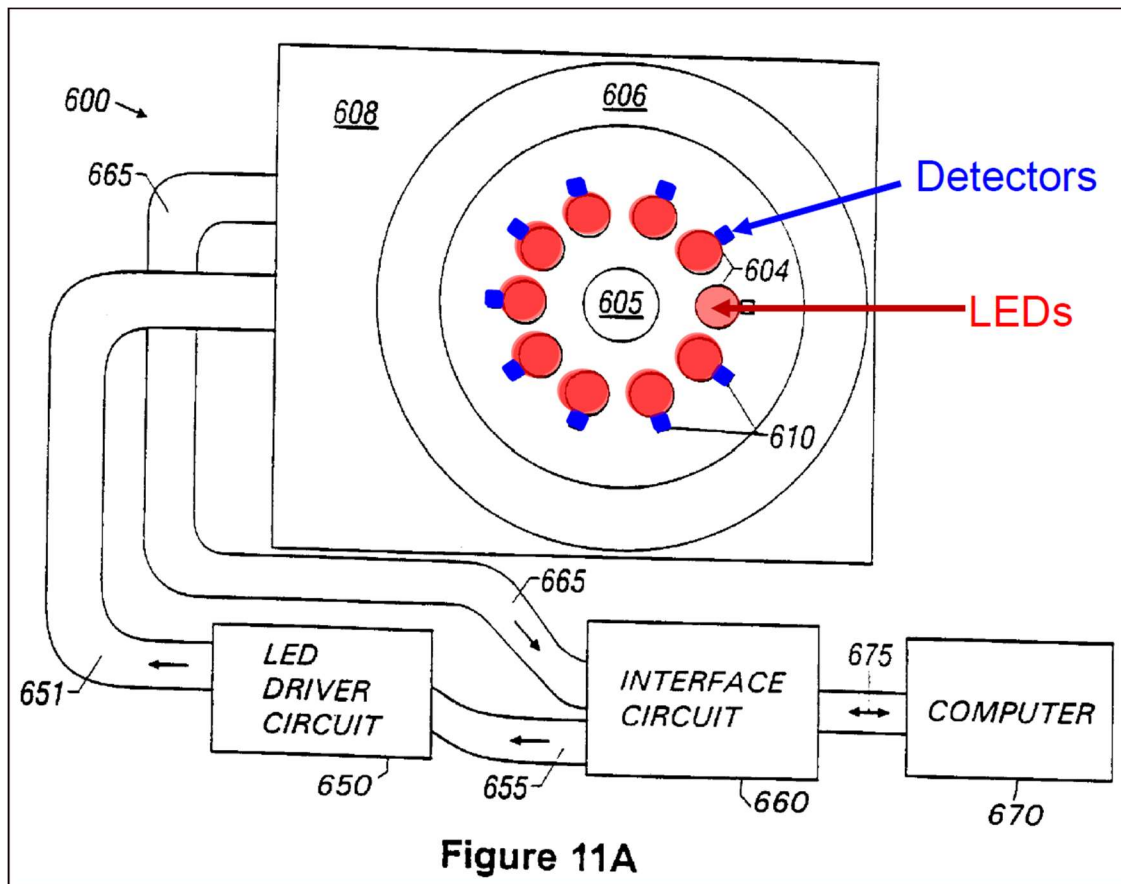
105. Claim 11 recites a “measurement system comprising: a wearable measurement device ..., including a light source comprising a plurality of semiconductor sources ...; the wearable measurement device further comprising a receiver.” Ex. 1001 at 37:39-53. Dependent claim 15 further recites, “the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc that is offset from the first arc.” Ex. 1001 at 38:47-51. Claim 16 depends on claim 15. Ex. 1001 at 38:52-53.

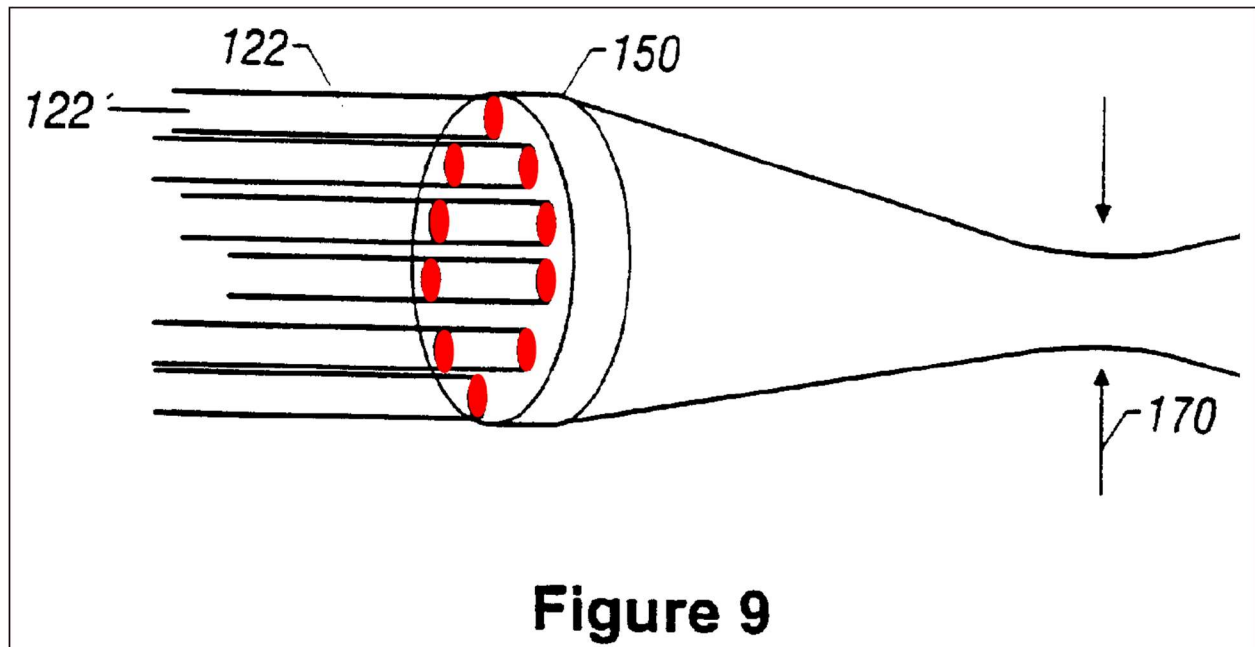
106. Claim 19 recites a “wearable device comprising: a measurement device including a light source comprising a plurality of semiconductor sources ...; the measurement device further comprising a receiver.” Ex. 1001 at 38:62-39:17. Dependent claim 21 further recites, “the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc that is offset from the first arc.” Ex. 1001 at 40:3-6. Claim 22 depends on claim 21. Ex. 1001 at 40:7-8.

107. As Petitioner and Dr. Mercier recognize, Lisogurski does not disclose any arrangement of its LEDs or detectors in “arcs” as recited in claims 4-6, 15-16, and 21-22. Ex. 1003 at ¶¶ 264, 256, 263; Petition at 65-66, 70. For example, the Petitioner states that Lisogurski “does not require the LEDs and detectors to be arranged in a particular configuration.” Petition at 70.

108. Petitioner and Dr. Mercier instead rely on Soller, arguing that Soller's Figures 9 and 11A allegedly show LEDs and optical detectors arranged in two respective arcs (which I refer to herein as the "alleged arc arrangement" in Soller) and that "[a] POSITA would have been motivated to combine the arrangement of detectors and LEDs in a first and second "arc" disclosed in Soller into the wearable sensor described by Lisogurski." Ex. 1003 at ¶¶ 256-265; Petition at 66-71.

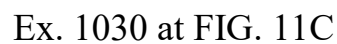
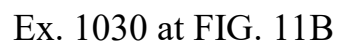
109. Petitioner and Dr. Mercier's argument includes the following annotated (in red and blue) versions of Soller's Figure 11A and Figure 9 purporting to show this alleged arc arrangement in Soller:





Petition at 67-68; Ex. 1003 at ¶ 256; Ex. 1030 at Figure 11A and Figure 9 (annotated).

110. Soller's Figures 11A-11C are related, as this embodiment depicted in Soller's Figure 11A (above) is also the same embodiment depicted in Soller's Figure 11B (below), and Soller's Figure 11C (below) depicts an alternate arrangement of the reference detectors 610 of Figures 11A-B. Ex. 1030 at FIGS. 11A-11C, 4:60-65, 17:36-50.



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have first modified Soller to change the *reference* detectors 610 (depicted in Soller’s embodiment in Figures 11A-11C) into *reflectance* detectors. Petition at 67-71 (arguing motivation to modify Soller’s [reference] detectors [610] depicted in Fig. 11A to be reflectance detectors and then further arguing “motivat[ion] to implement Soller’s two ... arcs into Lisogurski’s system”); Ex. 1003 at ¶¶ 256, 259-264 (arguing that a POSITA would have “modif[ied] Figure 11A of Soller such that the ‘reference detectors [610]’ ... could serve as ‘reflectance detector(s)’” and then further arguing that a POSITA would have “combine[d] the arrangement of detectors and LEDs in a first and second “arcs” disclosed in Soller into the wearable sensor described by Lisogurski”).

112. Petitioner and Dr. Mercier argue this preliminary modification of Soller’s *reference* detectors 610 into *reflectance* detectors because the claimed “detectors” and the relied-upon detectors in Lisogurski are detectors that receive reflected or transmitted light from the sample. Ex. 1001 at 36:26-40, 37:52-57, 39:9-17, 37:6-9, 38:49-52, 40:3-5; Ex. 1027 at 17:39-42 (Lisogurski’s “detector 318” is “for detecting the light that is reflected by or has traveled through the subject’s tissue”); Petition at 20 (recognizing that the ’304 Patent’s invention includes: “[t]he optical output beam is directed to a sample as an analysis output beam, and then reflected/transmitted back where it is captured by a receiver”), 23 (recognizing that Lisogurski teaches: “light is emitted by the LEDs ... , passes into a person’s tissue,

and is transmitted through/reflected back, where it is detected by a photodetector”), 36, 38, 39, 43, 66, 68; Ex. 1003 at ¶¶ 84, 140, 141, 145, 147, 148, 151, 152, 264 (recognizing that the ’304 Patent and Lisogurski involve detection of reflected light).

113. Petitioner and Dr. Mercier do not rely on Carlson for the arc limitation of Claim 4-6, 15-16, 21, 22. Petition at 66-74; Ex. 1003 at ¶¶ 256-287.

114. Lisogurski, Carlson, and Soller do not render obvious the arc limitation of claims 4-6, 15-16, and 21-22 of the ’304 Patent, including because (i) Soller does not disclose this limitation, (ii) a POSITA would not have been motivated, to modify Soller’s reference detectors 610 to be reflectance detectors or modify Lisogurski’s reflectance detectors based on Soller, and (iii) a POSITA would not have been motivated to implement Soller’s modified arrangement in the Lisogurski/Carlson combination.

a) Previous IPRs Regarding Related Patents

115. I understand that certain portions of the Petition and Dr. Mercier’s declaration rely on findings by the Board in prior IPR proceedings challenging patents related to the ’304 Patent, including the ’533-FWD and ’484-FWD.

116. However, the arc limitations recited in claims 4-6, 15-16, and 21-22 of the ’304 Patent are not recited in the claims of either the ’533 Patent or ’484 Patent, and Petitioner and Dr. Mercier do not rely on the ’533-FWD or ’484-FWD in their analysis of 4-6, 15-16, and 21-22 (e.g., claim 4). *See* Petition at 64-74; Ex. 1003 at

¶¶ 255-287. Therefore, to the extent that Petitioner and Dr. Mercier rely on the Board's findings in the '533-FWD and '484-FWD, those prior findings do not directly address the arc limitation in claims 4-6, 15-16, and 21-22 of the '304 Patent.

b) Soller Does Not Disclose “a plurality of detectors arranged along a first arc”

117. Soller does not disclose “a plurality of detectors arranged along a first arc” as claimed because Soller does not disclose an arc arrangement of detectors that receive reflected or transmitted light from the sample. Instead, the alleged arc arrangement that Petitioner and Dr. Mercier rely on in Soller involves *reference* detectors 610, which are different from the claimed “detectors.” Petition at 64-74; Ex. 1003 at ¶¶ 255-287.

118. Independent claims 1, 11, 19 of the '304 Patent require a receiver configured to: “capture... beam reflected [or transmitted] from the sample [/tissue].” Ex. 1001 at 36:26-40, 37:52-57, 39:9-17. Dependent claims 4, 15, 21 (e.g., claim 4) further require that “a[/the] receiver comprises a plurality of detectors arranged along a first arc.” Ex. 1001 at 37:6-9, 38:49-52, 40:3-5. In other words, the claimed “detectors” receive reflected or transmitted light from the sample. Based on my review, Petitioner and Dr. Mercier recognize this and rely on reflectance detectors in Lisogurski as allegedly constituting the claimed “detectors.” Petition at 68; Ex. 1003 at ¶¶ 256, 259-261; Ex. 1027 at 17:39-42. Thus, the arc limitation of

claims 4, 15, 21 requires “detectors” that receive reflected or transmitted light from the sample “located on one or more arcs.” Ex. 1001 at 36:26-40, 37:52-57, 39:9-17, 37:6-9, 38:49-52, 40:3-5.

119. Soller does not disclose an arc arrangement of reflectance detectors as required by the arc limitation. The Petition and Dr. Mercier’s declaration rely on Soller’s Figure 11A embodiment, but, as depicted in the following annotated version of Figure 11A, this embodiment includes a single reflectance detector 605 (green) that is centrally located, not an arc arrangement of multiple reflectance detectors. Petition at 67-74; Ex. 1003 at ¶¶ 256, 259, 260, 262; Ex. 1030 at FIG. 11A, 17:36-60 (“Reflectance detector 605 is ... centrally located”).

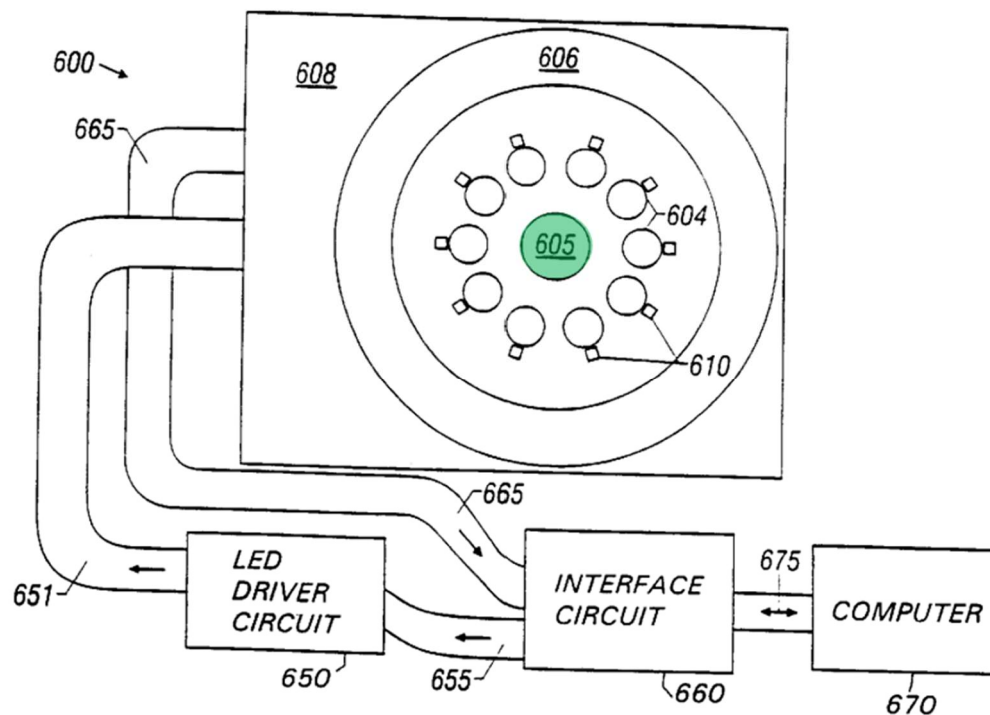


Figure 11A

Ex. 1030 at FIG. 11A (annotated)

120. Petitioner and Dr. Mercier appear to concede that Soller's Figure 11A embodiment does not disclose an arc arrangement of reflectance detectors because they argue that a POSITA would have modified this embodiment to meet the arc limitation (by changing reference detectors 610 into reflectance detectors). Petition at 68-69; Ex. 1003 at ¶¶ 256, 259-262.

121. Petitioner and Dr. Mercier also discuss Soller's interior detectors 105 and exterior detectors 110, and Dr. Mercier suggests that Soller's statement about "configured in a ring" purportedly applies to these detectors 105 and 110. Petition at 66, 71; Ex. 1003 at ¶¶ 256-257. I disagree. As depicted in the following annotated versions of Figures 5-6, Soller teaches that each interior detector 105 and exterior detector 110 (annotated in green) is centrally located – not that multiple detectors 105 and/or 110 are arranged in an arc.

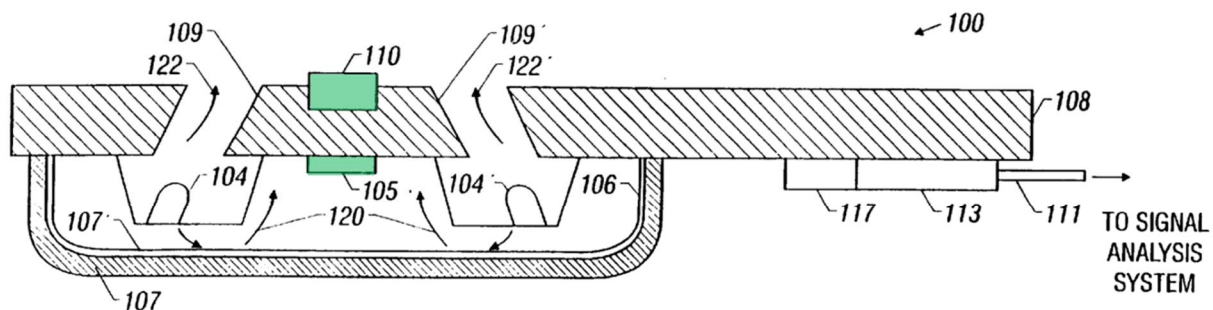


Figure 5

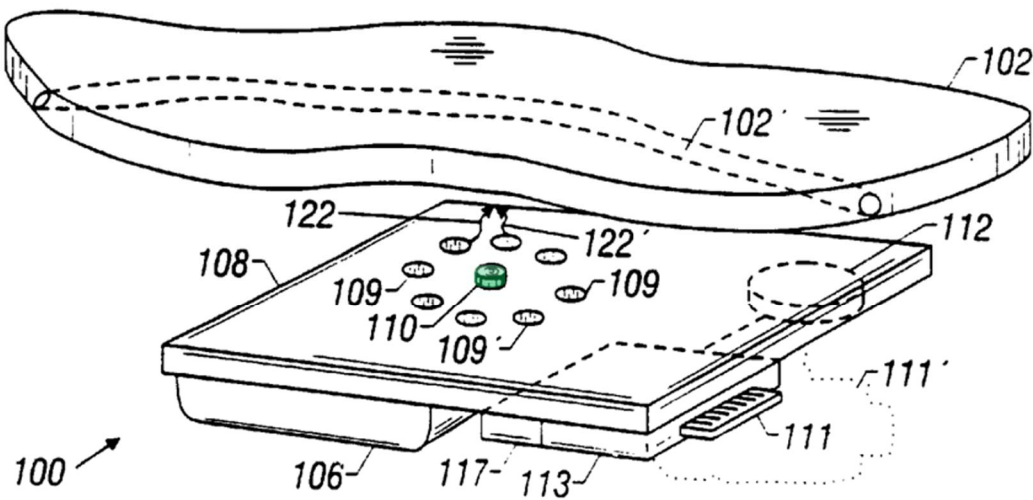


Figure 6

Ex. 1030 at FIGS. 5-6 (annotated); *see also* Ex. 1030 at 13:50-14:59

122. In contrast to detector 110, which Soller describes as a “reflection” detector, Soller does not likewise describe interior detector 105 as a reflection or reflectance detector. Ex. 1030 at 13:50-14:59. Soller’s statement regarding “configured in a ring” relates to a ring 781 of fibers 780 in the embodiment depicted in Figures 12A-B and does not relate to detectors 105 and 110 in the embodiment depicted in Figures 5-6. Ex. 1030 at 18:38-41, FIGS. 12A-B, 5-6; Petition at 66; Ex. 1003 at ¶ 257.

123. Dr. Mercier’s declaration (but not the Petition) also quotes portions of Soller regarding reference detector 155 and signal detector 157, and Dr. Mercier’s use of bold font and blue coloring suggest that Soller’s statements about “radially and symmetrically” disposed fibers apply to these detectors 155 and 157. Ex. 1003

Ex. 1030 at FIG. 7 (annotated); *see also* Ex. 1030 at 16:8-32

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fiber 166” as depicted in Figure 7, not any radial or symmetric arrangement of detectors 155 and/or 157. Ex. 1030 at 16:12-15, 16:25-27, FIG. 7; Ex. 1003 at ¶ 256.

125. Dr. Mercier’s declaration (but not the Petition) also quotes portions of Soller regarding reflectance detector 710 and reference detector 720. Ex. 1003 at ¶ 256. But as depicted in the following annotated version of Figures 12A-B, Soller teaches a single reflectance detector 710 and a single reference detector 720 (both green), not that multiple detectors 710 and/or 720 are arranged in an arc.

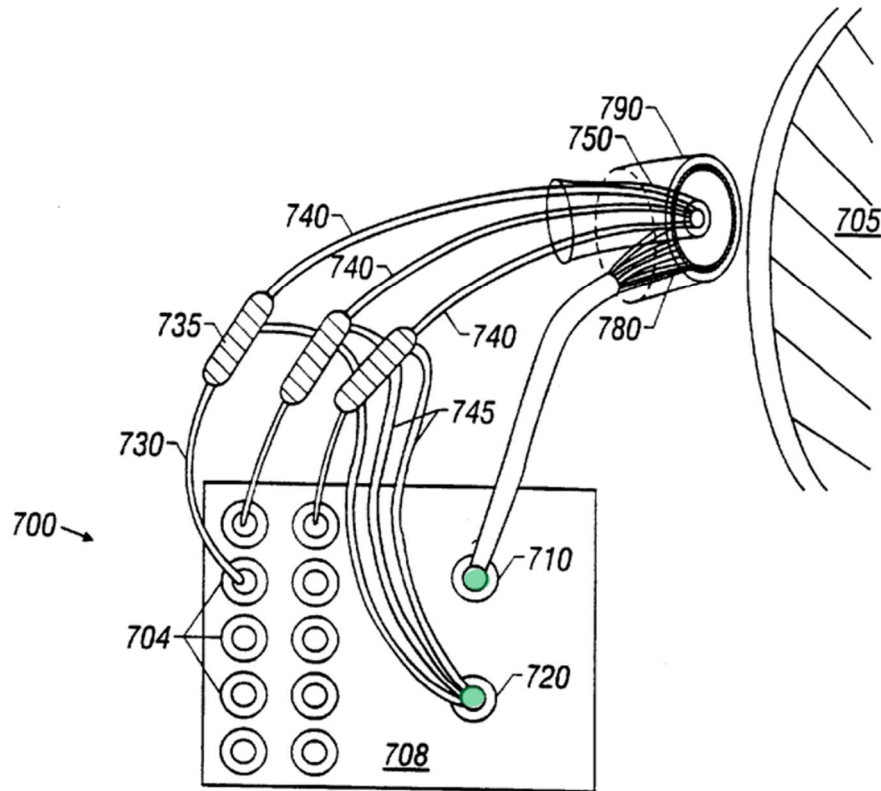


Figure 12A

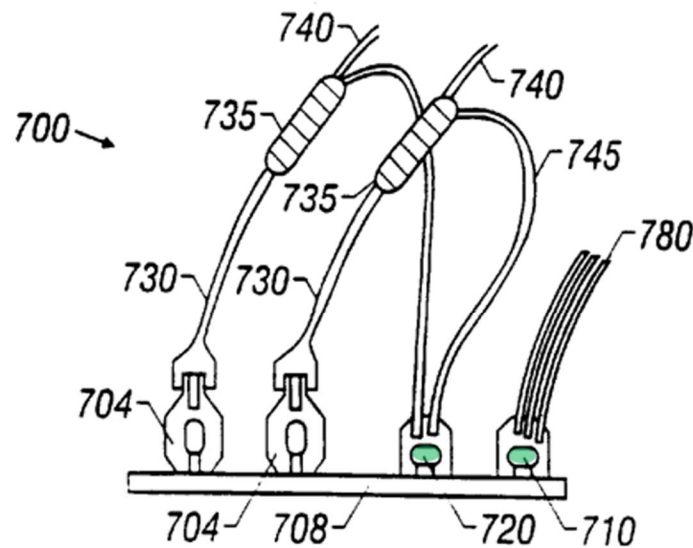


Figure 12B

Ex. 1030 at FIGS. 12A-B (annotated); *see also* Ex. 1030 at 18:24-25

Also, Soller teaches that detector 720 is a reference detector, not a reflectance detector. Ex. 1030 at 18:24-25.

126. In Soller, the reflectance detector that captures radiation reflected from the sample, such as the reflectance detectors discussed above, is centrally positioned and functions as a single reflectance detection element rather than as a plurality of detectors arranged along a curved or arc-shaped path. *See, e.g.*, Ex. 1030 at Figs. 3, 5, 6, 7, 10A, 10B, 11A, 11B, 12A, 12B. For example, Soller explains that “[r]eflectance detector 605 is preferably centrally located, e.g., center at about 4 mm from the optical axis of each LED 604.” Ex. 1030 at 17:54-56.

127. As discussed above, Petitioner and Dr. Mercier rely on Soller’s arrangement of reference detectors 610 depicted in Figure 11A for the arc limitation.

Petition at 67-74; Ex. 1003 at ¶¶ 256-264. However, Soller teaches, and a POSITA would have understood, that Soller's detectors 610 are *reference* detectors, which are different from *reflectance* detectors in the arc limitation. Ex. 1031 at 17:42-60. Reference detectors 610 are intended "to measure and correct for variations in the LED intensity due to temperature, aging, or electrical power source drifts," whereas reflectance detector 605 is intended to measure light reflected from sample 505. Ex. 1030 at 17:36-60; *see also* Ex. 1030 at 2:27-33 ("A detection system included in the device features a first optical [reflectance] detector and a plurality of second optical [reference] detectors. The first optical [reflectance] detector is configured to receive radiation from the sample. The plurality of second optical [reference] detectors is configured to receive radiation from each of the light sources."), 3:27-39 (similar). Reference detectors 610 are explicitly used to receive light directly from LEDs to monitor LED output for calibration purposes and are not configured to receive light reflected from the tissue like reflectance detector 605. Ex. 1030 at 17:45-48.

128. Based on the foregoing, Soller does not disclose the claim limitation of "a plurality of detectors arranged along a first arc." Indeed, based on my review, Petitioner and Dr. Mercier acknowledge this deficiency in Soller, since they instead rely on an alleged "modification" of Soller to meet this claim limitation. *See* Petition at 68-69; Ex. 1003 at ¶¶ 256, 259-262.

c) Petitioner and Dr. Mercier Do Not Show that a POSITA Would Have Been Motivated to Modify Soller's *Reference* Detectors 610 to Be *Reflectance* Detectors or Further Motivated to Modify Lisogurski's *Reflectance* Detectors Based on Soller

129. As discussed above, Petitioner and Dr. Mercier rely on Soller's reference detectors in FIG. 11A for the claimed arc arrangement. Petition at 67-74; Ex. 1003 at ¶¶ 256-264. As I explain above, these detectors in Soller are reference detectors, not reflectance detectors like those in Lisogurski. Ex. 1027 at 17:39-42; Petition at 23, 36, 38, 39, 43; Ex. 1003 at ¶¶ 84, 140, 141, 145, 147, 148, 151, 152.

130. I understand that Petitioner and Dr. Mercier argue (1) that a POSITA would have modified Soller to change *reference* detectors 610 in the alleged arc arrangement in Figure 11A into *reflectance* detectors to match Lisogurski's teaching of *reflectance* detectors, and (2) that a POSITA would have purportedly modified Lisogurski's arrangement of *reflectance* detectors based on Soller's alleged arc arrangement of detectors 610 (as modified) to purportedly meet the arc limitation. Petition at 68-71; Ex. 1003 at ¶¶ 256, 259-264.

131. Petitioner and Dr. Mercier do not, with supporting evidence, show that a POSITA would have been motivated to modify Soller's *reference* detectors 610 to be *reflectance* detectors or that a POSITA would have purportedly used Soller's alleged arc arrangement of detectors 610 to configure Lisogurski's *reflectance* detectors to meet the arc limitation. Petition at 68-71; Ex. 1003 at ¶¶ 256, 259-264.

132. The Petition addresses the alleged motivation to modify Soller's reference detectors 610 to instead be reflectance detectors in a single paragraph:

The detectors 604 above [in Fig. 11A] are reference detectors “to measure and correct for variations in the LED intensity,” whereas the center detector 605 is the “reflectance detector” for receiving light transmitted/reflected from the sample. EX1030, 17:36-49; EX1003 ¶259. Both types of detectors are conventional “photodiodes.” EX1003 ¶259; EX1030, 13:50-62. As Dr. Mercier explains, it would have been obvious to modify 11A of Soller to position the reflectance detectors in the position of the reference detectors, since both are conventional photodiodes performing their routine functions. EX1003 ¶¶260-61. Soller itself directly teaches modifying the arrangement of detectors. EX1030, 17:42-49, Fig. 11C. This modification to Soller would have been a straightforward substitution for a POSITA involving routine substitution of known elements. EX1003 ¶¶260-65.

Petition at 68-69; *see also* Ex. 1003 at ¶¶ 259-262.

133. Petitioner and Dr. Mercier argue that Soller's reference detectors 610 are “conventional photodiodes” and “it would have been obvious to modify 11A of Soller to position the reflectance detectors in the position of the reference detectors” Petition at 68-69 (citing Ex. 1030 at 17:42-49); Ex. 1003 at ¶¶ 260-261. I disagree. Soller does not teach that reference detectors 610 can be modified as reflectance detectors, much less provide any motivation for a POSITA to make such a change. Ex. 1030 at 17:42-49.

134. Even assuming that Petitioner and Dr. Mercier are correct that Soller's reference detectors 610 could be modified as reflectance detectors, they do not explain *why* one would do so. Petition at 68-69; Ex. 1003 at ¶ 260-261. That is, even

if reference detectors 610 *could* be modified to be reflectance detectors, Petitioner and Dr. Mercier do not explain *why* a POSITA would do so. Petition at 68-69; Ex. 1003 at ¶¶ 260-261. As I explain below in § X.D.1.d, a POSITA would not have been motivated to do so, at least because Soller’s embodiment with reference detectors 610 already includes a reflectance detector 605 and because this modification would result in that embodiment containing no reference detectors, which is inconsistent with Soller’s teachings of using both reference and reflectance detectors. Ex. 1030 at FIG. 11A, 17:42-60, 2:27-33, 3:27-32, 16:8-32, 18:24-25.

135. The Petition also argues that modifying Soller’s reference detectors 610 to be reflectance detectors would have been a “straightforward substitution for a POSITA involving routine substitution of known elements.” Petition at 69 (citing only Ex. 1003 at ¶¶ 260-265). The potentially relevant paragraphs of Dr. Mercier’s declaration (¶¶ 260-262) make similar arguments. Ex. 1003 at ¶¶ 260-262. Petitioner and Dr. Mercier do not explain what the alleged “straightforward substitution” would be, including what changes would be made to what components in the embodiment shown in Figures 11A-B. Petition at 69; Ex. 1003 at ¶¶ 260-262. For example, Petitioner and Dr. Mercier do not explain specifically where and how detectors 610 would be mounted, what would happen to existing reflectance detector 605, how LEDs 604 would be changed (e.g., angle), or how the embodiment would

work without any remaining reference detectors. Petition at 69; Ex. 1003 at ¶¶ 260-262.

136. I disagree with Petitioner and Dr. Mercier’s argument that modifying Soller’s reference detectors 610 to instead be reflectance detectors would be a mere “straightforward substitution,” and “straightforward design modification.” Petition at 69; Ex. 1003 at ¶¶ 260-262. This alleged modification would change the structure and function of the relied-upon embodiment (device 600) depicted in Soller’s Figures 11A-B. For example, Soller’s teaches a structure of device 600 in which “[r]eference detectors 610 are mounted on the side of each LED [604],” with the associated function “to measure and correct for variations in the LED intensity,” which involves reference detectors 610 receiving light from LEDs 604 directly (not reflected from sample 505). Ex. 1030 at 17:36-48, FIGS. 11A-B. Soller further teaches a structure of device 600 in which LEDs 604 are mounted “at an angle” around a “centrally located” reflectance detector 605, with the associated function of reflectance detector 605 receiving reflected light from sample 505 that is emitted by LEDs 604. Ex. 1030 at 17:36-43, 17:51-56, FIGS. 11A-B.

137. A POSITA would have understood that Petitioner and Dr. Mercier’s proposed modification of changing reference detectors 610 to be reflectance detectors would have altered the structure and function of reference detectors 610, at least because detectors 610 would then detect light reflected from sample 505

rather than directly from LEDs 604, and this would require changing the mounting and location of detectors 610 such that they no longer receive light directly from LEDs 604. Ex. 1030 at 17:36-48, FIGS. 11A-B. A POSITA would have understood that the proposed modification would necessitate additional changes to structure and function, including: changing the mounting angle of LEDs 604 depending on the location and mounting of the modified detectors 610; removing or changing the location of existing reflectance detector 605 depending on the location and mounting of the modified detectors 610, the related location and mounting of LEDs 604, and the redundancy of reflectance detector 605 and modified detectors 610; and modifying device 600—since the proposed modification would result in no remaining reference detectors in device 600—to add one or more new reference detectors (and/or convert reflectance detector 605 into a reference detector), including locating and mounting the new reference detector(s) appropriately in relation to the modified LEDs 604 in order to measure and correct for variations in LED intensity of LEDs 604. *See* Ex. 1030 at 17:36-60, FIGS. 11A-B.

138. The Petition and Dr. Mercier also argue that “Soller itself directly teaches modifying the arrangement of detectors.” Petition at 69 (citing Ex. 1030 at 17:42-49, FIG. 11C); Ex. 1003 at ¶ 260 (citing Ex. 1030 at 17:42-49, 18:47-58, FIG. 11C). Even assuming that this assertion by Petitioner and Dr. Mercier regarding “modifying the arrangement of detectors” is correct, modifying the *arrangement* of

detectors is not equivalent to modifying the *type* of detector. Soller does not teach modifying the *type* of detector, including the proposed modification of converting reference detectors 610 into reflectance detectors, which would result in no remaining reference detectors in device 600. Ex. 1030 at 17:42-43, FIG. 11A.

139. Petitioner and Dr. Mercier’s citations to Soller for their assertions about “modifying the arrangement of detectors” do not teach or suggest converting reference detectors 610 into reflectance detectors. *See* Petition at 69 (citing Ex. 1030 at 17:42-49, FIG. 11C); Ex. 1003 at ¶ 260 (citing Ex. 1030 at 17:42-49, 18:47-58, FIG. 11C). Their first citation is for Soller’s teaching that “FIG. 11C shows an alternate mounting position for reference detectors 610 which allows more light to reach reference detectors 610.” Petition at 69 (citing Ex. 1030 at 17:42-49, Fig. 11C); Ex. 1003 at ¶ 260 (citing and quoting Ex. 1030 at 17:42-49 regarding Fig. 11C). But this does not teach that reference detectors 610 can be modified to be reflectance detectors. Rather, the cited disclosure merely teaches that reference detectors 610 can be mounted in different ways relative to LEDs 604, which relates to improving the performance of detectors 610 *as reference detectors* by increasing the amount of light that detectors 610 receive directly from LEDs 604. Ex. 1030 at 17:42-50, FIG. 11C. A POSITA would have understood that a reference detector 610 arranged as shown in Figure 11C *cannot* serve as a reflectance detector because it receives light directly from LED 604 before that light reaches sample 505 and thus its

detection of reflected light from sample 505 would be contaminated. Ex. 1030 at 17:42-50, FIG. 11C.

140. Petitioner and Dr. Mercier’s second citation for their assertions about “modifying the arrangement of detectors” is to Soller’s teaching that “Hematocrit measuring device 700 can be modified.” Ex. 1003 at ¶ 260 (citing and quoting Ex. 1030 at 18:47-58). This does not teach that reference detectors 610 can be modified to be reflectance detectors, as this cited disclosure relates to a different embodiment of Soller (i.e., device 700 in Figures 12A-B), not the relevant embodiment of device 600 in Figures 11A-B that contains reference detectors 610. *Compare* Ex. 1030 at 18:18-19, 18:47-58, FIGS. 12A-B *with* Ex. 1030 at 17:36-38, FIGS. 11A-B. While Petitioner and Dr. Mercier cite this teaching that Soller’s “device 700 can be modified,” this teaching does not mention or involve modification of any detector, much less conversion of a reference detector into a reflectance detector. Ex. 1030 at 18:47-58.

141. Petitioner and Dr. Mercier do not specifically explain *how* a POSITA would have modified Soller’s device 600 to implement their proposed modification. Petition at 66-71; Ex. 1003 at ¶¶ 256-265. For example, Soller teaches that reference detectors 610 are mounted relative to LEDs 604 so that reference detectors 610 receive light directly from LEDs 604 (not reflected light from sample 505) and that LEDs 604 and centrally-located reflectance detector 605 are located and angled

appropriately for reflectance detector 605 to receive reflected light from sample 505. Ex. 1030 at FIGS. 11A-B, 17:36-60. A POSITA would have understood that changing reference detectors 610 to be reflectance detectors would have affected and necessitated changes to these aspects of Soller's device 600.

142. Petitioner and Dr. Mercier do not address how a POSITA would have done so. Petition at 66-71; Ex. 1003 at ¶¶ 256-265. For example, assuming that a POSITA sought to convert reference detectors 610 into reflectance detectors, Petitioner and Dr. Mercier do not address: the changes needed regarding the mounting and location of detectors 610; the resulting redundancy between the converted detectors 610 and existing reflectance detector 605 or any changes to detector 605; the addition of new reference detectors given that the modification to detectors 610 would result in no remaining reference detectors in device 600; and the relative location and angles of LEDs 604, converted detectors 610, and existing reflectance detector 605. Petition at 66-71; Ex. 1003 at ¶¶ 256-265; Ex. 1030 at FIGS. 11A-B, 17:36-60.

143. Based on the foregoing analysis, Petitioner and Dr. Mercier fail to show that a POSITA would have been motivated to modify *reference* detectors 610 in Soller's alleged arc arrangement in Figure 11A to instead be *reflectance* detectors. Petitioner and Dr. Mercier therefore fail to show that Soller renders obvious the arc

limitation with respect to the *reflectance* “detectors.” Petition at 66-71; Ex. 1003 at ¶¶ 256-265.

144. Petitioner and Dr. Mercier also fail to show that a POSITA would have modified the arrangement of Lisogurski’s *reflectance* detectors based on Soller to meet the arc limitation. Petitioner and Dr. Mercier make a two-part argument for combining Soller and Lisogurski to meet the arc limitation with respect to the claimed “detectors”—i.e., that (1) Soller would have been modified to change *reference* detectors 610 in the alleged arc arrangement in Figure 11A into *reflectance* detectors and (2) then Lisogurski would have been modified to arrange its relied-upon *reflectance* detectors based on Soller’s alleged arc arrangement. Petition at 66-71; Ex. 1003 at ¶¶ 256-265. Petitioner and Dr. Mercier’s two-part argument recognizes that their proposed modification of Lisogurski to implement Soller’s alleged arc arrangement is predicated on first modifying Soller’s *reference* detectors 610 to be *reflectance* detectors. Petition at 66-71; Ex. 1003 at ¶¶ 256-265. But for at least the reasons discussed above, Petitioner and Dr. Mercier fail to show motivation for part (1) of their argument, and thus part (2) also fails. That is, Petitioner and Dr. Mercier fail to show that a POSITA would have used Soller’s alleged arc arrangement of detectors 610 in Figure 11A to arrange Lisogurski’s *reflectance* detectors in an arc because, as discussed above, they fail to show that a

POSITA would have modified Soller's detectors 610 to be *reflectance* detectors.

Petition at 66-71; Ex. 1003 at ¶¶ 256-265.

d) A POSITA Would Not Have Been Motivated to Modify Soller's *Reference* Detectors 610 to Be *Reflectance* Detectors or Further Motivated to Modify Lisogurski's *Reflectance* Detectors Based on Soller

145. A POSITA would not have been motivated to modify Soller's reference detectors 610 to be reflectance detectors because Soller teaches that the device 600 already includes a reflectance detector 605. Ex. 1030 at 17:42-43, FIGS. 11A-B. Dr. Mercier recognizes that "Soller teaches ... the 'reflectance detector [605]' for receiving light transmitted/reflected from the sample." Ex. 1003 at ¶ 259 (citing Ex. 1030 at 17:42-60). A POSITA would have understood that if reference detectors 610 were converted into reflectance detectors, which would measure light reflected from sample 505, then those modified detectors 610 would be redundant to the existing reflectance detector 605 that already performs that same function of measuring light reflected sample 505. Ex. 1030 at 17:36-43, FIGS. 11A-B, 2:30-31. This modification and redundancy would be unnecessary and inefficient.

146. For example, a POSITA would have understood based on Soller that the existing reflectance detector 605 is sufficient for measuring light reflected from sample 505 and that additional reflectance detectors are not needed. Modifying reference detectors 610 to be reflectance detectors would create unnecessary

duplication of parts, costs, and functions. Because Soller already teaches reflectance detector 605, a POSITA would not have understood that the proposed modification of reference detectors 610 to add more reflectance detectors would have created any advantages or benefits.

147. Petitioner and Dr. Mercier do not address the existing reflectance detector 605 in Soller or why a POSITA would have purportedly been motivated to convert reference detectors 610 into reflectance detectors when Soller already teaches reflectance detector 605. Petition at 67-69; Ex. 1003 at ¶¶ 259-262. For example, Petitioner and Dr. Mercier do not address or explain:

- the fact that detectors 610, if modified to be reflectance detectors, would be redundant to existing reflectance detector 605. Petition at 67-69; Ex. 1003 at ¶¶ 259-262;
- if or how existing reflectance detector 605 would be modified as part of their proposed modification of reference detectors 610 into reflectance detectors. Petition at 67-69; Ex. 1003 at ¶¶ 259-262;
- differences (e.g., functional differences) between the proposed modified detectors 610 (i.e., detectors 610 modified to be reflectance detectors) and existing reflectance detector 605. Petition at 67-69; Ex. 1003 at ¶¶ 259-262;
- any advantage or benefit of Soller's device 600 containing both the proposed modified detectors 610 (i.e., detectors 610 modified to be reflectance

detectors) and existing reflectance detector 605. Petition at 67-69; Ex. 1003 at ¶¶ 259-262.

148. A POSITA would not have been motivated to modify Soller's reference detectors 610 to be reflectance detectors because this would result in device 600 containing no reference detectors, which is contrary to Soller's teachings and goals. Ex. 1030 at 17:36-48, FIGS. 11A-B. Soller is directed to hematocrit measuring devices that contain both reflectance detectors and reference detectors, with the reflectance detectors configured to receive and measure light reflected from a sample and the reference detectors configured to receive and measure light from LEDs:

- Ex. 1030 at 2:27-33 (“A detection system included in the device features a first optical [reflectance] detector and a plurality of second optical [reference] detectors. The first optical [reflectance] detector is configured to receive radiation from the sample. The plurality of second optical [reference] detectors is configured to receive radiation from each of the light sources”);
- Ex. 1030 at 3:27-32 (“detection system includes a first optical [reflectance] detector ... for receiving radiation from the sample” and “a second optical [reference] detector ... for receiving radiation directly from each of the light sources”);

- Ex. 1030 at 13:50-14:13 (“device 100 includes interior [reference] detectors 105 and exterior [reflectance] detectors 110”; “radiation is ... reflected by the sample towards the exterior reflection detector 110 for detection”; “interior [reference] detector 105 monitors the optical output emitted from the LEDs”), FIGS. 5-6;
- Ex. 1030 at 16:8-32 (“reference detector 155” and “signal detector 157”), FIG. 7;
- Ex. 1030 at 16:61-17:5 (“device 300 includes interior [reference] detector 350 and exterior [reflectance] detector 330”; “interior [reference] detector 350 monitors the optical output emitted from the LEDs”);
- Ex. 1030 at 17:42-48 (“Device 600 includes a reflectance detector 605 and a series of reference detectors 610”; “Reference detectors 610 ... measure ... variations in the LED intensity”), FIGS. 11A-B;
- Ex. 1030 at 18:24-25 (“Device 700 includes a reflectance detector 710 and a reference detector 720”), FIGS. 12A-B;
- Ex. 1030 at 18:66-67 (“Device 800 includes a reflectance detector 805 and two reference detectors 810”), 19:17-27 (“radiation is ... reflected by the sample towards reflectance detector 805”; “reference detector

810 monitors the optical output emitted from LEDs 804”), FIGS. 13A-B;

- Ex. 1030 at 23:14-36 (“A device for determining blood hematocrit ... comprising a first optical [reflectance] detector and a plurality of second optical [reference] detectors, the first optical [reflectance] detector being configured to receive radiation from the sample ... and the plurality of second optical [reference] detectors each being configured to detect radiation directly from one of the light sources”).

149. Soller teaches that its purported invention includes reference detectors for measuring and accounting for variations in LED intensity when calculating reflected light measured by the reflectance detector(s):

- Ex. 1030 at 2:58-63 (“the radiation detected by the plurality of second [reference] detectors can be ... used to determine a reference spectrum which ... is used to calculate the reflection spectrum. Inclusion of the reference spectrum allows variations in the intensity of each light source to be taken into account.”);
- Ex. 1030 at 7:26-29 (“The absorption spectrum ... can be calculated by taking the log of a reference spectrum ... divided by the sample reflection spectrum”);

- Ex. 1030 at 14:7-13 (“Radiation detected by the interior [reference] detector is used to determine a reference spectrum which allows intensity variations from the various LEDs to be accounted for. The actual reflectivity spectrum is calculated by taking the ratio of the reflected radiation, as measured with the exterior reflection detector, to the reference spectrum, as measured with the interior [reference] detector”);
- Ex. 1030 at 17:1-5 (“Radiation detected by the interior [reference] detector is used to determine a reference spectrum which allows intensity variations from the various LEDs to be accounted for”);
- Ex. 1030 at 17:45-48 (“Reference detectors 610 ... measure and correct for variations in the LED intensity due to temperature, gaining, or electrical power source drifts”);
- Ex. 1030 at 19:4-7 (“Reference detectors 810 ... measure and correct for variations in the LED intensity due to temperature, aging or electrical power source drifts”).

For example, Soller’s embodiment that Petitioner and Dr. Mercier rely upon for the arc limitation (device 600 depicted in Figure 11A) contains both “a reflectance detector 605 and ... reference detectors 610,” so that reference detectors 610 can “measure and correct for variations in the LED intensity due to temperature, gaining,

or electrical power source drifts.” Ex. 1030 at 17:36-48.

150. Petitioner and Dr. Mercier’s proposed modification to Soller would result in device 600 containing only reflectance detectors and no reference detectors. That is, Petitioner and Dr. Mercier argue that Soller would have been modified to change reference detectors 610 in device 600 into reflectance detectors. Petition at 68-69 (“it would have been obvious to modify 11A of Soller to position the reflectance detectors [605] in the position of the reference detectors [610], since both are conventional photodiodes performing their routine functions... Soller itself directly teaches modifying the arrangement of detectors.” (citing Ex. 1030 at 17:42-49)); Ex. 1003 at ¶¶ 260-261. Soller does not disclose any other reference detectors in device 600 besides reference detectors 610. Ex. 1030 at 17:36-18:17, FIGS. 11A-B. If Soller’s device 600 is modified to change reference detectors 610 into reflectance detectors, as Petitioner and Dr. Mercier propose, then this modified version of device 600 would not contain any reference detectors.

151. Because Petitioner and Dr. Mercier’s proposed modification to Soller’s detectors 610 would result in the device 600 containing no reference detectors, this modification is inconsistent with Soller’s invention, which is directed to devices that include reference detectors. Ex. 1030 at 2:27-33, 3:27-32, 13:50-14:13, FIGS. 5-6, 16:8-32, FIG. 7, 16:61-17:5, 17:42-48, FIGS. 11A-B, 18:24-25, FIGS. 12A-B, 18:66-67, 19:17-27, FIGS. 13A-B, 23:14-36. Petitioner and Dr. Mercier do not

identify any teachings in Soller that only use reflectance detector(s) and zero reference detectors (which is the result of their proposed modification). Petition at 66-71; Ex. 1003 at ¶¶ 256-265.

152. Additionally, their proposed modification would result in the device 600 containing no reference detectors, which is inconsistent with and detracts from Soller's stated goal of using reference detectors to account for variation in LED intensity to more accurately calculate reflected light from a sample. Ex. 1030 at 2:58-63, 7:26-29, 14:7-13, 17:1-5, 17:45-48, 19:4-7. Petitioner and Dr. Mercier do not explain how Soller's device 600 would achieve this stated goal if modified as proposed to change all of device 600's reference detectors 610 into reflectance detectors. Petition at 66-71; Ex. 1003 at ¶¶ 256-265. A POSITA would not have been motivated to make Petitioner and Dr. Mercier's proposed modification, since that modification is inconsistent with Soller's teachings and goals. That is, based on Soller's teachings and goals regarding inclusion of reference detectors to account for variation in LED intensity, and because Petitioner and Dr. Mercier's proposed modification of Soller would change reference detectors 610 into reflectance detectors and leave device 600 with no remaining reference detector, a POSITA would not have been motivated to make that proposed modification of Soller.

153. Additionally, a POSITA would not have been motivated to modify Soller's reference detectors 610 to be reflectance detectors because this would result

in incompatibilities and inoperability in device 600. A POSITA would have understood that modifying reference detectors 610 to be reflectance detectors would be incompatible with how those detectors 610 are disposed in device 600. Soller teaches that detectors 610 are located and mounted relative to LEDs 604 to receive light directly from LEDs 604. Specifically, Soller teaches, as shown in Figures 11A-B, that “[r]eference detectors 610 are mounted on the side of each LED to measure ... the LED intensity,” and also teaches, as shown in Figure 11C, “an alternate mounting position for references detectors 610 which allows more light to reach reference detectors 610” from LEDs 604. Ex. 1030 at FIGS. 11A-C, 17:42-50. Given this positioning of detectors 610 in device 600, detectors 610 cannot function as reflectance detectors because detectors 610 receive light directly from LEDs 604 before that light is transmitted to and reflected from sample 505.

154. A POSITA would have understood that if detectors 610 were converted into reflectance detectors, their detection and measurement of reflected light from sample 505 would be contaminated by their reception of light directly from LEDs 604 (also known as spillover or interference). If detectors 610 were modified to be reflectance detectors, Soller does not teach any means of preventing such spillover or interference with respect to the modified detectors 610 (e.g., filters or spatial separation from LEDs 604). Thus, if reference detectors 610 were modified to be reflectance detectors, then those modified detectors 610 would be incompatible with

their positioning (location and mounting) in device 600, which would preclude detectors 610 from properly and accurately functioning as reflectance detectors.

155. Also, modifying reference detectors 610 to be reflectance detectors would render device 600 inoperable for its intended purpose of measuring reflected light from sample 505, as the modified detectors 610 would not be capable of accurately measuring such reflected light for the same reasons discussed above regarding incompatibility. That is, the positioning of detectors 610 in device 600 precludes detectors 610 from properly and accurately functioning as reflectance detectors, so Petitioner and Dr. Mercier's proposed modification of changing detectors 610 into such reflectance detectors would render those detectors 610 and device 600 inoperable for their intended purpose.

156. Petitioner and Dr. Mercier do not address these incompatibility and inoperability issues. For example, Petitioner and Dr. Mercier do not acknowledge or address the fact, as explained above, that detectors 610 cannot function as reflectance detectors due to their positioning in device 600 to receive light directly from LEDs 604. Petition at 67-69; Ex. 1003 at ¶¶ 259-262. Petitioner and Dr. Mercier do not address whether a POSITA would have modified the positioning of those detectors 610, and if so, how. Petition at 67-69; Ex. 1003 at ¶¶ 259-262.

157. Dr. Mercier's declaration includes an assertion that "[i]t would have been readily apparent to a POSITA reading Soller that the reflectance detector(s)

could also be arranged in a different position, including to be further away from the LEDs,” but this assertion merely refers to what “could” be done, not that a POSITA *would* have made this change. Ex. 1003 at ¶ 261. Also, this assertion in Dr. Mercier’s declaration is unclear as to what specific “reflectance detector(s)” it is referring to, and this assertion lacks any cited support or explanation. Ex. 1003 at ¶ 261.

158. For at least the reasons I discuss above, a POSITA would not have been motivated to modify *reference* detectors 610 in Soller’s alleged arc arrangement in Figure 11A to instead be *reflectance* detectors, as Petitioner and Dr. Mercier argue. Soller thus does not render obvious the arc limitation with respect to the *reflectance* “detectors.”

159. Additionally, because a POSITA would not have modified *reference* detectors 610 in Soller’s alleged arc arrangement in Figure 11A to be *reflectance* detectors to begin with, a POSITA also would not have been motivated to use that alleged arc arrangement of detectors 610 in Soller to arrange Lisogurski’s *reflectance* detectors, as Petitioner and Dr. Mercier further argue. That is, since Soller’s alleged arc arrangement involves *reference* detectors 610, and a POSITA would not have modified those *reference* detectors 610 to be *reflectance* detectors, a POSITA would not have used that alleged arrangement of (unmodified) *reference* detectors 610 to arrange Lisogurski’s *reflectance* detectors. Indeed, Petitioner and Dr. Mercier recognize that a POSITA would not be motivated to modify the

arrangement of Lisogurski's *reflectance* detectors based on Soller's arrangement of (unmodified) *reference* detectors 610, as Petitioner and Dr. Mercier first argue an alleged modification of Soller's *reference* detectors 610 into *reflectance* detectors before then arguing the alleged modification of Lisogurski based on Soller. Petition at 67-71; Ex. 1003 at ¶¶ 259-264.

e) Petitioner and Dr. Mercier Do Not Show that a POSITA Would Have Been Motivated to Implement's Soller's Alleged Arc Arrangement in Lisogurski to Meet the Arc Limitation

160. For the arc limitations recited in claims 4-6, 15-16, and 21-22, Petitioner and Dr. Mercier argue that “[a] POSITA would have been motivated to combine the arrangement of detectors and LEDs in a first and second “arc” disclosed in Soller into the wearable sensor described by Lisogurski.” Ex. 1003 at ¶¶ 256-265; Petition at 66-71.

161. Dr. Mercier's and Petitioner's discussion of Soller's alleged arc arrangements consists largely of restating what Soller discloses and asserting that the same arrangement could be applied to Lisogurski. *See* Ex. 1003 at ¶¶ 256–265; Petition at 66-71. Petitioner and Dr. Mercier fail to identify any teaching in Lisogurski suggesting the need for such an arrangement, nor any recognized design problem that Soller uniquely solves in the Lisogurski context. *See* Ex. 1003 at ¶¶ 256–265; Petition at 66-71.

162. Petitioner and Dr. Mercier do not show that a POSITA would have been motivated to implement Soller's alleged arc arrangement of LEDs and detectors to arrange Lisogurski's sensor's LEDs and detectors.

1) Soller and Lisogurski Are Directed to Fundamentally Different Measurement Problems and Systems

163. Soller is directed to hematocrit measurement, not oximetry. Soller explains: "Hematocrit is the volume percent of red blood cells in a blood sample." Ex. 1030 at Abstract, 1:19–20. Soller states that "[t]he invention provides an optical and mathematical method to measure hematocrit with increased accuracy relative to other methods, e.g., impedance and oximetric methods." Ex. 1030 at 5:42-45.

164. Soller distinguishes its invention from conventional oximetry methods, stating "[a]ll of the reported optical techniques are variations on oximetric methods where hematocrit is measured using only the concentrations of oxygenated and deoxygenated hemoglobin." Ex. 1030 at 1:36–40. Soller further notes that those concentrations are measured "using 2 to 4 wavelengths of light in the near-infrared region of the hemoglobin Spectrum," underscoring the limited-wavelength nature of the oximetry approaches. Ex. 1030 at 1:41–44.

165. Soller emphasizes that its method is different from oximetric: the present invention provides a "new optical method, which measures blood hematocrit by quantifying a plurality of red blood cell constituents." Ex. 1030 at 1:49–51. Hematocrit in Soller is determined by "processing the optical spectrum with a

mathematical model” that relies on a “method includ[ing] irradiating blood with optical radiation having a selected range of optical wavelengths to produce an optical spectrum.” Ex. 1030 at 1:52–62. Soller teaches that accurate hematocrit measurement requires explicitly accounting for additional hemoglobin species and other red-blood-cell constituents beyond oxygenated and deoxygenated hemoglobin. Ex. 1030 at 5:33–42. Soller explains that “other forms of hemoglobin are also present in the red blood cell, including methemoglobin, carboxyhemoglobin and sulphemoglobin,” and that the red blood cell includes other optically relevant components such as “the nucleus and cellular membranes.” Ex. 1030 at 5:33–42. Soller then states: “[t]o accurately measure hematocrit, not only must these additional forms of hemoglobin be accounted for, but so must the remaining 10% of the cellular components, the nucleus and cell membranes, which do not contain hemoglobin.” Ex. 1030 at 5:38–42.

166. Lisogurski, in contrast, is a pulse oximetry system that estimates blood oxygen saturation by exploiting the known absorption differences between oxyhemoglobin (HbO_2) and deoxyhemoglobin (Hb). Ex. 1027 at 4:42–48, 24:58–25:5. Lisogurski explains that “[r]ed and infrared (IR) wavelengths may be used because it has been observed that highly oxygenated blood will absorb relatively less red light and more IR light than blood with a lower oxygen saturation.” Ex. 1027 at 4:42–48, 24:58–25:5. Lisogurski further teaches that “[b]y comparing the intensities

of two wavelengths at different points in the pulse cycle, it is possible to estimate the blood oxygen saturation of hemoglobin in arterial blood.” Ex. 1027 at 4:48-51. Lisogurski’s measurement principle depends on a two-channel comparison tied directly to HbO₂/Hb absorption physics. Ex. 1027 at 4:48-56.

167. Consistent with that physiological model, Lisogurski relies on the conventional two-wavelength ratio-of-ratios computation, which assumes that oxygen saturation can be inferred from the relative pulsatile changes measured at two wavelengths. Lisogurski expressly states that oxygen saturation may be computed “using two wavelengths of light and a ratio-of-ratios calculation.” Ex. 1027 at 4:52–56. Lisogurski also confirms that “[r]atio-of-ratio calculations are common calculations in pulse oximeters” and “may use IR and red ... to determine oxygen saturation.” Ex. 1027 at 45:6-9. “The ratio-of-ratio calculation term may be approximated as:

$$\frac{\left(\frac{Red_{max} - Red_{min}}{Red_{mean}} \right)}{\left(\frac{IR_{max} - IR_{min}}{IR_{mean}} \right)}$$

where terms relate to the maximum, minimum, and mean amplitudes of the associated signals.” Ex. 1027 at 45:11-21. A POSITA would therefore understand

that Lisogurski is not designed for spectral measurements across many wavelengths, as disclosed by Soller (Ex. 1030 at 5:48–63), but instead is built around a deliberately simplified, standard dual-wavelength ratio-of-ratios model tailored specifically to estimating blood oxygen saturation. Ex. 1027 at 4:52–56, 45:6-21.

168. A POSITA would understand that Soller is not merely adding incremental features to an oximetric method, but is departing from the core assumption that HbO_2/Hb alone can support accurate hematocrit measurement. Ex. 1030 at 5:33–54. Soller’s solution is not a ratio-of-ratios approach but a broader spectral-modeling technique, requiring a larger wavelength set and a multivariate calibration framework. Ex. 1030 at 5:48–63.

169. Soller states that “[t]he invention quantifies these additional blood cell components both by using a larger set of wavelengths in the measurement.” Ex. 1030 at 5:48–51. Soller further indicates that the measurement may use “7 or more wavelengths, to record optical spectra of blood.” Ex. 1030 at 5:55–63. Soller discloses that its LEDs collectively cover a broad spectral range, stating that “LEDs 310 are commercially available and uniformly span the 500-1100 nm range with emission band widths of about 30-100 nm for each LED.” Ex. 1030 at 17:31-33. Soller explains that “by using a larger set of wavelengths for analysis, the method compensates for variations in blood volume by accounting for factors relating to blood volume.” Ex. 1030 at 5:51–54. Soller emphasizes that “[t]o accurately

measure blood hematocrit, it is important that the range of optical wavelengths chosen includes the absorption and scattering affects of the plurality of red blood cell constituents,” “such as the nucleus and cell membrane.” Ex. 1030 at 6:33–41.

170. Soller also relies on a different mathematical model than Lisogurski’s ratio-of-ratios approach:

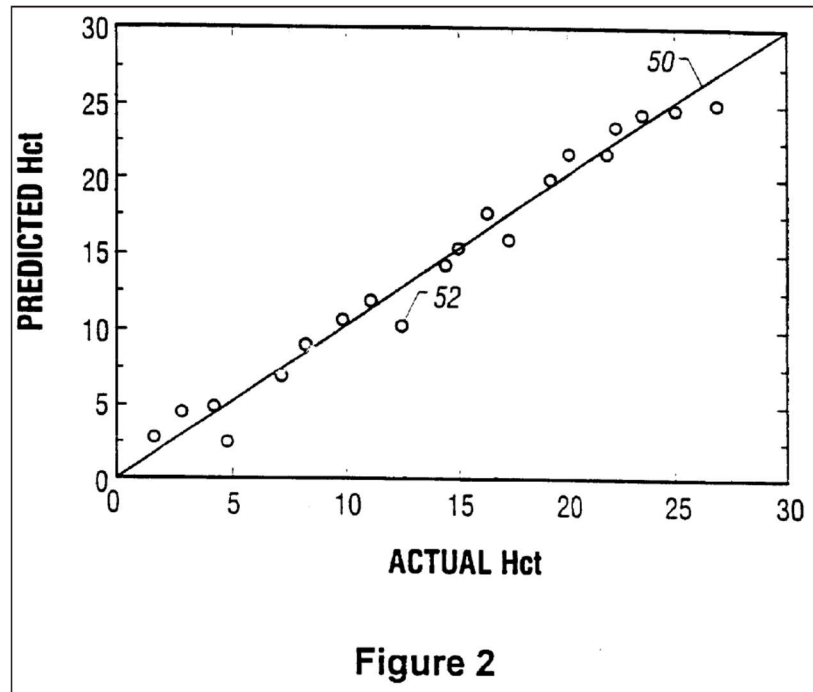
The mathematical model relates actual blood hematocrit to optical data. The model is generated by taking optical spectra for a range of wavelengths affected by the plurality of red blood cell constituents from a number of samples at known hematocrit values, and then processing the spectra and the hematocrit values with a multivariate calibration procedure, e.g., a Partial Least Squares (PLS) fitting algorithm. The model is then used to determine the blood hematocrit of a blood sample, e.g., tissue containing blood, by measuring a reflection or transmission spectrum from the blood, and then comparing the spectrum to the model. Multivariate calibration procedures incorporate information from a variety of chemical species and physical processes without having to measure separately the effect of each one. PLS accounts for all of the different red blood cell constituents, e.g., various forms of hemoglobin and other cellular bodies, by relating the optical measurements to a single parameter, hematocrit.

Ex. 1030 at 6:42–59.

The actual blood hematocrit is recorded as a Single numerical value, while the optical Spectrum, e.g., a reflection or absorption spectrum, is in the form of an x-y array of points. The x values of the array represent particular optical wavelengths or frequencies, while the y values represent either reflectance or absorption intensities corresponding to these wavelengths or frequencies.

Ex. 1030 at 7:18–25. Soller further discloses: “FIG.2 shows a representative graph plotting the predicted hematocrit as determined by the model as a function of the actual hematocrit generated using the cross-validation procedure.” Ex. 1030 at 11:5–

8.



Ex. 1030, Figure 2

171. A POSITA would recognize that the two systems are not compatible at the system level, because the measurement objectives and signal-processing mathematical models are fundamentally different. Lisogurski’s oxygen saturation computation depends on “two wavelengths of light and a ratio-of-ratios calculation,” which is meaningful only under a two-channel absorption comparison tied to oxygenation changes. Ex. 1027 at 4:42–56, 24:58-25:5, 45:6-21. Soller, in contrast, is built around accounting for multiple hemoglobin species and cellular components and therefore requires “a larger set of wavelengths” plus “a multivariate calibration technique.” Ex. 1030 at 5:33–63. A POSITA would not view these as

interchangeable signal processing options; rather, Soller's approach replaces the simplified dual-wavelength HbO₂/Hb inference model with a multi-constituent spectral analysis approach. Ex. 1027 at 45:6-21; Ex. 1030 at 5:33-63.

172. Combining Soller with Lisogurski would not "improve" Lisogurski's dual-wavelength oximetry; it would require substantial redesign and would undermine Lisogurski's intended measurement principle. For example, the redesign includes reengineering Lisogurski's light source array with optic cables, significantly increasing the count of the light sources and detectors, and replacing its two-channel ratio-of-ratios processing with a multi-wavelength spectral calibration model to acquire and analyze a much larger dataset. Ex. 1027 at 45:6-21; Ex. 1030 at 5:33-63, 11:5-8. The resulting system would no longer measure blood oxygen saturation using Lisogurski's two-channel ratio-of-ratios approach and would therefore undermine the very principle Lisogurski implements. Ex. 1027 at 45:6-21; Ex. 1030 at 5:33-63, 11:5-8. Lisogurski is expressly optimized for blood oxygen estimation by comparing the intensities of "two wavelengths" and using "a ratio-of-ratios calculation," which assumes the dominant relevant absorbers are oxygenated and deoxygenated hemoglobin. Ex. 1027 at 4:42-56, 17:65-66, 24:58-25:5, 45:6-21. Soller, however, teaches that measuring blood properties using only oxygenated and deoxygenated hemoglobin is the hallmark of "oximetric methods" and requires a different approach through accounting for additional components

using a broad band of wavelengths and multivariate calibration. Ex. 1030 at 5:33–63. A POSITA would therefore understand that adopting Soller’s framework would shift Lisogurski away from its dual-wavelength ratio-of-ratios calculation oximetry architecture and toward a different multi-wavelength spectral modeling paradigm—making the proposed combination fail to deliver the intended outputs of either system—at least because (i) applying Soller’s mathematical model and system would not produce the oxygen-saturation output Lisogurski is designed to generate because Soller is calibrated to estimate hematocrit from a broad, multi-wavelength spectrum reflecting multiple blood constituents, not to compute blood oxygen level from the red/IR pulsatile absorption relationship captured by two channels, and (ii) applying Lisogurski’s ratio-of-ratios calculation would not produce Soller’s predicted hematocrit result because the ratio-of-ratios algorithm assumes only two wavelengths selected for oxy- and deoxyhemoglobin discrimination, whereas Soller’s hematocrit prediction requires multi-wavelength spectral data calibration across multiple constituents. Ex. 1027 at 45:6-21; Ex. 1030 at 5:33–63, 11:5–8.

2) Soller’s Alleged Arc Arrangement Is Specifically Tied to Soller’s Hematocrit Measurement Configuration, Which Lisogurski Does Not Use

173. Dr. Mercier argues that “[a] POSITA would therefore have understood that modifications to the arrangement and number of LEDs and detectors in Lisogurski’s sensor unit would have been straightforward design modifications

within the skill of a POSITA that yielded predictable results.” Ex. 1003 at ¶ 264; *see also* Petition, 65-66, 70-71. I disagree for at least the following reasons.

174. Petitioner’s and Dr. Mercier’s “straightforward design choice” assertion is conclusory and untethered to Soller’s actual disclosure tied to the Hematocrit Measurement. Ex. 1003 at ¶ 264; *see also* Petition, 65-66, 70-71. Petitioner and Dr. Mercier rely on the following descriptions of Soller for the alleged detector arc:

The light from the semiconductor sources is transmitted to the sample, and the “return reflected light” from the tissue is “received by an array of, e.g., twenty-five single fibers” (coupled to detectors), which are “configured in a ring 781 concentric about fiber bundle 750.” EX1030, 18:36-46; *see also id.*, 16:6-39 (radiation reflected by the tissue is collected by “signal fibers” attached to the detectors “disposed around the delivery fiber [*i.e.*, semiconductor source fiber] in a radial, symmetrical pattern to maximize the coupling efficiency of, respectively, the incident and reflective radiation”); EX1003 ¶¶256-57, 266-68, 280, 284.

Petition at 66-67 (citing Ex.1003 at ¶¶ 256-57, 266-68, 280, 284).

175. Petitioner and Dr. Mercier rely on the following descriptions of Soller for the alleged semiconductor arc:

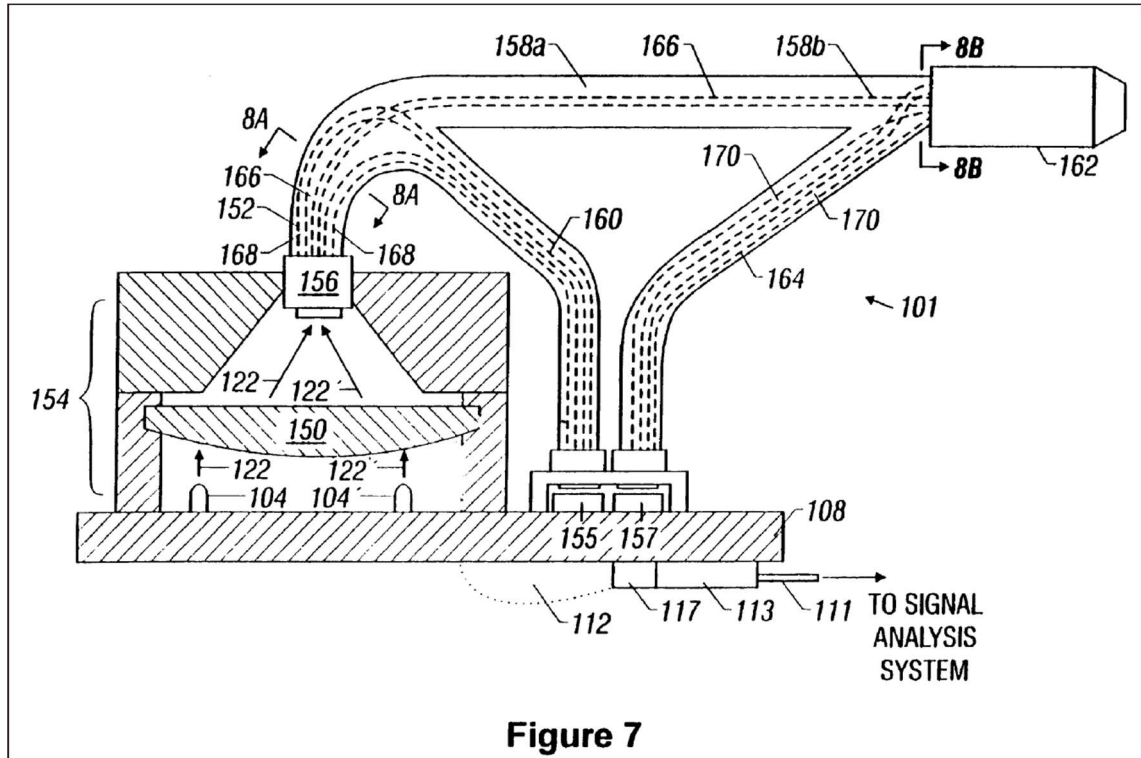
Soller’s measurement device includes LEDs (“*semiconductor sources*”) that are “evenly spaced and arranged in a circular pattern” [(“*second arc*”)]. EX1030, 13:47-49; *id.*, 16:39-48 (describing LEDs in a “symmetric, ring-like pattern around the center of the lens”), 17:36-41 (describing a “circular array” of LEDs); Fig. 9; EX1003 ¶¶258, 266-68, 280, 284.

Petition at 67 (citing Ex.1003 at ¶¶ 258, 266-68, 280, 284).

176. Petitioner and Dr. Mercier rely on descriptions of Soller that disclose a fiber-optic or porthole coupling architecture relating to the arrangement of the LEDs in which the LEDs do not illuminate the sample directly. Ex. 1030 at 3:19–22, 12:30–31, FIG. 9, 13:35–49. Soller explains that “a fiber optic cable is attached to each light source” and “[t]he fiber optic cable includes a delivery fiber for delivering radiation [from the light source] to the sample.” Ex. 1030 at 3:19–22. Soller further explains that as shown in Figure 3, “[t]he radiation is delivered via an optical delivery cable 80 to a probe 82 positioned in close proximity to the skin 73.” Ex. 1030 at 12:30–31. Soller also explains that “[t]he mounting plate 108 includes a series of portholes 109, 109’ positioned above each LED so that radiation 122, 122” can pass through the mounting plate 108 and onto the sample.” Ex. 1030 at 13:35–49.

177. Soller likewise explains that “FIG. 7 shows [] an integrated hematocrit measuring device 101 wherein radiation 122, 122’ from the LEDs 104, 104’ is focus[ed] by a lens 150 into a fiber optic cable 152. A lens housing 154 attached to the mounting plate 108 is used to support both the lens 150 and an annular fiber housing 156 disposed radially around the fiber optic cable 152.” Ex. 1030 at 15:57–63, 16:39–48. Thus, the alleged “ring-like” LED arrangement in Soller is expressly disclosed as part of a specific fiber-optic coupling architecture used to deliver

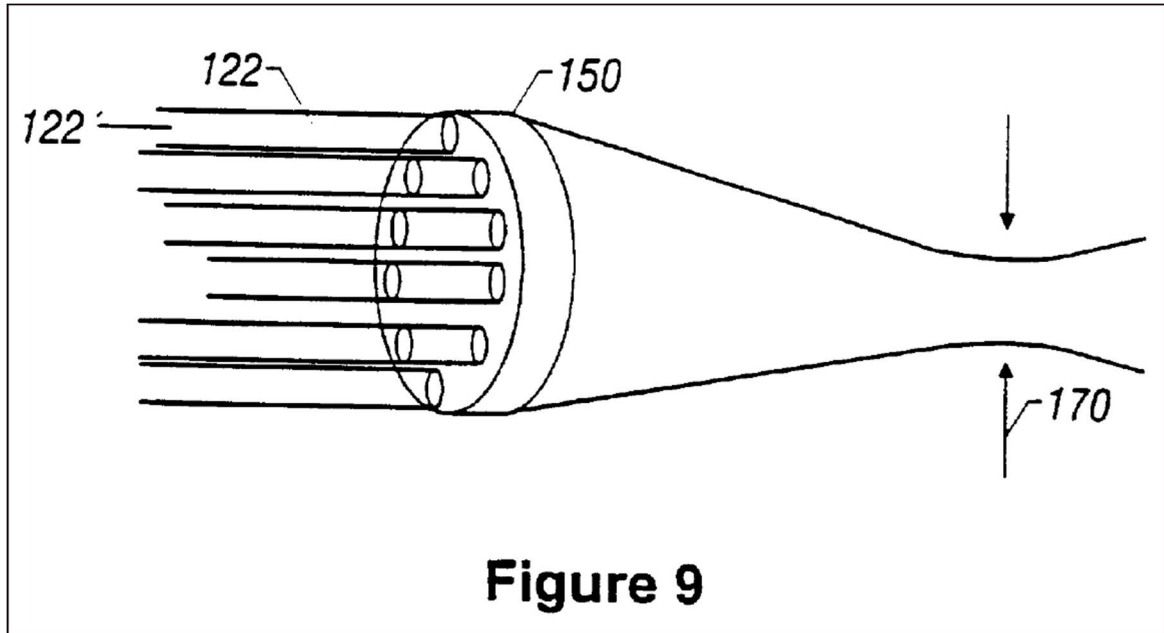
radiation to the tissue within a hematocrit analysis system. Ex. 1030 at 15:57–63, 16:39-48.



Ex. 1030, Figure 7

178. Soller confirms that the reason for arranging LEDs in the geometry of Figure 9 is to maximize optical coupling into a fiber optic cable: “[t]he component of the light from each LED that is collimated will be focused by the lens into a small spot at the entrance end of cable [152], thereby maximizing the amount of radiation coupled into the fiber optic cable.” Ex. 1030 at 16:44–48. Soller emphasizes that the geometry is organized around the fiber optic delivery cable and its mechanical support, including “an annular fiber housing ... disposed radially around the fiber optic cable.” Ex. 1030 at 15:60–63. A POSITA would therefore recognize that

Soller's LED geometry is inseparable from its fiber optic delivery scheme and is not disclosed as a general illumination geometry in a compact wearable sensor. Ex. 1030 at 15:57–63, 16:39-48.



Ex. 1030, Figure 9

179. The alleged “ring-like” arrangement in Soller is a solution to a specific optical coupling problem associated with routing LED radiation into a fiber optic cable or porthole. Ex. 1030 at 15:57–63, 16:39-48, 13:35-49. In other words, the LEDs are arranged in Soller so that their light is delivered to a fiber optic delivery cable or porthole for hematocrit analysis. Ex. 1030 at 16:39–48, 13:35-49. Relatedly, a POSITA would understand that Soller's fiber optic delivery or porthole path inherently defines the illumination “dimension” at the sample by the fiber geometry, not by the LED package itself. For example, Soller teaches that “radiation

... from the LEDs ... is focus[ed] by a lens ... into a fiber optic cable,” meaning the fiber optic cable becomes the effective optical output aperture, and the illumination area and angular distribution at the sample are fundamentally constrained by the fiber’s geometry and coupling optics. Ex. 1030 at 15:57–63, 16:39-48. Soller states that “the optical delivery and signal fibers have diameters of between about 0.1 and 2 mm, and 10 to 500 microns, respectively.” Ex. 1030 at 13:10–12.

180. Soller’s disclosure further demonstrates that the fiber optic cable or porthole is not incidental, but is integral to the measurement architecture, including reference measurement paths. Ex. 1030 at 16:8–21, 13:35-49. As discussed in § X.D.1.b and X.D.1.c above, the reference detectors perform a different function than the reflectance detector and the reference detectors are absent from Lisogurski. The optical fiber structures are specifically arranged to support the bifurcated optical path associated with the reflectance detector and the reference detectors in Soller. Ex. 1030 at 16:8–12. Soller explains that in FIG. 7, “[t]he fiber optic cable 152 is bifurcated at a first point 158a to deliver a portion of the incident radiation through a first fiber optic cable section 160 to a reference detector 155. This radiation is then processed to determine the reference spectrum,” confirming that the fiber cable structure participates directly in measurement and calibration functionality. Ex. 1030 at 16:8–12.

181. Soller further explains:

Accordingly, as shown in FIG. 8A, a cross-sectional slice of the fiber optic cable 152 immediately after the fiber housing 156 features a delivery fiber 166 surrounded by radially and symmetrically disposed reference fibers 168. During operation, radiation from the LEDs is focus[ed] by the lens into both the delivery 166 and reference fibers 168. Radiation from the delivery fiber passes through the cable and onto a sample, while radiation coupled into the reference fibers propagates through the first fiber optic cable section 160 and onto the reference detector 155.

Ex. 1030 at 16:12–21. This reinforces that Soller’s system is architected around fiber-based optical bifurcated routing and signal handling for the hematocrit measurement, which in turn motivates the annular/radial LED coupling arrangement. Ex. 1030 at 15:57–63, 16:8–21, 16:39–48, FIG. 7, FIG. 9.

182. Lisogurski, on the other hand, does not disclose or require any fiber-optic delivery cable or porthole coupling architecture from light sources to the sample tissue. Lisogurski instead teaches a compact wearable sensor for a different physiological variable, oxygen saturation, in which LEDs directly illuminate tissue and reflected/transmitted light is detected locally. *See, e.g.*, Ex. 1027 at Fig. 1, 4:6–11, 10:42–11:20. Lisogurski discloses that “[a]n oximeter may include a light sensor that is placed at a site on a patient, typically a fingertip, toe, forehead or earlobe, or in the case of a neonate, across a foot” and it “may use a light source to pass light through blood perfused tissue and photoelectrically sense the absorption of the light in the tissue.” Ex. 1027 at 4:6–11. Lisogurski further explains that “[s]uitable sensors for these locations may include sensors for sensing absorbed light based on detecting

reflected light.” Ex. 1027 at 4:21–22. A POSITA would understand that Lisogurski’s measurement paradigm relies on direct optical interaction between the LEDs, tissue, and detector at the sensor site—without any need for an intervening fiber optic delivery conduit. Ex. 1027 at 4:6–11, 4:21–22.

183. Lisogurski’s disclosed implementation further confirms that its LEDs are intended to directly illuminate tissue, not to be coupled into an optic delivery cable or porthole. Ex. 1027 at 4:6–11, 4:21–22, 12:11–16. Lisogurski explains that when the “red and IR light emitters” are driven, “they emit pulses of light at their respective wavelengths into the tissue of a subject.” Ex. 1027 at 12:11–16. Lisogurski further teaches that “detector 140 may be configured to detect the intensity of light at the Red and IR wavelengths,” and that this light is received “after passing through the subject’s tissue.” Ex. 1027 at 11:9–14. This is the opposite of Soller’s fiber-coupling design, where radiation of light sources is “focus[ed] ... into a fiber optic cable” via annular fiber housings, and the fiber output defines the illumination aperture and distribution. Ex. 1030 at 15:57–63, 16:8–21, 16:39–48, 13:35–49; Ex. 1027 at Fig. 1, 4:6–11, 10:42–11:20, 12:11–16.

184. Lisogurski also confirms that the only “cable” it discusses is a communication cable, not an optical delivery fiber. Specifically, Lisogurski states: “Monitor 314 may be communicatively coupled ... via a cable” to a sensor input port or digital communications port. Ex. 1027 at 18:58–62, 18:16–23. Thus,

Lisogurski contains no disclosure of delivering light from LEDs through a fiber optic cable or porthole, and therefore none of the optical coupling constraints that motivate Soller’s alleged “ring-like” LED arrangement exist in Lisogurski. Ex. 1027 at 18:58–62, 18:16–23, 13:35-49; Ex. 1030 at 16:39–48.

185. Because fiber delivery or porthole inherently reduces the illumination aperture to the output and imposes a different angular distribution, the illumination “dimension” and coupling physics in Soller are fundamentally different from—and incompatible with—Lisogurski’s direct-illumination wearable architecture. Soller requires “[t]he component of the light from each LED that is collimated will be focused by the lens into a small spot at the entrance end of [the fiber optic] cable” and mechanical structures “disposed radially around the fiber optic cable,” indicating that the system is designed around fiber input and output constraints. Ex. 1030 at 15:57–63, 16:8–21, 16:39-48, FIG. 7; FIG. 9. Lisogurski, in contrast, is designed around LEDs that directly “emit pulses of light ... into the tissue” and a local detector that receives that tissue-modulated light, with no suggestion that the light is routed and bifurcated through an optical delivery path. Ex. 1027 at Fig. 1, 4:6–11, 10:42–11:20, 12:11–16. A POSITA would recognize that these different illumination geometries are not interchangeable because they define different optical footprints, coupling efficiencies, and spatial distributions at the tissue. Ex. 1027 at 4:6–11, 4:21–22, 12:11–16; Ex. 1030 at 15:57–63, 16:39-48, 13:35-49, 13:35-49.

186. Importing Soller's fiber-driven or porthole-driven LED geometry into Lisogurski would be both unnecessary and incompatible with Lisogurski's compact direct-illumination oximetry structure. Soller's configuration is expressly tied to focusing LED radiation "by the lens into both the delivery 166 and reference fibers 168" and to structures "disposed radially around the fiber optic cable." Ex. 1030 at 15:57–63, 16:8–21, 16:39-48, 13:35-49, FIG. 9. Soller expressly discloses the probe dimensions and fiber spacing, explaining that "[p]robe fibers 740 from fiber splitter 735 are combined into a single fiber bundle 750 terminating at a probe tip 790. Light from fiber bundle 750 illuminates sample 705. ...The spacing between the center illuminating fiber bundle 750 and the outer fiber ring 781 is preferably 2-4 mm when the probe tip 790 has a diameter of 5 mm." Ex. 1030 at 18:43–46, FIG. 7, FIG. 9.

187. Soller emphasizes that hematocrit measurement should sample tissue containing a significant amount of blood with specific optic fiber geometry:

spacing of the individual fibers used to conduct these measurements was approximately 40 microns. Referring to FIG. 14B, a separation of 1–5 mm, of the receiving fiber 1030 from the illuminating fibers 1020, arranged in a radially symmetric array about receiving fiber 1030, facilitates obtaining adequate depth penetration into the tissue being sampled by the light received by the receiving fiber 1030. If the spacing of the illumination fibers 1020 from the receiving fiber 1030 is too small then the majority of the reflected light signal received by receiving fiber 1030 will originate at the air/tissue interface which does not contain a significant amount of blood. Also, the geometry of the fiber optic probe is likely to be a limiting factor in the noise level in the spectral data obtained.

Ex. 1030 at 21:20–34.

188. Lisogurski, on the other hand, teaches a local wearable sensor in which LEDs “emit pulses of light ... into the tissue of a subject” and reflected/transmitted light is detected locally at the sensor. Ex. 1027 at Fig. 1, 4:6–11, 10:42–11:20, 12:11–16. Pulse oximetry does not depend on ensuring the sampled region contains a “significant amount of blood” in the same sense as hematocrit measurement, because it mathematically isolates the pulsatile arterial contribution and corrects for tissue/venous background absorption:

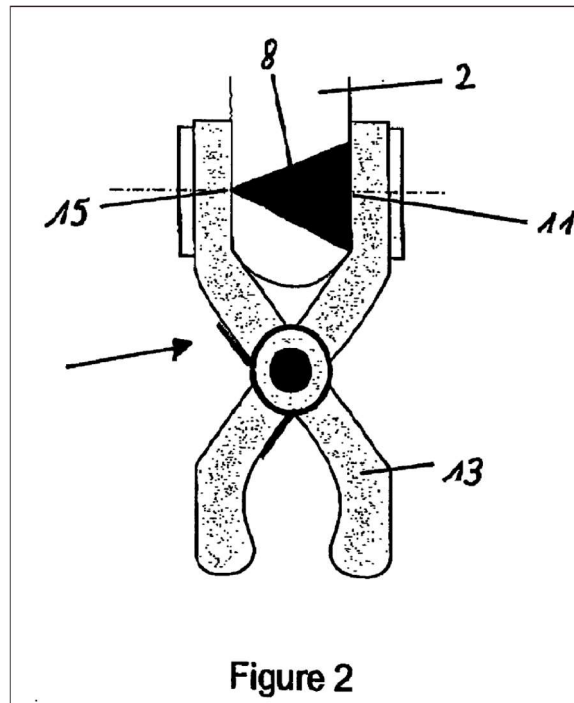
Most of the absorbance is caused by the tissue and venous blood (which is relatively constant and comprises the fixed component of the absorbance) with a small proportion attributable to the pulsatile component caused by inflow of arterial blood. The pulse oximeter calculates the ratio of the pulsatile component with the non-pulsatile component. This ratio is calculated separately for each of the two wavelengths (by having the light-emitting diodes alternately turning off and on), and it is the ratio of these two ratios which is empirically related to arterial oxygen saturation. In this way, the oximeter is able to correct for the underlying light absorption of the tissue and venous blood and effectively ‘focus’ on the arterial blood and thereby display arterial oxygen saturation. This reading is relatively independent of the intensity of the light, the thickness of the tissue and the degree of skin pigmentation.

Ex. 2052, at 5.

189. Because Lisogurski lacks by design—and does not require—any fiber optic delivery or porthole delivery and reference cable/detector constraint to direct a region of “significant amount of blood,” a POSITA would have had no reason to adopt Soller’s fiber-coupling or porthole geometry and would understand that doing so would introduce an architectural feature absent from and unneeded by

Lisogurski's oxygen-measurement structure. Ex. 1027 at 4:6–11, 4:21–22, 12:11–16; Ex. 1030 at 15:57–63, 16:39–48, 13:35–49. Petitioner and Dr. Mercier do not address how a POSITA could incorporate Soller's fiber-optic or porthole delivery configuration into Lisogurski's system—either by implementing Soller's approach without the requisite optic cables/portholes or by explaining how adding those cables/portholes (and their associated components) would not increase the size and complexity of Lisogurski's device in a manner inconsistent with its portable design.

190. Petitioner and Dr. Mercier also fail to explain why a POSITA would have chosen an arc arrangement from amongst the wide array of non-arc arrangement options (e.g., a single element or linear designs), let alone the alleged arc arrangement in Soller's FIG. 11A. Petition, 66–74; Ex. 1003 at ¶¶ 255–265. For example, Carlson discloses a single-detector configuration in which “[t]he sensor or ear clip 13 ... includes a light source 15 which emits a light beam 8 to a light receiver 11,” as shown in FIG. 2. Ex., 1028, ¶ [0049], FIG. 2.



Ex. 1028 at FIG. 2

191. Carlson also discloses “optical radiation 8 emitted from the two LEDs 15” in FIG. 4 as a linear configuration of the LEDs. Ex. 1028, at ¶ [0054], FIG. 4.

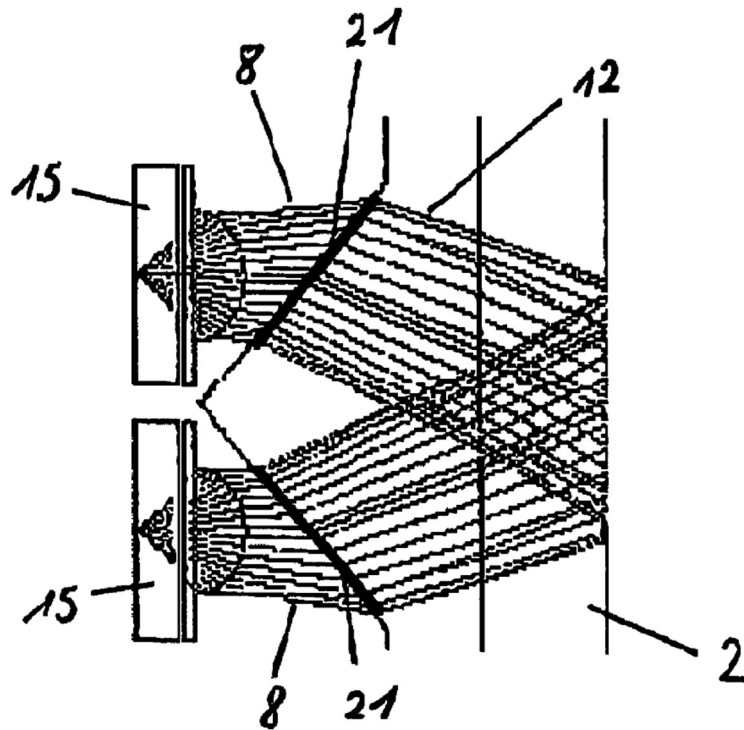


Figure 4

Ex. 1028 at FIG. 4

192. Indeed, Petitioner and Dr. Mercier acknowledges that “Lisogurski does not teach arranging the LEDs and detectors in arcs.” Ex. 1003 at ¶ 264; Petition at 70.

193. In addition, Petitioner and Dr. Mercier argue at a high level that all three references involve optical measurement systems and that Lisogurski’s goal of improving SNR would have motivated a POSITA to look to Soller for accuracy improvements, including arranging LEDs “in a ring.” Petition, 65-66; Ex. 1003 at ¶¶ 111-113, 262-265. But that reasoning, at most, supports a general desire to improve performance—not a reasoned basis to adopt Soller’s *particular* arc/ring-

like configuration (and multi-LED/multi-detector structure) in Lisogurski's specific wearable oximetry sensor. Petition, 65-66, 70-71; Ex. 1003 at ¶¶ 111-113, 262-265. Petitioner and Dr. Mercier do not identify any deficiency in Lisogurski that would be solved specifically by adopting Soller's arc geometry (as opposed to any number of LEDs/detector layouts), and they never explain why Soller's solution—developed for multi-wavelength hematocrit spectral analysis—would be expected to improve a dual-wavelength ratio-of-ratios oximeter. Petition, 70-71; Ex. 1003 at ¶¶ 111-113, 262-265. In other words, Petitioner's and Dr. Mercier's motivation is too generalized and amounts to improper hindsight. Petitioner and Dr. Mercier assert a POSITA would use Soller's ring in Lisogurski, without explaining why that specific selection would have been made or why it would yield predictable results in Lisogurski's system. Petition, 70-71; Ex. 1003 at ¶¶ 111-113, 262-265.

194. Lastly, Petitioner and Dr. Mercier never explain the implementation details necessary to support “predictable results” or a reasonable expectation of success. Petition, 65-66, 70-71; Ex. 1003 at ¶¶ 111-113, 262-265. The Petition and Dr. Mercier assert that applying Soller's modifications to the “arrangement and number” of LEDs and detectors in Lisogurski “would have been straightforward” and would yield “predictable results.” Petition, 66; Ex. 1003 at ¶264. But Petitioner and Dr. Mercier do not address what redesign would be required to (i) add Soller's many-wavelength LED array to Lisogurski's two-wavelength oximetry sensor, (ii)

incorporate Soller's multiple detector scheme (including reference detectors), or (iii) reconcile Soller's correction and calibration framework with Lisogurski's time-varying, two-channel oximetry processing. Petition, 65-74; Ex. 1003 at ¶¶ 111-113, 255-265. Without those details, Petitioner has not shown that the modification is truly routine or that the outcome would be predictable.

3) The alleged Detectors in Soller Serve a Reference-Calibration Function Absent from Lisogurski

195. As noted above, Petitioner and Dr. Mercier rely on Soller—not Lisogurski—to supply the “first arc” and “second arc” arrangements required by the arc limitation of claims 4-6, 15-16, and 21-22. Dr. Mercier and Petitioner mainly point to the “interior detector” or “reference detector” 610 arrangements in FIGS. 11A and 11B to show the alleged detector arc. Ex. 1003 at ¶¶ 256-265; Petition at 66-71.

196. However, Soller expressly explains that these reference detectors are not used to “capture... beam reflected or transmitted from the sample” as required by the independent claims (e.g., claim 1) of the '304 Patent. Ex. 1001 at 36:26-40. Instead, “the interior detector 350 monitors the optical output emitted from the LEDs” and serve a reference calibration function: “[r]adiation detected by the interior detector is used to determine a reference spectrum which allows intensity variations from the various LEDs to be accounted for.” Ex. 1030 at 17:1–5.

197. Similarly, Soller states that the reference detectors 610 are used “to measure and correct for variations in the LED intensity due to temperature, aging, or electrical power source drifts.” Ex. 1030 at 17:45–48.

198. Lisogurski contains no reference detector and no disclosure of correcting LED intensity variations using a separate, spatially arranged reference detector. Ex. 1027 at 10:48-11:27. Instead, Lisogurski uses the same detector 140 to detect light “after [the light] passing through the subject’s tissue.” Ex. 1027, 11:13-14. Lisogurski further explains that “[t]he light intensity may be directly related to the absorbance and/or reflectance of light in the tissue. That is, when more light at a certain wavelength is absorbed or reflected, less light of that wavelength is received from the tissue by detector 140.” Ex. 1027 at 11:16-20.

199. Dr. Mercier and Petitioner fail to explain how or why a POSITA would graft Soller’s reference-detector architecture—designed for spectral calibration of hematocrit measurement—onto Lisogurski’s oximetry system, which neither needs nor contemplates such detectors.

200. As discussed above, Lisogurski and Soller address different physiological parameters, rely on incompatible optical architectures and signal models, and pursue distinct design goals. Soller expressly distinguishes from oximetry, and its LED arrangement geometry is tied to fiber-optic coupling and spectral calibration absent from Lisogurski.

201. Therefore, the combination of Lisogurski and Soller does not render obvious this arc limitation at least because a POSITA would not have been motivated to apply Soller's alleged arc arrangement in Lisogurski.

f) Petitioner and Dr. Mercier Similarly Do Not Show that a POSITA Would Have Been Motivated to Implement's Soller's Alleged Arc Arrangement in Carlson to Meet the Arc Limitation

202. Petitioner and Dr. Mercier argue that "A POSITA would have considered Lisogurski, Carlson, and Soller together; they are analogous optical measurement systems with common applications and utility." Petition at 65-66; Ex. 1003 at ¶ 111. Petitioner and Dr. Mercier further state that "All three describe techniques for improving the performance of wearable, optical devices used to remotely monitor physiological parameters, including blood oxygen." Petition at 65-66; Ex. 1003 at ¶ 111.

203. For similar reasons with respect to the combination of Lisogurski and Soller as discussed above, Petitioner and Dr. Mercier likewise fail to show that a POSITA would have been motivated to combine Soller's alleged arc arrangement with Carlson's system. Petition at 65-66; Ex. 1003 at ¶¶ 111-113, 255-265.

204. Carlson is directed to "optical pulsoximetry used for non-invasive measurement of pulsation and oxygen saturation in arterial human or animal blood." Ex. 1028 at ¶¶ [0002]-[0003]. Similar to Lisogurski, Carlson relies on conventional

dual-wavelength pulse oximetry principles—measuring absorption differences between oxygenated and deoxygenated hemoglobin. Ex. 1028 ¶ [0003]. Soller, by contrast, is directed to hematocrit measurement using multi-wavelength spectral acquisition and mathematical modeling of red blood cell constituents. Ex. 1030 at Abstract; 1:49–62. A POSITA would have recognized that Soller’s spectral modeling hematocrit measurement framework is fundamentally different from—and incompatible with—Carlson’s dual-wavelength, time-varying oximetry architecture, which mirrors the system implemented in Lisogurski. Ex. 1030 at Abstract; 1:49–62.

205. Moreover, the physical arrangement of LEDs in Soller is driven by a design constraint of the fiber-optic delivery cable that is entirely absent from Carlson. Soller expressly discloses fiber-optic delivery cables attached to each light source and explains that its LED arrangement is used to maximize optical coupling into a fiber-optic cable by focusing collimated light into a small spot at the cable entrance. Ex. 1030 at 3:19–22; 12:30–31; 16:44–48. Carlson does not disclose or require any fiber-optic delivery cable, annular fiber housing, or lens-to-fiber coupling architecture. Instead, Carlson teaches compact pulse oximeter sensors in which LEDs directly illuminate tissue and detector placement is optimized to reduce ambient-light interference. *See, e.g.*, Ex. 1028 at ¶¶ [0048]-[0052], [0073], Figs. 1, 2, 10a, 10b. Because Carlson lacks the very fiber-optic coupling problem that

motivates Soller's alleged arc arrangement, a POSITA would have had no reason to import Soller's geometry into Carlson's sensor.

206. Finally, Petitioner and Dr. Mercier attempt to rely on Soller's "interior" or "reference" detectors to supply the alleged detector arc (Ex. 1003 at ¶¶ 256-265; Petition at 66-71), but those detectors serve a calibration function that Carlson neither discloses nor needs. Soller explains that its reference detectors monitor LED output to generate a reference spectrum and correct for LED intensity variations due to temperature, aging, or power drift. Ex. 1030 at 17:1-5; 17:45-48. Carlson, by contrast, "receiving and detecting the emitted and shaped light with at least one light receiving element for determining the light transmitted through the tissue portion of the person or the animal." Ex. 1028 at ¶ [0025]. Dr. Mercier offers no explanation as to why a POSITA would graft Soller's reference-detector architecture—designed for spectrally calibrated hematocrit analysis—onto Carlson's pulsoximetry system. His assertion that such modifications would have been "straightforward design modifications" yielding predictable results (Ex. 1003 at ¶ 264) is conclusory and relies on hindsight rather than any articulated technical rationale grounded in the prior art.

207. Therefore, the combination of Lisogurski, Carlson, and Soller does not render obvious this arc limitation at least because a POSITA would not have been motivated to apply Soller's alleged arc arrangement in Lisogurski and Carlson.

208. Accordingly, claims 4–6, 15–16, and 21–22 are not rendered obvious by Lisogurski in view of Carlson, and Soller.

209. For at least these reasons, I disagree with Petitioner’s and Dr. Mercier’s conclusions for Ground 4 and claims 4-6, 15-16, and 21-22 of the ’304 Patent.

2. Claims 7, 17, and 23

210. Claim 7 depends from claim 6 and includes the same limitation as claim 6. Ex. 1001, 37:14-17. Claim 17 depends from claim 16 and includes the same limitation as claim 16. Ex. 1001, 38:54-57. Claim 23 depends from claim 22 and includes the same limitation as claim 22. Ex. 1001, 40:9-11.

211. Petitioner’s and Dr. Mercier’s analysis for Claims 7, 17, and 23 does not address any of the aforementioned deficiencies regarding Lisogurski, Carlson and Soller explained above for Ground 4 and claims 4-6, 15-16, and 21-22 of the ’304 Patent. *Supra*, § X.D.1.

212. Therefore, Lisogurski, Carlson and Soller do not render obvious claims 7, 17, and 23 for at least the same reasons explained above with respect to Ground 4 and claims 4-6, 15-16, and 21-22 of the ’304 Patent. *Supra*, § X.D.1.

3. Claims 8, 18, and 24

213. Claim 8 depends from claim 7 and includes the same limitation as claim 7. Ex. 1001, 37:18-21. Claim 18 depends from claim 17 and includes the same

limitation as claim 17. Ex. 1001, 38:58-61. Claim 24 depends from claim 23 and includes the same limitation as claim 23. Ex. 1001, 40:12-15.

214. Petitioner's and Dr. Mercier's analysis for Claims 8, 18, and 24 does not address any of the aforementioned deficiencies regarding Lisogurski, Carlson and Soller explained above for Ground 4 and claims 7, 17, and 23 of the '304 Patent. *Supra*, § X.D.2.

215. Therefore, Lisogurski, Carlson and Soller do not render obvious claims 8, 18, and 24 for at least the same reasons explained above with respect to Ground 4 and claims 7, 17, and 23 of the '304 Patent. *Supra*, § X.D.2.

4. Claim 10

216. Claim 10 depends from claim 8 and includes the same limitation as claim 8. Ex. 1001, 37:35-37.

217. Petitioner's and Dr. Mercier's analysis for Claim 10 does not address any of the aforementioned deficiencies regarding Lisogurski, Carlson and Soller explained above for Ground 4 and claim 8 of the '304 Patent. *Supra*, § X.D.3.

218. Therefore, Lisogurski, Carlson and Soller do not render obvious claim 10 for at least the same reasons explained above with respect to Ground 4 and claim 8 of the '304 Patent. *Supra*, § X.D.3.

E. Ground 5: Obviousness Based on Lisogurski, Carlson, and Tran (Claims 12–13, 26)

219. I understand that Petitioner and Dr. Mercier argue for Ground 5 that claims 12-13, and 26 of the '304 Patent are obvious over Lisogurski, Carlson, and Tran. Petition at 75-82; Ex. 1003 at ¶¶ 288-308. I disagree with Petitioner and Dr. Mercier for at least the reasons provided below.

220. Claim 11 recites a “measurement system comprising: a wearable measurement device for measuring one or more physiological parameters.” Ex. 1001 at 37:39-41. Dependent claim 12 further recites, “wherein the measurement system is at least in part configured for selection or identification of an object.” Ex. 1001 at 38:20-32. Claim 13 depends on claim 12 and thus includes the same claim limitation. Ex. 1001 at 38:33.

221. Claim 19 recites a “wearable device comprising: a measurement device including a light source comprising a plurality of semiconductor sources for measuring one or more physiological parameters.” Ex. 1001 at 38:62-66. Dependent claim 26 further recites, “wherein the wearable device is at least in part configured for selection or identification of an object.” Ex. 1001 at 40:26-38.

222. Petitioner’s and Dr. Mercier assert that the “selection or identification of an object” limitation of claims 12, 13, and 26 is disclosed by Lisogurski and/or Tran. Petition at 80-82; Ex. 1003 at ¶¶ 298-301. I disagree.

223. For this limitation, the Petitioner and Dr. Mercier note that “In its Second FWD [(Second Final Decision on Remand)], the Board found Lisogurski and Tran teach ‘calculating an amount of a blood constituent’ and therefore teach ‘identify[ing] an object.’” Petition, 80; Ex.1003, ¶ 301; Ex.1013, 3-7.

224. I am informed and understand that the Board’s remand decision concerning the ‘484 Patent is currently on appeal.

225. Petitioner and Dr. Mercier argue that “Lisogurski and Tran both teach techniques for selecting or identifying blood oxygen saturation and other blood constituents.” Petition at 81; Ex. 1003 at ¶¶ 298-299. Petitioner further notes that “[m]easuring blood oxygen saturation requires selecting oxygenated and deoxygenated hemoglobin from among other blood constituents, and then identifying and quantifying both components, which Lisogurski and Tran do by measuring reflected light at particular wavelengths known to be associated with each substance.” Petition at 81; Ex. 1003 at ¶¶ 298-300.

226. As the Board found in the decision concerning the ‘484 Patent, in the context of the ‘304 Patent, a POSITA would recognize that identifying an object is different from merely detecting something or measuring a parameter of a presumed object. Ex. 1011 at 10. To identify an object, the system must determine what the object is, recognizing the object as a particular thing. Ex. 1011 at 10. This is distinct from assuming an object and simply quantifying one of its attributes. Ex. 1011 at 10.

The '304 Patent's specification is consistent with this approach, describing identification in terms of classifying materials or constituents, such as via spectral analysis and library matching, as opposed to signal measurement. Ex. 1001 at 29:9-16, 35:19-44.

227. Distinguishing an object is distinct from measurement, and the specification explains this in further detail with examples. For example, “most drug packaging materials are at least partially transparent in this wavelength range, so that drug *compositions* may be detected and identified through the packaging....” Ex. 1001 at 28:58-65 (emphasis added). The specification explains that “many solids have distinct spectral signatures in the [short wave infrared (SWIR)], so particular solids may be identified using stand-off detection or remote sensing. For instance, many explosives have unique signatures in the SWIR.” Ex. 1001 at 20:45-49.

228. The specification describes spectral techniques that support identification. For example, the specification explains that certain blood constituents other than glucose may have spectral features that overlap with that of glucose. Ex. 1001 at 4:58-62, 18:50-54. To distinguish between blood constituents, the '304 Patent describes using “pattern matching algorithms and other software and mathematical methods to identify the blood constituents of interest.” Ex. 1001 at 4:58-62, 35:17-44. It also describes “using a wider wavelength range and using more

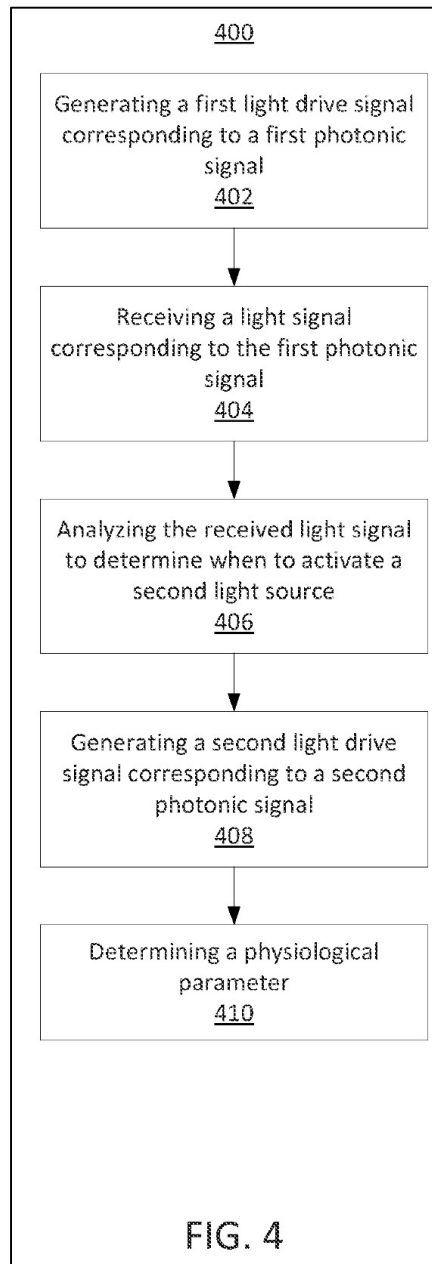
sampling wavelengths [to] improve the ability to discriminate one signal from another.” Ex. 1001 at 35:41-44.

229. The specification describes signal processing techniques that support object identification. “Various mathematical derivatives, including the first and second derivatives, may help to accentuate differences between spectra.” Ex. 1001 at 20:17-19. Additionally, “the spectrum may be correlated with a library of known spectra to determine the overlap integrals.” Ex. 1001 at 35:20-21. The specification explains that “[t]his is just one way to perform the signal processing, and many other techniques, algorithms, and software may be used and would fall within the scope of this disclosure.” Ex. 1001 at 35:23-26.

230. The ’304 Patent specification describes that “it may be advantageous to use pattern matching algorithms and other software and mathematical methods to *identify the blood constituents of interest*. In one embodiment, the spectrum may be correlated with a library of known spectra to determine the overlap integrals, and a threshold function may be used to quantify the concentration of different constituents.” Ex. 1001 at 35:17-26 (emphases added). The specification further recognizes that when “identifying the blood constituents of interest,” “[o]ne of the issues in measuring a particular blood constituent is the interfering and overlapping signal from other blood constituents. The *selection of the constituent of interest* may be improved using a number of techniques. For example, a higher light level or

intensity may improve the signal-to-noise ratio for the measurement.... In addition, by using a wider wavelength range and using more sampling wavelengths may improve the ability to discriminate one signal from another.” Ex. 1001 at 35:27-44 (emphases added).

231. Lisogurski is directed to a physiological monitoring system incorporating a pulse oximeter to non-invasively measure oxygen saturation. Ex. 1027 at 3:61-4:41. Lisogurski describes a system where a wearable sensor emits light at two wavelengths and detects the transmitted or reflected light with a detector. Ex. 1027 at 4:42-62. The system calculates a physiological parameter based on the ratio of absorbed light at the two wavelengths. Ex. 1027 at FIG. 4, 4:52-62.



Ex. 1027 at FIG. 4

232. Lisogurski describes oximetry, which exclusively focuses on one blood constituent, hemoglobin and measuring the ratio of oxygenated and deoxygenated hemoglobin, without discriminating hemoglobin from other blood constituents. Ex. 1027 at 3:61-4:3. In other words, Lisogurski is designed to monitor a known

constituent (hemoglobin) and to compute a known metric (oxygen saturation) from the optical signals. Ex. 1027 at 3:61-4:3.

233. A POSITA would recognize that Lisogurski's pulse oximeter is performing parameter measurement, not object identification or selection. Ex. 1027 at 3:61-4:3. As explained in § X.D.1.e.1, pulse oximetry estimates oxygen saturation by applying a ratio-based calculation to hemoglobin's differential absorption at selected wavelengths. Ex. 1027 at 4:52–56, 45:6-21. It does not select or identify hemoglobin as an object from among other blood constituents. Ex. 1027 at 4:52–56, 45:6-21. Lisogurski operates on the presupposition that the object of interest, hemoglobin, is present. Ex. 1027 at 4:35-41. It uses known characteristics of that constituent to estimate oxygen saturation. Ex. 1027 at 4:35-41. Lisogurski does not include any step where the system attempts to determine what the substance or object is. Ex. 1027 at 4:35-41. Instead, Lisogurski assumes the object. Ex. 1027 at 4:35-41. A POSITA would understand that this approach does not amount to identifying an object as required under the claim construction.

234. A POSITA would recognize that Tran, like Lisogurski, performs parameter measurement, not object identification or selection. For example, Tran explains that “the system can analyze blood pressure, heart rate, and pulse oximetry values to characterize the user's cardiac condition.” Ex. 1031 at 74:29–67. Tran teaches “[a]s the heart pumps blood through the patient's finger, blood cells absorb

and transmit varying amounts of the red and infrared radiation depending on how much oxygen binds to the cells' hemoglobin. The photodetector detects transmission at the predetermined wavelengths, for example red and infrared wavelengths, and provides the detected transmission to a pulse-oximetry circuit embedded within the wrist-watch.” Ex. 1031 at 36:62–37:13. The alleged “object identification” in Tran is merely the use of a pulse-oximetry transmission ratio–based calculation to estimate a physiological condition—not by identifying any unknown substance or object. Ex. 1031 at 36:62–37:13. Tran includes no step in which the system attempts to determine what the substance is; instead, it presupposes the tissue and computes physiological parameters. A POSITA would therefore understand that Tran, like Lisogurski, does not identify an object as required under the claim construction.

235. Dr. Mercier argues that “Tran also teaches selecting a blood constituent (e.g., hemoglobin). EX1031, 36:62–37:13 (“As the heart pumps blood through the patient’s finger, blood cells absorb and transmit varying amounts of the red and infrared radiation depending on how much oxygen binds to the cells’ hemoglobin”).” Ex. 1003 at ¶299. Dr. Mercier also argues that “Lisogurski teaches the selection of a blood constituent. EX1027, 4:36-51 (“The light intensity . . . may then be used to calculate any of a number of physiological parameters, including an amount of a blood constituent (e.g., oxyhemoglobin) being measured [T]he photonic signal . . . is selected to be . . . representative of the blood constituent concentration”).” Ex.

1003 at ¶299. Dr. Meicier and Petitioner fail to recognize that the ratio-based oximetry methods in both Lisogurski and Tran do not select any constituent from among multiple constituents; they merely compute a ratio from detected signals at two wavelengths.

236. To identify or select an object as required by claims 12, 13, and 26, a POSITA would understand that discernment of the object's identity is required. The '304 Patent describes how a wearable device may use spectral data and algorithms to classify unknown samples, identifying them through techniques including spectral analysis and library matching, as opposed to simply signal measurement. Ex. 1001 at 29:9-16, 35:19-44. It discloses several "examples of some of the methods of improving the ability to discriminate between different constituents," Ex. 1001 at 20:51-23. This is object identification.

237. For at least these reasons, I disagree with Petitioner's and Dr. Mercier's conclusions for Ground 5 and claims 12, 13, and 26 of the '304 Patent.

F. Ground 6: Obviousness Based on Lisogurski, Carlson, Soller, and Tran (Claim 9)

238. I understand that Petitioner and Dr. Mercier argue for Ground 6 that claim 9 of the '304 Patent is obvious over Lisogurski, Carlson, Soller, and Tran. Petition at 83-84; Ex. 1003 at ¶¶ 309-312. I disagree with Petitioner and Dr. Mercier for at least the reasons provided below.

239. Claim 9 depends from claim 8 and includes the same limitation as claim 8. Ex. 1001 at 37:22-34.

240. Petitioner's and Dr. Mercier's analysis for Claim 9 does not address any of the aforementioned deficiencies regarding Lisogurski, Carlson and Soller explained above for Ground 4 and claim 8 of the '304 Patent. *Supra*, § X.D.3.

241. Petitioner's and Dr. Mercier's analysis for Claim 9 also does not address any of the aforementioned deficiencies with respect to "selection or identification of an object" limitation regarding Lisogurski, Carlson, and Tran explained above for Ground 5 and claims 12–13, 26 of the '304 Patent. *Supra*, § X.E.

242. Therefore, Lisogurski, Carlson, Soller, and Tran do not render obvious claim 10 for at least the same reasons explained above with respect to Ground 4 and claim 8 and Ground 5 and claims 12–13, 26 of the '304 Patent. *Supra*, § X.D.3 and § X.E.

XI. CONCLUSION

243. In my opinion, the challenged claims of the '304 Patent would not have been obvious to a POSITA as of the priority date of the '304 Patent in view of the asserted references that Petitioner and Dr. Mercier rely upon in Grounds 1-6. Accordingly, it is my opinion that all challenged claims of the '304 Patent are patentable over the asserted references.

244. I reserve the right to modify or supplement my opinions, if necessary, based on further review and analysis of the evidence in this case, including review and analysis of information that may be provided to me subsequent to the date of this declaration.

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

Date: January 5, 2026



Igor Efimov, Ph. D.